SOUTH CAROLINA MAPS
AND AERIAL
PHOTOGRAPHIC SYSTEMS

SC MAPS

Teaching Manual

Fourth Edition
January 2000

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PREFACE TO THE THIRD EDITION

Very few South Carolina students have had the opportunity to view our state from high altitude aircraft, and even fewer students have had an opportunity to see first hand what South Carolina's landscape looks like from an orbiting satellite platform. As the name suggests, South Carolina Maps and Aerial Photographic Systems provides South Carolina middle school students with a fresh look at the state by using infrared aerial photographs matched with topographic and special purpose maps. In addition, these products are complemented by two satellite images and several state base maps. These unusual peeks at our diverse state allow students to make comparisons between landform terrain, vegetative cover, and current land use.

Through a variety of activities, students learn to make connections between the traditional middle school core disciplines. One example of an interdisciplinary lesson focuses on moving the state capital away from Charleston. While science students are studying the geology of the state, the resulting landscapes, and drainage systems, students in South Carolina history classes are considering the rationale used by the Assembly to relocate the capital of South Carolina to a more central location. Landform regions, rivers, and floodplains were all factors that had to be taken into account before a suitable location was selected. In the mathematics classroom, students use their problem solving skills to determine the most appropriate way to locate the center of the state. Language arts students retell early tales about several of the state's founders, for example, how General Thomas Sumter tried to persuade the Assembly to locate the new capital near his home in Stateburg. These types of classroom activities help students make connections between disciplines rather than simply memorizing isolated facts. Other broad themes, on topics like transportation, hurricanes, and the rice culture, are woven throughout the teaching manual.

In a collaborative effort, the South Carolina Department of Education and the South Carolina Department of Natural Resources have joined efforts by linking the talents of both agencies for long term enhancement and implementation of the SC MAPS project. Full color reprints of the award winning *South Carolina Wildlife* magazine featuring SC MAPS study sites are printed in multiple copies for classroom use. A specially prepared Teaching Guide Supplement has been developed linking the SC MAPS Teaching Manual with the bimonthly articles. All of these initiatives are designed to enhance students' appreciation for the natural, historical, and cultural diversity that makes up our state's heritage.

Through these initiatives, the authors of SC MAPS emphasize how the geological events and their resulting landforms and the abundance of natural resources influenced South Carolina's historical events, cultural diversity, economic development, and environmental outlook. We trust these materials will raise not just the literacy of South Carolina's students in all disciplines, but also their ability to comprehend and contribute meaningfully to the continuing dialog on how best to both utilize and preserve the state's abundant natural heritage.

Peggy W. Cain, Ph.D.
John R. Wagner, Ph.D.
July, 1996    James B. (Chip) Berry, III
Perhaps you like to go fishing in a nearby pond, duck hunting in the swamp, deer driving in the fall, hunting rabbits with your beagles, coon hunting at night, birding at the beach, white water rafting down the Chattooga River, swimming in the ocean, hiking to water falls in the mountains, skiing on a man-made lake, canoeing down the river, golfing on a rolling fairway, or walking through stately oaks on an old plantation. No matter where your interests may take you, the landscape of South Carolina is intriguing.

South Carolina's small size, 80,583 square kilometers, fortieth among fifty states has the greatest landform diversity and can brag on a fascinating geological as well as human history. There are few places on earth where one can watch the sun rise over the ocean in the morning, see the sun set in the mountains in the evening, and observe five distinct landform regions within one day.

Maybe you have wondered about the diversity of the state. Why do we have fast moving streams in the mountains and meandering rivers on the coast? Why do we have granite outcropping in the Upstate and flat fields in the Low Country? Why do we have flood plain swamps in the lower part of the state and water falls in the mountains? Why do we have sandy soils with marine fossils in Columbia which is over 100 miles from the ocean? Why are sea shells found in a Sumter County branch? Why did the early settlers grow rice in the intertidal zone? Why are the larger farms in the coastal plain area of the state? What brought many industries to the upper part of the state? What were the reasons for moving the Capital to Columbia? These questions and many more will be answered through activities using infrared aerial photographs complemented with a variety of topographic and special purpose maps.

The diverse geological formations apparent by the landform regions have laid the pattern for the historical development of South Carolina. Each has its own fascinating story to tell. SC MAPS illustrates this interrelationship by recalling historical events, economic trends, and the land use that has been shaped by the geological formations of the state. In addition, environmental issues have been raised that should enhance the students' appreciation of South Carolina's natural and cultural heritage.

July, 1989  Peggy W. Cain, Ph.D.
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DEVELOPMENTAL HISTORY OF SC MAPS

Premise for Developing SC MAPS

South Carolina has mountain chains, monadnocks, rolling hills, a variety of drainage patterns, a delta, waterfalls, rivers, swamps, barrier islands, rocks over a billion years old and land that was once part of another continent. South Carolina’s heritage embraces Native American legends, short-lived Spanish settlements, land grants from kings, pirating escapades along the coast, Scotch-Irish ballads reminiscent of their homeland, cash crops dependent on slave labor, ravages of two wars, cultural contributions of African Americans and other immigrant groups, alteration of landscapes by hurricanes, King Cotton tumbling from its throne, an economic shift from textiles to other industries, and an invasion of summer tourists along the coast. Such diversity in landforms, historical development and culture is hard to match anywhere in the world. To fully understand and appreciate how the landscape has shaped historical events, customs, folklore, land use, economic trends, and environmental concerns, all students growing up in South Carolina must heighten their appreciation for South Carolina’s unique characteristics. With this purpose in mind, the SC MAPS curriculum has been designed for all students growing up in South Carolina to make connections between:

- Geologic events that have produced the state’s five landform regions;
- Drainage systems, wetlands, and landform regions that have had an impact on the state’s historical events, cultural diversity, and important wildlife habitats;
- Economic trends and regional differences that have resulted in land use diversity in relation to the state’s industries, agriculture, and tourism;
- Historical events, regional customs, stories, and folk tales that have reflected the state’s cultural diversity;
- Mathematical applications that have been used to solve problems involving concepts of fractions, decimals, percentages; principles of organizing data, graphic representation of numerical facts, and estimation;
- Environmental concerns that have been the focus of state efforts to encourage citizens to appreciate, use wisely, and preserve the state’s unique resources.

It is with this premise in mind that SC MAPS was developed for our future lawmakers, business men and women, farmers, factory workers, educators, builders, industrialists, homemakers, and all other citizens of South Carolina who need to develop an appreciation and understanding of the land on which they live and work.

Appeal of Infrared Aerial Photographs

The authors’ first attempt to use South Carolina maps to relate landforms to land use began when Mr. Ned Owings, Science Coordinator, Florence School District 1 asked Dr. Peggy Cain to conduct an inservice program for earth science teachers in his district. Peggy immediately made contact with Mr. Chip Berry, Cartographic Specialist at the South Carolina Land Resources Division, for information and resources that might be used for this inservice program. It was Chip who pointed out that infrared photographs and accompanying topographic maps of South Carolina were available through the National High Altitude Photography Program (NHAP) and the United States
Geological Survey (USGS). A close inspection of the Columbia NHAP photographs revealed landform details that could be used to identify and explain the geological structure of the region. For example, rapids visible on the Saluda and Broad Rivers made it easy to conceptualize that the Fall Line Zone was the dividing boundary between the Piedmont and the Coastal Plain regions of South Carolina. A closer inspection of the river systems and drainage patterns of the central part of South Carolina helped explain the distribution of early transportation routes, which resulted in Columbia being selected as the capital of the state. Furthermore, General William T. Sherman’s choice of cannon placement for bombardment of the State Capitol Building, near the end of the Civil War, made strategic sense when viewed on the aerial photograph. It became apparent that these maps could be utilized as a teaching tool by which students could be given an opportunity to relate basic landform regions, historical development, and current land use patterns to the geological framework of South Carolina.

In addition to the infrared aerial photographs, Chip outlined a variety of special purpose maps covering soil types, forest types, prime agricultural land, and land use. Chip’s enthusiasm for cartographic products was catching. At the conclusion of this first meeting both Chip and Peggy were convinced that these photographs and maps must be made available to students, in conjunction with a set of related classroom activities. They both realized the benefits of making South Carolina’s legacy of intriguing landscapes an integral aspect of every student’s schooling. Geological formations, historical events, landform features, and environmental concerns could be made relevant to each area of the state, and curriculum materials, using cartographic products, could be made available to all South Carolina students.

Seed Funding Essential

Prior to the development of the first SC MAPS activities, the project had to be sanctioned by the South Carolina Department of Education staff. The concept of using South Carolina aerial photographs and topographic maps for instructional purposes was readily approved by Mr. William B. Hynds, Chief Supervisor, Curriculum Development Section; Mr. Joel Taylor, Director of the Office of General Education; and Mr. Sidney B. Cooper, Deputy Superintendent, Instructional Division. Furthermore, Mr. John W. Parris, Executive Director, South Carolina Land Resources Conservation Commission gave his blessings and support to this project by encouraging Chip Berry to assist in the writing. Without the stamp of approval of both the South Carolina Department of Education and the South Carolina Land Resources Conservation Commission, this project would never have been launched.

Funding was received through the Title II Education for Economic Security Act (EESA) allocations for implementation of demonstration and exemplary programs, administered by Dr. Marjorie Claytor. The initial seed funding was used to purchase infrared photographs and transparencies, along with the accompanying topographic maps. Additional EESA allocations, now called the Dwight D. Eisenhower Mathematics and Science Education Act, under the supervision of Dr. Shirley Sturgeon, provided the funds necessary for further development including purchase of additional map sets, dissemination of these materials, and training workshops for teachers.
Committee Selects Study Sites

A committee was appointed to outline the overall design of the project and select study site locations that were geologically significant to South Carolina. Dr. Ted Steinke, Department of Geography, University of South Carolina; Dr. Norman Olson, South Carolina State Geologist; and Dr. John Carpenter, Director, Center for Science Education, University of South Carolina, met with Chip Berry and Dr. Peggy Cain to formulate a design that would utilize major thematic objectives for the project. Each study site selected would contain a geological feature recognizable from 40,000 feet and would also be a place where students could be taken on a field trip. Rudy Mancke, Naturalist, South Carolina ETV, also provided a wealth of excellent suggestions that were subsequently used. With the study sites selected, the process of picking maps and writing the activities began.

Second Committee Formed

Another committee was appointed to address the practical concerns of introducing this material to students and teachers. Martha Boswell, Gifted and Talented Coordinator, Clarendon School District 2, reviewed the first draft of the project and gave many excellent suggestions. At this time, Dr. John Wagner, Department of Geological Sciences, Clemson University, became involved in writing several of the units. He provided not only his knowledge of the geologic history of South Carolina, but also his expertise in developing critical thinking activities to enhance these curriculum materials.

Writing the 1991 Edition of SC MAPS

Dr. John Wagner began sending drafts from Clemson University focusing on the geological aspects of the study sites and incorporating suitable student activities, while Chip Berry provided an array of activity questions, and problem solving situations for the Manual. Dr. Peggy Cain organized these segments into a pragmatic set of curriculum materials. The original Power Thinking activities at the beginning of each study site were developed by Kevin Peter, Center for Environmental Education at Seabrook Island, with one exception. Major Scott Cain, F-16 Pilot at McEntire Air National Guard Base, wrote the Power Thinking activity related to the Table Rock Blue Ridge Study Site. Jim Mayer, Science Consultant for the Oconee County School District, field tested this Study Site and pointed out that "parts of the SC MAPS curriculum materials could be used at a variety of grade levels." He also wrote a significant portion of the Preface outlining the stages of development. Jim kept reminding the authors of the need for students to enhance their geographic skills with relevant South Carolina applications. His encouragement helped spur the authors on to completion. During the next few months, drafts of each study site were passed from John to Peggy to Chip, back to John, and back to Peggy until all three authors felt comfortable with the materials.
Field Testing the Program

Five teachers agreed in September 1989, to pilot SC MAPS with their students. These teachers and their schools were Martha Boswell, Manning Middle School; Melba McKenzie, Estill Middle School; Jim Mayer, Oconee County School District; Giles Roberts, Southside Middle School; and Karen Stratton, Fulmer Middle School. They attended a Briefing for SC MAPS held on September 20, 1989 (one day prior to Hurricane Hugo). Pilot teachers received a set of the curriculum materials to use with their students. After critiquing the activities, each pilot teacher submitted written reviews for each study site. Subsequent changes were made to the document reflecting the recommendations of the pilot teachers. Frances Crawford reviewed the SC MAPS Teaching Manual for technical errors.

Vignettes of South Carolina’s Heritage

Credit is given to Margaret Walden, Social Studies Consultant, South Carolina Department of Education, for several of the historical anecdotes used in the SC MAPS Teaching Manual which relate landform characteristics to our cultural development. These glimpses into our state’s heritage enhance the study of South Carolina history by relating geological landform features to economic reasons for the locations of cities, industries, and resorts. Furthermore, additional credit must be given to Chip Berry who also provided a variety of suggestions for inclusion of unique historical vignettes covering events that shaped South Carolina’s heritage.

Cartographic Products Custom Printed

Prior to 1994, the SC MAPS infrared aerial photographs were available only as transparencies. In many cases, details of the infrared aerial photographs projected on a screen by overheads were hard to see, especially for those students sitting in the back of the classroom. The need to enhance the visibility of these unique curriculum materials soon became apparent and was recognized by Leon Temples at the South Carolina Department of Education. It was through his logistical support that Chapter 2 funds for printing cartographic products became available. All twelve infrared aerial photographs and two satellite images were custom printed as lithographs. In addition, twelve United States Geological Survey topographic maps and two state base maps were customized by adding place names related to SC MAPS performance tasks and then printed. Subsequently, the Geologic Map of South Carolina and South Carolina Soil Map have become part of the SC MAPS Portfolio classroom sets. The SC MAPS Portfolio contains six sets of 31 cartographic products laminated for continuous student use with wipe-off pens and housed in two large portfolios. As a result of this printing, students now have in front of them a clear view of the study sites as they work through a variety of performance tasks. Custom printing of these lithographs, topographic maps, and special purpose maps have enhanced the quality of the SC MAPS experience for students. And having multiple copies of all products available at an affordable cost allows all students to actively participate in discovery activities.
Another grant was received in 1993, through the South Carolina Department of Education’s Chapter 2 funds, to expand the SC MAPS program into a complete interdisciplinary curriculum to be used by middle school teaching teams as a stand-alone, complete unit on "South Carolina Studies." Leon Temples, at the South Carolina Department of Education, again provided exceptional logistical support to make the project a reality. The focus of the expansion was to add a mathematics component, a storytelling component, and a significantly enhanced historical component, to the existing SC MAPS structure. The ultimate objective was to produce a set of interrelated activities which would utilize the cartographic products and provide students with the opportunity to make meaningful connections between the four major middle school disciplines, language arts, earth science, mathematics, and South Carolina history.

Twenty educators on all levels, including historians, librarians, scientists, literary buffs, and mathematicians, representing all four disciplines, were recruited to begin the development of interdisciplinary curriculum materials based on several shared themes or content strands. Practitioners in the core middle school subjects were brought in to develop the background information and performance tasks for Expanding SC MAPS. The Language Arts team members included: Dr. Lyn Zalusky Mueller (Chair), Writing Improvement Program, University of South Carolina; Libby Carnohan, Writing Improvement Program, University of South Carolina; Christy Clonts, Pine Ridge Middle School, Lexington School District 2; Mary Holmes, R. E. Davis School, Sumter School District 2; Dodie Marshall, Gifted and Talented Program, Charleston School District; and Sandy Morgan, Learning Collaborative Program, Dent Middle School. The Mathematics team members were Dr. Marjorie Claytor (Co-chair), South Carolina Department of Education; Dr. Kay Creamer (Co-chair), Chester Middle School, Chester School District; Betty McDaniel, Mathematics Supervisor, Florence School District 1; Paula Pruett, Irmo Middle School, Lexington School District 2; and Marge Scieszka, League Middle School, Greenville School District. Serving on the South Carolina History Team were Dr. Larry Greer (Chair), Beck Middle School, Greenville School District; Robin Copp, Librarian, Richland County Library; Eugene Davis, Leavelle McCampbell Middle School, Aiken School District; Willie Harriford, South Carolina Department of Education; and Dr. William F. Steirer, Jr., History Department, Clemson University. In addition, Linda Sinclair, South Carolina Department of Education, provided technical assistance for the project. Dr. Peggy Cain, South Carolina Department of Education, coordinated the SC MAPS Expanding Team with the assistance of Dr. John R. Wagner, Geological Sciences Department, Clemson University. The group met for five weekends in the winter and spring of 1994, sharing resources and ideas, and completed a preliminary set of activities in time for pilot testing to begin during the fall of 1994. Also contributing to the writing of mathematics activities was Jennifer Cain, Hillcrest High School, Sumter School District 2.

Five middle schools were selected to try out the new activities. A team of teachers from each school attended a two day training session to learn how to work with the materials and to provide critiques for each activity they used with their students. School team captains were Martha Boswell from Manning Middle School, Dr. Kay Creamer from Chester Middle School, Molly S. Schulz from Hillcrest Middle School, Andrea Hicks from Sneed Middle School, and Karen Stratton from Fulmer Middle School. In late fall of 1994, the pilot teams reconvened with the interdisciplinary expansion team to review the assessment results. As expected, some of the activities received high praise, while others were discarded or slated for extensive revision. Over the next several months,
informal groups met periodically to work on activities for particular study sites or specific discipline topics. This process culminated in the printing of a draft copy of the revised SC MAPS Teaching Manual in July 1995. Although not in a publishable format, this version nevertheless proved invaluable in conducting "train the trainer" workshops for master teachers throughout the state. Feedback from those workshops provided the final review, along with comments from the SC MAPS Advisory Committee, leading to the publication of this current edition.


The extensive revision of the SC MAPS Teaching Manual resulted in a greatly enhanced comprehensive set of curriculum materials. It has taken input from a large number of educators to accomplish these revisions. The first two editions, printed in 1989 and 1991, were designed for eighth grade Earth Science and South Carolina History students. After the SC MAPS expansion teams completed their work, the teaching manual had expanded to four times its original size and had undergone a complete renovation in background information, performance tasks, and number of study sites. It is now a complete interdisciplinary curriculum designed for middle school students, grades 6-8, to interrelate the four core disciplines. New components have been added for Language Arts and Mathematics courses in addition to markedly increasing coverage of South Carolina History vignettes and Earth Science concepts.

To enable students to relate to South Carolina's unique landscape, eighteen SC MAPS study sites focus on areas within close proximity to all South Carolina schools. Even though the basic format of the teaching manual has remained unchanged, many innovative features make this version more user friendly. Each section begins with an Index Map displaying regional names and study site locations. Performance Objectives reflect the subject content of each section. Student activities consist of titled Performance Tasks which require the use of one or more cartographic products, and Enrichment questions which suggest further study site explorations, but do not necessarily require use of the maps. Figures and diagrams enrich the dialog, stories, diary entries, and folk tales are boxed for emphasis, inclusion of recent newspaper articles add timely interest to study sites, suggestions for organizing topics are included, a glossary has been added, and a comprehensive listing of references for storytelling and history vignettes is provided.

It has taken many hardworking dedicated people to revise the teaching manual. Once the expansion team completed their development task, the materials had to be reorganized and revised to sound like one voice. The entire SC MAPS Teaching Manual has been rewritten primarily by Dr. John R. Wagner and Dr. Peggy W. Cain. Richard D. White provided his expertise in editing, formatting, and page layout to produce the finished version of the 1996 Revised Edition. Additional staff at Clemson University took care of many other logistical details. Jody Tinsley contributing to the writing and proofing of the document. Patrick Henricks and Dr. Larry Greer were the primary formatters of the references and resources lists provided in the manual. While all this was taking place in Room 330 of Brackett Hall, Norma Adams was keeping the paperwork flowing smoothly on the fourth floor. As in the proverb, "it takes a whole community to raise a child," it took good folks from the whole state to develop the 1996 Revised Edition of the SC MAPS Teaching Manual.
The collaborative efforts of the SC MAPS Project Staff have been strengthened by support from the SC Wildlife Magazine, especially editor John Davis and staff member Linda Renshaw. For two years, each bimonthly issue of this award winning publication, published by the SC Department of Natural Resources, contained an article designed to enhance one of the SC MAPS study sites. Individual articles were reprinted as mini South Carolina Wildlife magazine supplements and were accompanied by a Teaching Guide, written by teachers, linking the articles with the SC MAPS activities and cartographic products. A classroom packet containing 30 copies of the full color supplement, a Teaching Guide, and two full issues of the South Carolina Wildlife magazine were packaged together and mailed to subscribers. Although this packet is no longer being produced, back issues should be available in your school library or may be obtained from the South Carolina Department of Natural Resources.


Teacher feedback from the 3rd Edition of the SC MAPS Teaching Manual made it obvious that certain changes were necessary to make the curriculum materials even more user-friendly in the classroom. There was an overwhelming demand for including page listings in the Table of Contents and for the publication of an Answer Key. And of course there was the usual collection of typographical errors, nebulous questions, and mistakes that needed correcting. Since the 1996 publication of the 3rd Edition, four new study sites have been developed (Lake Jocassee Region, Savannah River Site, Kings Mountain, and Sugarloaf Mountain). The first two were included in a preliminary printing released in June, 1999 while all four sites are included in the complete 4th Edition. Several new performance tasks have been added, some background information has been enhanced, and the distribution balance among disciplines has been improved.

Ultimate Goals for SC MAPS

South Carolina Maps and Aerial Photographic Systems (SC MAPS) is specifically designed to create an awareness among students of the diversity of our state’s landforms, natural vegetation, abundant wildlife, recreational facilities, lakes and river systems, and land usage. These materials provide students with a background in South Carolina’s geological setting so that they can perceive the relationships among our historical developments, economic trends, environmental concerns, cultural diversity, and current land use. Ultimately it is hoped that using SC MAPS will lead students to the realization that they must assume the responsibility for proper conservation practices which will allow for future use and enjoyment of our state’s resources. Such variety makes South Carolina an intriguing place to live, a state that, if its resources are wisely used, will be enjoyed for generations to come.
DESIGN OF SC MAPS

Introduction

South Carolina Maps and Aerial Photographic Systems is an interdisciplinary middle school curriculum utilizing a diverse collection of aerial photographic and satellite images, maps, transparencies, topographic maps, and computerized special purpose mapping products available through a variety of sources. The map products were carefully chosen to provide different spatial perspectives, in a variety of map scales, featuring unique geological features focusing on the state’s five major landform regions, Blue Ridge, Piedmont, Sandhills, Coastal Plain, and Coastal Zone.

Section 1 of the SC MAPS Teaching Manual provides a statewide overview of South Carolina’s intriguing landscape and natural resources by examining similarities and differences between landform regions. Within each of these regions, individual study sites have been selected as the focal point for detailed student activities. The eighteen primary study sites each reflect unique geological features characteristic of a particular region in South Carolina. At least one study site has been selected for each landform region. Each of the study sites has been chosen because of its accessibility for student field trips, thereby providing further enhancement and appreciation of the study sites. Each study site is formatted with specific subtopics for ease of use and clarity of understanding. Stimulating student interest in these topics is achieved through the identification and analysis of observable features contained on cartographic products. Enrichment activities, individual and group projects, power thinking problems, and field trip suggestions aid in arousing student interest in the state’s cultural heritage.

Section Organization

INDEX MAP: A state map shows the locations of the study sites and highlights sites covered in the section.

TABLE OF CONTENTS: The sequence of topics, along with page numbers, is listed in table form.

POWER THINKING ACTIVITY: An open ended problem solving scenario, which requires the use of one or more cartographic products, is introduced at the beginning of each section. This activity is designed to focus on the specific geographical setting of the region thereby stimulating student interest and awareness of the unique features of this area.

PERFORMANCE OBJECTIVES: Major learning outcomes stated in behavioral terms.

BACKGROUND INFORMATION: A summary of interesting geological, historical, cultural, economic, and environmental information is provided for each landform region and study site to stimulate student interest, comprehension, and appreciation for the area. This material has been organized into three subheadings: Description of Landforms, Drainage Patterns, and Geologic Processes; Influence of Topography on
Historical Events and Cultural Trends; and Natural Resources, Land Use, and Environmental Concerns.

GLOSSARY TERMS: The first occurrence of each glossary word is bolded in each section of the text. A full glossary of important terms is located at the end of the introductory section, page 47 through page 51.

PLACES TO VISIT: Field trip suggestions for enhancing and personalizing study site objectives are outlined, including a listing of phone numbers and other contact information. Most of these places offer educational programs and/or guided tours.

REFERENCES AND RESOURCES: A listing of various print sources and other media, including videotapes and computer software, is provided.

NEWSPAPER ARTICLE: Each study site begins with a recent newspaper article which highlights several features of the area in unique ways. This adds human interest as well as providing additional information about landscape features.

RATIONALE: Reasons are outlined for selecting each study site and justifying the significance of that location to the state.

BRIEF SITE DESCRIPTION: Additional information is provided about the specific locale represented by the cartographic products assigned to the study site.

ACTIVITIES: A grouping of performance tasks having a common theme or topic.

MATERIALS: Cartographic products and other supplies needed for the activities are listed.

PERFORMANCE TASKS: A variety of instructional strategies direct students through interdisciplinary activities based on each of the landform regions and study sites. These activities are subdivided into individual performance tasks which are coded for particular disciplines. Many of these tasks are appropriate for cooperative learning groups to perform. Activities may be either teacher-directed or self-paced depending on the student's level of attainment and the teacher's lesson objectives.

ENRICHMENT: Additional follow-up studies challenge students to reach beyond the original performance tasks and use of cartographic products by focusing on extended concepts related to the study site. These activities stress combining applications of newly learned concepts in a problem solving format. Processes of analysis and synthesis are emphasized in both individual and group research projects.
Environmental Issues as Major Organizing Theme of SC MAPS

The study and interpretation of cartographic products can provide a unique perspective on both nature and human society. Cartography is concerned with the spatial dimension of human experience. An understanding of geographical and geological patterns and their implications for human use of the land is critical if society is to solve its present and future environmental problems. SC MAPS contains student activities highlighting many of today's most important and complex environmental issues. Some of these issues include:

- Over-commercialization and development versus wilderness preservation
- Pros and cons of constructing reservoirs, dams, and power projects
- Prevention of erosion as land is developed or farmed
- Dealing with contamination from current gold mining operations
- Waste disposal problems of urbanized areas
- Groundwater pollution in Karst areas
- Sediment load in rivers and other types of non-point source pollution
- Construction of groins, jetties, and seawalls along beaches
- Environmental restoration of mining areas
- Loss of habitat for threatened and endangered species

The chart below provides an easy reference list to natural resource related background information and activities, organized by landform region. Location refers to the page numbering system. For example, page 1-15 means the fifteenth page of Section 1. 3B-6 means the sixth page of Study Site 3B in Section 3.

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Earth Science Strategies for Teaching SC MAPS

Prior Earth Science Content Knowledge Requirements

A basic knowledge of the principles of geography and cartography is required for students to receive the full benefit of the SC MAPS curriculum. Some science teachers do not stress these concepts because they think it is not pure science. And conversely, many social studies teachers do not cover map interpretation because they think it is too "scientifically" oriented. Geographic concepts cover much more than simply memorizing place names, or knowing which countries border Switzerland. It is more important to know why certain land uses are connected to certain landform regions, and what the environmental implications of that land use are in both human and habitat costs.

In many school systems, earth science is taught in the eighth grade. In others, earth science is part of an integrated science approach which covers the middle school years. An understanding of certain fundamental earth science principles will provide the student a much more enriching experience when working with the map products. Students should have at least a rudimentary understanding of the following concepts:

- Most important rock types making up oceanic and continental crust
- Most common methods of mining economically important minerals and ores
- Effect of weather and water in causing the disintegration of rocks to form soil
- Rock cycle
- Theory of plate tectonics and its application to continental drift
- Rates of various geologic processes and their relation to geologic time
- Major landscape features produced by various surficial processes
- Hydrologic cycle
- Causes of folding and faulting in the earth’s crust
- Causes of earthquakes, volcanoes, landslides, and other natural disasters
- Dimensions, shape and behavior of the earth as a planet
- Effects of pollution on natural ecosystems

Earth Science Laboratory Skills Used in SC MAPS

Most middle school earth science units contain a laboratory component. Without prior experience in "doing" science through laboratory work, students will likely have difficulty using their map observations to solve the investigative problems which are included in the SC MAPS activities. Students should be able to read topographic and highway maps, identify precise locations using latitude and longitude coordinates, and construct topographic profiles. They should master these three skills before beginning work on any of the SC MAPS units.

In addition to the specific skills listed above, students should have also developed some experience in the basic science process skills, such as observing, classifying, measuring, inferring, predicting, designing, and communicating. Familiarity with the Scientific Method of inquiry is important, including practice in formulating and testing hypotheses. Students will be presented with significant quantities of data from a variety of activities in SC MAPS. Prior laboratory experience will help them determine which data are relevant to the problem at hand and which are not.
Scientific Reasoning Skills and Relationship to Curriculum Frameworks

Science is a process, not just a body of facts. The domains of science include the knowledge of science, the nature of science, and the process skills used to perform science. Concepts should be learned through active involvement with the subject matter. Hands-on, investigative learning is the best way for students to gain both confidence and competence in the pursuit of scientific inquiry. Success at problem solving also strengthens students' understanding and retention of science concepts.

The South Carolina Science Framework document details several suggestions about how science should be taught. These include "making connections to other disciplines," "talking, writing, and communicating," and "making effective use of technology." The SC MAPS curriculum stresses all three of those recommendations. The interdisciplinary nature of the activities and performance tasks presents real problems with real solutions, rather than contrived questions, and invites collaboration with other teachers in different subject areas. Both oral and written communication extends across the entire curriculum, not just in language arts performance tasks, but with most activities. Sharing results with other groups or other classes is standard procedure in most SC MAPS performance tasks. The cartographic products offer classes a chance to use state-of-the-art materials produced by sophisticated technology. Many activities and performance tasks relate directly to the technological aspects of the maps, satellite images, and aerial photographs, as well as to their analysis and interpretation.

Resource List for Earth Science

Resources for Geological Concepts and Landscapes

Earth science textbooks and supplements will be useful and adequate references for the geological, meteorological, and oceanographic concepts used in SC MAPS.


Resources for Aerial Photography, Satellite Imagery, and Cartography


South Carolina History Strategies for Teaching SC MAPS

Prior Historical Content Knowledge Requirements

To be able to effectively use the SC MAPS curriculum, social studies students need to have some basic knowledge of the geography of South Carolina and a command of basic map skills. They need to know the four major river systems, the five major geographic regions and their characteristics, the location and significance of the Fall Line, and the major cities of the state. If this information has not been previously introduced, it is suggested that the students be assigned the geography chapter in their South Carolina history text prior to using SC MAPS. Once those basic concepts are mastered, the performance tasks and other activities provide sufficient historical information for students to complete them without requiring additional resources.

Social Studies Skills Used in SC MAPS

Map Skills
- Orient a map and identify direction
- Interpret meanings of infrared coloration on aerial photographs
- Use scale and estimate distance
- Compare maps and make inferences from them
- Identify specific locations and physical features
- Use latitude and longitude
• Interpret information from a contour map
• Interpret map symbols

Library Skills
• Use reference indexes to locate information
• Use the card catalog and/or a computer catalog service

Social Studies Reasoning Skills
SC MAPS can be effectively utilized to increase students' ability to classify, interpret, summarize, synthesize, and evaluate information obtained from the aerial photographs, contour maps, and historical information that is provided in the program. Historical vignettes can be effectively utilized to motivate and stimulate interest in the SC MAPS study sites. For example, in completing the activity tracing George Washington's route through South Carolina, Terry Lipscomb's South Carolina in 1791; George Washington's Southern Tour is an excellent source for historical vignettes on Washington's tour. Three other books which contain interesting Historical Vignettes are: (1) Rod Gragg's Pirates, Planters, and Patriots: Historical Tales From the South Carolina Grand Strand (2) Louise Pettus and Ron Chapesiuk's The Palmetto State: Stories from the Making of South Carolina and (3) Lewis P. Jones, South Carolina A Synoptic History for Laymen.

Teaching the Venn diagram for Comparing and Contrasting
There are four basic steps in using Venn diagrams to compare and contrast:
1. Determine what items you want to compare.
2. Select the characteristics of items on which you want to base your comparison.
3. Explain how items are similar and different based on the characteristics chosen.
4. Summarize how the items are different and how they are alike.

Social Studies Reasoning Skills and Relationship to Curriculum Frameworks
SC MAPS addresses several of the "themes" identified by the National Council for the Social Studies in their publication: Expectations of Excellence, Curriculum Standards for Social Studies, Bulletin 89 (1994). These themes are:

1. The study of culture and cultural diversity
   SC MAPS includes materials which demonstrate the cultural diversity of the state.

2. The study of time, continuity, and change
   SC MAPS includes activities that engage students in identifying patterns of change over time such as the development of transportation and agricultural systems in the state.

3. The study of people, places, and environments
   SC MAPS includes activities that have students interpret aerial photographs and contour maps in order to make inferences about the relationships between people and their environment concerning land use, settlement/population patterns, influence of physical geography upon historical events, and the impact of environmental changes and disasters upon the state and its people.
4. The study of how people organize for the production, distribution, and consumption of goods and services

SC MAPS includes activities which help to explain historical (as well as current) economic development within the state.

5. Science, technology, and society

SC MAPS includes activities which help students examine how developments in science and technology have impacted upon transportation, agriculture, industry, and population centers in the state.

Resource List for South Carolina History


Prior Mathematical Content Knowledge Requirements

A basic knowledge of arithmetic operations is essential to the working of most of the mathematics activities in SC MAPS. Number sense, set theory, quantitative literacy, elementary geometry, and some problem solving experience are sufficient background for almost all performance tasks. Students are expected to use fractional and decimal numbers and to understand the concept of percentage. A few questions require simple algebraic manipulations. Questions requiring trigonometry and higher level algebra are designated as enrichment problems. Students must also have the ability to work with fractional and verbal scales, and be able to convert units of measure, for example from square feet or square miles to acres. A working knowledge of the principles of organizing data and representing it graphically should be attained before attempting most SC MAPS performance tasks.

Mathematics plays a pervasive role in the home, the workplace, and the world of everyday living. Problems in SC MAPS are real problems with real world applications: problems which help students understand the relevance of mathematical thinking to their own lives. Mathematical literacy enables a student to use exploration, conjecture, and logical reasoning to solve a variety of problems. From an interdisciplinary perspective, it also gives students practical experience in evaluating the cost effectiveness of projects and business activities related to other fields.

Mathematics Skills Used in SC MAPS

Basic
- Estimating values using a variety of techniques
- Practicing arithmetic skills
- Substituting numbers into formulae
- Applying critical thinking skills to mathematical problems
- Enhancing problem solving skills
- Using metric and English measurements and conversions
- Enhancing calculator skills
- Communicating mathematical information to others

Statistical
- Enhancing graphing skills (line graphs, circle graphs, bar graphs, etc.)
- Making and interpreting graphs
- Organizing data tables
- Determining measures of variability
- Estimating probabilities relative to sample size

Geometry
- Labeling coordinates using radial and Cartesian coordinate systems
- Making topographic profiles
- Estimating measurements of area, perimeter, volume, etc.
- Calculating dimensions of shapes using formulae
- Comparison of lines and other geometric shapes
Algebra

- Determining slope of lines or line segments
- Applying time, distance, and speed formulas
- Finding the equation of a line connecting two points
- Applying equation for an ellipse

**Mathematical Reasoning Skills and Relationship to Curriculum Frameworks**

The mathematics activities used in SC MAPS incorporate the standards of the National Council of Teachers of Mathematics and those in the South Carolina Mathematics Framework and the South Carolina Mathematics Achievement Standards. Many of the activities are designed to be performed in cooperative learning groups with all students involved actively. The performance tasks require using critical thinking skills to interpret solutions to problems concerning the state in which the students live.

The South Carolina Mathematics Framework document stresses active learning and use of manipulatives in mathematics teaching. Some suggestions for accomplishing those goals include: "learning mathematics with understanding," "learning mathematics in familiar, realistic contexts," and "talking and writing about the mathematics they are learning as a means of strengthening their understanding." There are many performance tasks in SC MAPS that have science or history as their main focus, but are driven from a mathematical point of view. For example, in locating the site for the new capital, at Columbia, students must first calculate the geographic center of the state. Several performance tasks that require calculations also require students to communicate orally or in writing about their rationale for choosing a particular problem solving strategy or about their confidence in the accuracy or precision of their numerical answer.

**Resource List for Mathematics**


Prior Language Arts Content Knowledge Requirements

The performance tasks and other questions used in SC MAPS are written at a middle school level. Students should have a sufficient language arts background in vocabulary, spelling, sentence construction, and reading comprehension to function at that level. Students should have some experience in storytelling and developing their listening skills. They should have enough library experience to know how to recognize different genres of writing and speaking, and to be able to examine setting, plot, theme, and character in folktales, historical fiction, and fiction. Students should also be able to compare and contrast information and opinions from different sources.

Language Arts Skills Used in SC MAPS

Nothing is allowed to die in a society of storytelling people. It is all--the good and the bad--carted up and brought along from one generation to the next. And everything that is brought along is colored and shaped by those who bring it.


Storytelling is one of the easiest and most natural ways to recount events and to access our common history. We do it all the time--every day. It's a shame that we don't use it more in the classroom. Embedded in storytelling are many features that, as teachers, we know to be critical to the development of language and the understanding of print. However, there are wider, and perhaps more important consequences of language that storytelling embraces.

Story functions as a binding element in our culture. It brings people together for a shared purpose. In any community, a family or a classroom, stories are told and retold and events are related in many different ways. Virginia Hamilton, author of The People Could Fly, (American Black Folktales, New York: Alfred A. Knopf, 1985) says:

that we all live in a present-day America made up of polyethnic, culturally diverse communities. We live in parallel cultures. Certainly this is true of both our local communities and our classroom communities. Many of us teach in classrooms where three or four languages and numerous dialects are spoken. What better way to learn about the members of our classroom community and of our local community than through story?

In South Carolina we are fortunate to have a rich heritage of oral tradition to draw from for our stories. As well, the diversity of cultures in our state provides us with wonderful sources for our research into local stories. Embedded in the SC MAPS Teaching Manual are a variety of South Carolina stories. Many of these had not previously been documented! These stories are a sampling of what's in your own back yard. The activities that accompany each story can be used as is, but don't hesitate to experiment, swap activities among stories, and best of all, let your students take the lead. If you've never had students tell stories before--take heart! Use this opportunity as an excellent excuse to try a little risk taking along with your students. We promise, you'll be glad that you did!
Here are some suggestions to help your students get started.

Learning a Story
1. Select a story that really appeals to you.
2. Read or listen to it several times.
3. Read or talk about it out loud many times until you begin to get comfortable with it.
4. Keep a note card with the following information on it:
   - title,
   - source,
   - list of characters,
   - first three lines of the story,
   - brief notes outlining the events of the story sequence,
   - the last line of the story.
5. Memorize the opening and the ending of the story.
6. Don't try to memorize the rest of the story, just tell it from your heart by thinking of the pictures that the story creates in your mind. Remember--it's like learning to sing a song.

Storytelling with Students
Students can use the above suggestions or they can come up with their own method of learning stories. Here's a plan for practicing stories in the classroom.
1. Allow students the opportunity and time to read or discover many different stories until they find one that they would like to tell.
2. Assign, or let students select, a partner.
3. Partners work together to help each other learn the story and to practice.
4. Once partners are comfortable telling their stories to each other, put two sets of partners together forming groups of four.
5. Each student tells his/her story to the other three in round robin fashion.
6. Group members should offer praise and encouragement.
Most of the students will have learned not only their story, but will have also learned the three stories from their group members.

South Carolina Stories
A wide variety of South Carolina stories are found in this guide. Many of our South Carolina tales are based on fact but flavored with fiction. These tales are not meant to substitute for history but illuminate documented facts by demonstrating how people personalized events around them.

Language Arts Reasoning Skills and Relationship to Curriculum Frameworks

Storytelling helps students develop and refine skills critical to language arts mastery and is a natural way to address these goals. The strands of the new South Carolina English Language Framework document stress "using language to learn," "using the conventions and forms of language," "using language to communicate," and "appreciating language." For middle schoolers, storytelling is an important way to involve students with hands-on experiences with words and stories - a way that capitalizes on those unique traits that middle schoolers exhibit. It is a way to connect reading with writing, listening with speaking. Telling original and created stories can help establish self-confidence with language and provide authentic reasons for reading and writing.
Storytelling is also critical for the reading, writing, listening, and speaking skills that students use in other content areas. “Story is the best vehicle for passing on factual information. . . .The facts about how plants and animals develop, how numbers work, or how government policy influences history - any topic, for that matter - can be incorporated into story form and made more memorable if the listener takes the story to heart” (National Council of Teachers of English). The following concepts and strategies are important factors to consider while incorporating SC MAPS storytelling material into the language arts curriculum:

- The writing process
- Peer and teacher conferencing techniques
- Journals, notebooks, or learning logs
- Webbing, story graphing, or other story visuals
- Reading aloud
- Ways to incorporate good literature
- Conducting research - the active kind like real writers and storytellers do to find out about their subjects

In other words, if your classroom buzzes with most of the strategies listed above, then you should have no problem finding hundreds of ways to use the SC MAPS stories and storytelling activities and weaving them into your instruction of reading, writing, listening, and speaking.
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Figure 1: Map Showing Location of SC MAPS Stories and Folk Tales
Resource List for Language Arts

The following list of resources are helpful as well as easily accessible in school libraries, public libraries, and popular bookstores. The stories and other resources below are listed by title to facilitate correlation with the story location map provided above. Stories and storytelling activities related to each study site are located in each section of the SC MAPS Teaching Manual. It is hoped that you and your students will enjoy these stories and will use them to introduce your studies, supplement your research, and celebrate the rich cultural diversity of South Carolina.

Resources for Storytelling


The Jack Tales, by Richard Chase. Houghton Mifflin Co., 1943


South Carolina Ghosts: From the Coast to the Mountains, by Nancy Roberts. South Carolina Press, 1983.


Resources for Teaching Storytelling


Stories in the Classroom: Storytelling, Reading Aloud and Role-playing with Children


Storytelling: At the Heart of Teaching, by Lyn Zalusky Mueller and Christy Clonts.

Teaching Level, Time, and Scheduling Suggestions

The SC MAPS curriculum was developed as a middle school project yet is flexible enough to be used at many levels of instructional programs. Middle school teachers will find the SC MAPS program particularly valuable as an interdisciplinary program that lends itself readily to team teaching across the curriculum. Using this model for the team teaching approach, where science, mathematics, social studies, and language arts teachers plan their lessons together with a common theme; students easily recognize the connections that interrelate these disciplines. Several examples of thematic strands focusing on South Carolina are transportation, rice cultivation and culture, hurricanes, environmental concerns, agricultural trends, African American impact, tourism, diversity of land use, and conservation of nature resources.

Remember that "less is more." Keep coverage simple at first, until everyone is familiar with the map products and map reading skills. A few overview activities widely spaced will allow students to become acclimated to the precepts of SC MAPS before an in-depth study is begun. Use the Power Thinking Activities to introduce different topics or sections of the curriculum. These activities will give students a "big picture" of the region and will give them the opportunity to become comfortable with the cartographic products which go with that area. Make sure students are successful with concepts and procedures before moving on to other lessons.

Recall that the heart and soul of the SC MAPS program are the maps and lithographs. The more the students work directly with the cartographic products, the more involved they will become with the materials and the more they will realize the goals of the curriculum. Try to use the maps as often as possible when working with South Carolina stories, South Carolina history, and concepts in science and math. At first, make a special effort to focus on study sites or other materials located close to your school, so that students will be able to connect these features and concepts with their own lives.

Curriculum Integration and Use of Performance Task Icons

When team teaching the materials, it is advisable to construct a flow chart ahead of time so each teacher in the team will know when and what other teachers are covering. Several of the pilot teachers for SC MAPS suggested having the science and social studies classes begin work with the maps using the overview activities identified by the symbol \( \rightarrow \), then have the language arts and math classes follow at a later time. Once the groundwork has been laid, the math and language arts teachers will get off to a smoother start. Also, students may tire of looking at maps all day long if all discipline groups work on SC MAPS at the same time.

Schools not using the team approach will find certain SC MAPS units appropriate for insertion into the traditional curriculum for content classes in science, math, language arts, and social studies. Even if only one teacher in a school chooses to use the materials, students will pick up on the interdisciplinary character of the program and will be able to relate it to concepts studied in other classes. Most of the SC MAPS activities qualify as stand-alone exercises. As many or as few of these can be used as best fits the teacher's lesson plan. One or many of the eighteen study sites available
All performance tasks in SC MAPS are labeled by icons representing five categories; the icons are as follows:

- ☀ the Sun represents science,
- ☑ the computer represents mathematics,
- ☒ the book represents history,
- ☘ the pen-in-hand represents language arts, and
- ➤ the airplane represents an overview task.

These icons, which include four disciplines, are used to identify the main components in the tasks. In addition, an overview icon is used for general tasks which relate primarily to locating features or events on maps and lithographs. Several questions have more than one icon, indicating that the task has components based on two or more disciplines. Teachers should decide ahead of time who will assign that particular task. These multi-icon questions should not be broken up for use in different classes. In general, overview questions should be assigned prior to any discipline-specific exercises.

### Cooperative Learning Techniques Applied to SC MAPS

Many of the performance tasks contained in the SC MAPS curriculum are designed for cooperative learning groups. Teachers may structure positive interdependence by establishing mutual goals, joint rewards, shared resources, and assigned roles. When working well, students promote each other's learning by helping, sharing, and encouraging efforts to learn. Students explain, discuss, and teach what they know to their classmates. Individual accountability is still important. Teachers may structure this by giving individual tests to students or randomly selecting one group member to give the answer. Social skills such as leadership, decision-making, trust-building, communication, and conflict management are an integral part of the success of the cooperative learning model. Teachers should monitor groups and give feedback to individual groups as well as to the class as a whole. One possible way of assigning task roles to students is presented in the accompanying figure.

What you need to implement cooperative learning techniques.
- Classroom arranged so students work in Groups of 3-5
- Students should be sitting around a table or desk
- Every student must be able to face the front of the classroom
- Students must have sufficient space between groups
- Materials and activities must be suitable for cooperative learning techniques
- Outline clearly students' roles in their group
- Teachers become a **Guide on the Side**, instead of a **Sage on the Stage**!

Which learning style is each of the following expressions conveying?

- **We are Each in this alone!**
- **I swim, You sink; I sink, You swim!**
- **We sink or swim together!**
Figure 2: Suggested Cooperative Group Assignments

<table>
<thead>
<tr>
<th>Maps &amp; Materials Manager</th>
<th>Reader</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gathers all maps needed and other supplies.</td>
<td>Read information from resources aloud to the group. Check to be sure everyone is listening.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recorder &amp; Checker</th>
<th>Map Marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill out any forms. Write information as group members dictate. Check to be sure all members agree on your group’s answer or information.</td>
<td>Use a wipe-off pen to mark locations, trace areas, identify features, etc. as instructed in the activities. Clean off the map when activity is completed.</td>
</tr>
</tbody>
</table>
Cooperative learning techniques to try

1. Turn to your neighbor for three to five minutes. Ask them to explain the following items:
   - The concept you've just taught,
   - The assignment,
   - How to do what you've just taught,
   - Summarize the three most important points of the discussion.

2. Cooperative Learning Groups: Students read materials together and answer the questions. One person is the READER, another the RECORDER. The third person is the REPORTER, and the fourth student is the RUNNER. If there are five students in the group, that person assumes the role of the CHECKER.
   - READER reads the group's material out loud to the group, carefully with expression, so that the group members can understand and remember it.
   - RECORDER writes the answers in a legible form.
   - REPORTER presents the group’s conclusion to the class
   - RUNNER gets the materials or equipment needed by the group, keeps track of them and puts them carefully away.
   - If needed, the CHECKER checks on the comprehension or learning of group members by asking them to explain or summarize materials learned or discussed.

3. Jigsaw: Each person reads and studies part of a selection, then teaches what he or she has learned to the other members of the group. Each then quizzes the group members until satisfied that everyone knows his or her part thoroughly.


Teaching Students with Diverse Backgrounds

The SC MAPS materials are particularly valuable to students who learn better visually than verbally. The ability to actually draw on the cartographic products with wipe-off pens lets even students with poor verbal and reading skills take a full part in the investigation. It is helpful to start out at a concrete, less abstract level until you are sure that all students in the class have grasped the fundamental concepts of the activity. Economically disadvantaged students, who may not have had the opportunity to travel widely, can gain important perspectives on the world outside their local neighborhood through close study of the aerial photographs and satellite images contained in SC MAPS.

Cultural diversity is a feature of South Carolina society which should be celebrated. SC MAPS includes a significant amount of material geared towards Native American and African American contributions to the state, as well as referring to a variety of immigrant groups, such as the Scotch-Irish, who have had a significant impact in the development of modern South Carolina. Storytelling, in particular, can be an incentive for students to travel down cultural roads to discover the patchwork of different customs and conduct which make up their own ancestral heritage.
SC MAPS: Links to South Carolina Frameworks

SC MAPS curriculum materials reflect the emphases set forth by recent national and state curriculum initiatives.

**SCIENCE (South Carolina Science Framework, 1996)**
- Show how earth materials differ from one another.
- Describe characteristics of different bodies of water and different landforms.
- Identify local features on maps, aerial photos, and remotely sensed images.
- Explore and evaluate earth history through observing features of the earth.
- Explain how earth materials are transported by water and wind.
- Explain the relationship between various earth materials and the geologic processes that created them.
- Evaluate how surface & subsurface geologic processes cause changes on the earth’s surface.
- Explain the significance of geologic time to changes in rock and fossil records.

**MATHEMATICS (South Carolina Mathematics Framework, 1993)**
- Emphasize Strands, Communication, Connections, and Problem Solving.
- Use estimation to determine reasonableness of results.
- Visualize, construct, and represent geometric figures.
- Use and apply coordinate geometry to locate position in two dimensions.
- Extend understanding of the process of measurement.
- Estimate, make, and use measurement to describe and compare phenomena.
- Select appropriate tools to measure with required degree of accuracy.
- Use statistics to solve problems.
- Display data in appropriate ways.

**LANGUAGE ARTS (South Carolina English Language Arts Framework, 1996)**
- Use language to learn.
- Select, access, and use information from a variety of print and nonprint sources across the curriculum.
- Use the conventions and forms of language
- Use forms appropriate to task.
- Use language to communicate
- Use writing processes and speaking strategies to express ideas clearly.
- Communicate in a variety of language forms.
- Appreciate language.
- Appreciate a variety of print and nonprint materials.
- Relate literacy work to personal experiences.
- Place works of literature into historical and cultural context.

**SOCIAL STUDIES (National Council for the Social Studies, 1994)**
- Study culture and cultural diversity.
- Study time, continuity, and change.
- Study people, places, and environments.
- Study how people organize for the production, distribution, and consumption of goods and services.
- Study relationships among science, technology, and society.
Science

The best assessment techniques for science involve students actually performing tasks with the cartographic products. For example, in the Blue Ridge Region Study Site, one question asks students to mark the state boundary line, between North and South Carolina, on the Table Rock Lithograph. That boundary line is not shown on the lithograph. To answer this question, the student must realize that the boundary in this part of the state was placed along the drainage divide. They must then analyze the lithograph, using their knowledge of how to interpret infrared aerial photography, to determine the location of the ridgeline which acts as the drainage divide. The student can then trace this line on the lithograph indicating knowledge of the boundary line, thereby mastering the skills needed to interpret map and photographic information to solve a problem. Test questions should use map and lithograph data whenever possible.

Open ended questions are another excellent method for assessing student comprehension. Although taking longer to grade, such questions allow students to demonstrate their ability to think through a problem, hypothesize, and design a strategy to solve the problem. By asking students to document their progress throughout their answer, it is possible to ascertain what misconceptions, if any, the student has developed about the topic and to evaluate the logical structure of their reasoning.

Mathematics

There are a variety of ways to assess the mathematics skills taught through the SC MAPS curriculum. Some examples include: extended projects, with periodic checkpoints; direct problem solving, where students would show their work and explain each step they took; student designed mathematical problems developed from the cartographic products, in which students model their own questions after performance tasks in SC MAPS; teacher prepared pretest/posttest questions which directly tie mathematical skills to the maps; portfolio assessment, in which students would prepare samples of work done with the maps, and examinations with clearly defined scoring rubrics, in which several steps of student mathematical reasoning are compared with predetermined criteria.

Portfolios can showcase a student’s best work, worst work, most creative work, etc. depending on the criteria stated by the teacher. Teachers should look for evidence of improvement in work through time, and should pay particular attention to performance in group tasks versus individual tasks. It is important to be able to document that the material submitted is actually the student’s own work. Particular attention must be paid to specific assessment criteria to avoid a subjective or biased evaluation.
Some examples of criteria for use with scoring rubrics for a question involving the concept of perimeter of a field might include:

- Shows understanding of concept of perimeter
- Use of appropriate strategies to solve the problem
- Correctness of computations
- Clarity of written explanations
- All requirements of problem are satisfied or addressed

This list of criteria may be graded on the basis of superior, satisfactory, marginal, or unsatisfactory answers.

**Social Studies**

It is recognized that the specific assessment techniques are left to the teacher and the school system. SC MAPS assessment could involve any number of assessment techniques including:

- Teacher prepared pretest to determine what the students know about SC history and geography before the use of SC MAPS followed later by a teacher made posttest
- Checklist where teacher assesses student accomplishment of unit objectives
- Use of portfolio
- Use of projects developed and presented by students which reflect objectives of SC MAPS activities e.g., maps showing transportation systems
- Written reports on themes of topics introduced in SC MAPS activities

It should also be noted that many of the books listed in the bibliography are excellent sources for historical vignettes.

**Language Arts**

Assessment strategies for measuring student growth and change are as varied as the storytelling activities themselves. Remember, too, that all assessment must be directly linked to the teacher's overall purpose for language arts instruction of which the SC MAPS activity is only one part. However, the following vignette incorporates an assessment strategy with an SC MAPS activity and can be used to assist teachers in generating their own strategies.

After investigating, reading about, and telling local stories, a class of middle school students wants to investigate the particular stories that relate to a cave that is located outside of their town. Then, they want to retell their favorite tales about the cave and compose original ones. In small groups, the students design a long list of requirements for evaluating their oral and written story products. They rank order the requirements, listing the most important first. After researching old newspaper articles, interviewing folks living near the cave, and obtaining a local park ranger or interpreter as a guest speaker, the students decide to create group stories of different types.

For example, one group wants to create a story to explain the origin of a cave; another a story that describes bats incubating their babies in a cave; a third wants to explain groundwater flow by telling about the trip of a golf ball through a cave; and so forth. The class decides to revise their evaluation list, shortening it and making it...
specific for each story type. Two weeks later, the students are ready to tell their stories. After the first couple of tales, the class decides to eliminate any ratings on their evaluation requirements having to do with actual storytelling performance and to instead give points for amount and accuracy of research and for the creative ways that each group has incorporated the factual information. Each group scores and discusses the other groups’ work. Then, each student writes a personal reflection discussing their individual progress within their group and identifies things that they might like to try differently next time as well as ideas for future explorations.

This scenario allows the teacher to assess what students initially know about story composition and to assess what they are learning as the groups progress. It also incorporates an assessment of the final product and the process, and provides for group and individual evaluations. Most importantly, it involves students in an authentic, purposeful, and useful self-assessment throughout the investigation.

**Culminating Assessment Activity**

At the end of the SC MAPS portion of the yearly course of study, pilot teachers have found it useful to achieve closure on the topic of South Carolina map studies by arranging a culminating group activity involving all of the map products. Each group is assigned two study sites to investigate. The sites are selected to be as different as possible although all sites have certain basic categories of features which can be compared. Instructions to groups include describing the following three items for each map and preparing a report to the class highlighting similarities and differences between their two sites.

A. The natural landforms and diversity of the landscape  
B. Man's interference with the landscape including alterations and use of land  
C. Ways that culture was affected by the landscape in this region

The following study site pairs are suggested:

- Charleston vs. Columbia  
- Congaree Swamp vs. Lake Marion  
- Table Rock vs. Woods Bay  
- Silverstreet vs. Forty Acre Rock  
- Winyah Bay (pre Hurricane Hugo) vs. North Inlet (post Hurricane Hugo)  
- Graniteville vs. Myrtle Beach  
- Upstate Satellite Image vs. Coastal Satellite Image
Introduction

Infrared aerial photographs and their accompanying topographic maps, complemented with special purpose maps, have been selected to focus on a perspective of South Carolina that can be attained in no other way. Eighteen specific study sites have been carefully chosen to highlight the geological features of South Carolina that have influenced historical development, economic trends, cultural diversity, environmental concerns, and current land uses. Recent technological advances in photographic and cartographic products are used as a basis to enhance students' geographic skills and create an awareness of the responsibility that citizens must accept to protect our natural resources.

Prior Cartographic Content Knowledge Requirements

Students must have mastered some basic map-reading skills to receive full benefit from the SC MAPS curriculum. A familiarity with spatial relationships such as compass directions, scale and proportion, linear and areal measurements, and the use of a grid system, such as latitude and longitude, for locating map features is of primary importance. Students must become familiar with basic map symbols, such as representations for roads, railroads, rivers, swamps, and buildings. A list of topographic symbols and their interpretation is supplied with the SC MAPS Portfolio of cartographic products. That list may be referred to as needed, but students should have the basic symbols committed to memory before beginning work on the maps.

A working knowledge of contour lines is an important skill, although not necessarily essential. Several of the performance tasks in the SC MAPS activities require manipulation of contour line data. Even if students have not mastered the mathematical intricacies of analyzing contour lines, they should have an intuitive grasp of the concept, for example, that contour lines drawn close together indicate steep slopes.

No prior technical knowledge of aerial photography or satellite imagery is required. Most students will have taken pictures themselves and will understand the basic principles of photography. The relationship of camera altitude to scale is important and can be related to students' perceptions of image size on a photograph diminishing with the object's distance from the camera. Although satellite images are not technically photographs, the imaging process produces products which can be treated as pictures without loss of significance.

State of South Carolina Base Maps

Three State of South Carolina Base Maps with identical scales, 1:500,000, have been selected to provide a unifying statewide framework for the five study areas, eighteen study sites, and various associated student activities. The State of South Carolina Base Map with Shaded Relief (STATE BASE MAP #1, SHADeD RELIEF) identifies rivers, reservoirs, railroads, cities, and counties, and also indicates elevation differences by variations of color in the landform representation. The State of South Carolina Base Map with Highways (STATE BASE MAP #2, WITH HIGHWAYS) identifies the same features as the relief map, without shading, but also includes
highways and locations of National Forest land. The third state base map (LAND USE/LAND COVER MAP) is computer generated from Landsat satellite imagery to highlight various land uses within the state. The colors on this map correspond to land use categories identified in the map index. The first two base maps are customized versions of standard maps produced by the United States Geological Survey's (USGS) National Mapping Program. The third map was digitized and printed by the South Carolina Department of Natural Resources using the USGS map as a template. Additional state index maps at the beginning of each section illustrate the location of the five landform regions and the study sites selected for the SC MAPS curriculum.

### Topographic Maps

The topographic maps supplied with the SC MAPS portfolio were customized from selected quadrangle maps produced by the United States Geological Survey's (USGS) National Mapping Program. Each map series conforms to established specifications for size, scale, content, and symbols. Most of the SC MAPS topographic maps are based on the USGS 7.5 minute series and have a scale of 1:24,000. The original USGS maps used for reference are listed below the map title on all SC MAPS cartographic products. The following chart lists the standard coverage of USGS maps.

<table>
<thead>
<tr>
<th>Series &amp; Scale</th>
<th>One Inch Represents Approx.</th>
<th>Land Area</th>
<th># of Maps Needed for Statewide Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Base 1:500,000</td>
<td>8 miles</td>
<td>State Area</td>
<td>1</td>
</tr>
<tr>
<td>State Base 1:250,000</td>
<td>4 miles</td>
<td>2° x 1°</td>
<td>10</td>
</tr>
<tr>
<td>State Base 1:100,000</td>
<td>1.6 miles</td>
<td>1° x 30 min.</td>
<td>28</td>
</tr>
<tr>
<td>State Base 1: 24,000</td>
<td>2000 feet</td>
<td>7.5 x 7.5 min.</td>
<td>566</td>
</tr>
</tbody>
</table>

### Interpreting Topographic Maps

#### Map Scale

Map scale is the relationship between the distance measured on a map and the corresponding real distance on the ground. The base map scale of 1:500,000 represents a dimensionless ratio in which one unit on the map is equivalent to 500,000 real units on the ground. Inches, feet, miles, millimeters or centimeters could be used with equal validity. The choice of map scale depends on how a particular map will be used and what level of detail or coverage is desired. The state base maps, for example, are considered "small scale" because they cover large land areas with less detail (everything on the map appears very small). Conversely, the 7.5 minute topographic maps are considered "large scale" because they show a greater amount of detail while covering a smaller land area (everything on the map appears very large). When measuring distances on a map, the fractional scale can be used to set up a ratio of numbers which can be solved mathematically, or the graphic scale at the bottom of the map may be used to measure real distances directly from the map.

#### Contour Lines

The shape of the earth's surface as portrayed by contours is the distinctive characteristic of any topographic map. Contours are imaginary lines which follow the land surface at a constant elevation above sea level. Contour intervals of selected SC
MAPS products vary with the relief of the landscape and therefore are affected by the region in which the maps are located. Contour intervals of five feet are common in the Coastal Zone, while Blue Ridge maps commonly use contour intervals of 40 feet. Map scale differences are an important concept of the SC MAPS curriculum, because they provide a variety of spatial geographic perspectives of the earth's surface. Both contour intervals and scales are indicated in the legend of most topographic maps.

Map Symbols

All USGS maps use standard symbols that are consistent with other maps of that particular series. Likewise, the level of detail for natural and cultural features is also similar when the same geographic area is covered. For example, the 7.5 minute topographic maps assigned to each detailed study site remain consistent in regards to format and symbols. A brochure giving details of all symbols used for this series of USGS maps is included in the SC MAPS Portfolio. This brochure also highlights the importance of color in distinguishing symbols for both manmade and natural features.

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Cultural features such as roads, buildings, and place names</td>
</tr>
<tr>
<td>Blue</td>
<td>Hydrographic feature such as lakes, rivers, and swamps</td>
</tr>
<tr>
<td>Brown</td>
<td>Contour lines</td>
</tr>
<tr>
<td>Green</td>
<td>Forested areas and orchards</td>
</tr>
<tr>
<td>Red</td>
<td>Major roads and public lands boundaries</td>
</tr>
<tr>
<td>White</td>
<td>Open areas such as agricultural fields and pasture lands</td>
</tr>
<tr>
<td>Purple</td>
<td>New features added from aerial photographs during map revision</td>
</tr>
</tbody>
</table>

High Altitude Infrared Aerial Photographs

The activities for some study sites focus on information gathered from color infrared high altitude aerial photographs with a scale of 1:18,000 obtained from the National High Altitude Photography (NHAP) Program. These photographs were taken of South Carolina in the spring of 1982 and 1983 by the United States Department of Agriculture with cameras mounted in a jet flying at 40,000 feet. Another source of the infrared photographs is through the National Aerial Photographic Program (NAPP) taken in 1989 of South Carolina from a jet flying at 20,000 feet. In February 1990, post- Hurricane Hugo NAPP photographs were taken of the coastal area. The scale of the NAPP infrared photographs is 1:12,000. The SC MAPS infrared photographs were taken during the winter months when deciduous trees were in their dormant or leaf-off season. Interpretation of the various intensities of infrared hues or false colors yields information about vegetative ground cover, trees, physical geography, pollution problems, and land use.

The infrared high-altitude aerial photographs are unique in the fact that the invisible infrared portion of the electromagnetic spectrum is captured on film. The human eye only sees the visible light spectrum of the electromagnetic wavelengths. We see the "Roy G. Biv" colors in the rainbow: Red, Orange, Yellow, Green, Blue, Indigo, and Violet. Infrared wavelengths, light slightly longer than the red end of the visible spectrum, are referred to as "near red." Light waves slightly shorter than violet visible light are called ultraviolet. Neither the infrared (near red) nor the ultraviolet bands can be detected by the human eye. Many insects have a broader range of vision and can see wavelengths in the infrared band undetected by the human eye, just as dogs can hear higher frequency sounds than humans. Infrared photographs allow us to detect many more variations in color hues than a regular color photograph, thereby providing a greater source of information.
Color films have three distinctive layers or emulsions, each sensitive to different wavelengths of reflected sunlight. Standard color film usually records the visible wavelengths as red, green, and blue. Processing of the film generates cyan, magenta, and yellow dyes in proportion to the amount of exposure they received when the picture was taken. When these layers are combined, they produce a picture very close to what we observe in nature. Color infrared film has a yellow filter over the three layers to block out ultraviolet and blue wavelengths. The emulsions on color-infrared film are sensitive to green, red, and near-infrared wavelengths. The processing of the film produces yellow, magenta, and cyan dyes. Because infrared photographs usually appear reddish, the term "false-color image" is often used to describe them. The unique view that results provides a special tool for determining what is going on at the earth's surface.

Aerial cameras mounted in jet airplanes use specially designed sensitized film to record the infrared wavelengths. Many details not recorded on regular photographs can be depicted on the infrared film such as vegetative patterns, landform features, land usage, sediment load in water bodies, and old river beds. The infrared band of light penetrates atmospheric haze better than visible light, thereby recording clear images even on hazy days. NHAP and NAPP infrared photographs provide very high quality and high resolution maps that portray a wealth of information about the landscape. In processing infrared photographs, care is taken to maintain a color balance between different negatives. This gives a greater meaning to the differences detected in color hues from one picture to another.

**Satellite Imagery**

The infrared satellite imagery used in SC MAPS was donated by EOSAT, the Earth Observation Satellite Company, which is the distribution vendor for data obtained from the Landsat 5 program. Landsat satellites contain scanning instruments which record data in several different wavelength categories called spectral bands. Landsat 5 contains a scanner called the Thematic Mapper which can produce images in seven different spectral bands, including visible, reflected infrared, and thermal infrared. The two satellite images used with SC MAPS are referred to as infrared color images because they combine data from the green, red, and near infrared regions of the electromagnetic spectrum. The composite images created by this process are clear and crisp because near-infrared wavelengths penetrate atmospheric haze very effectively. The filtering out of blue wavelengths of light also eliminates the effects of reflections from atmospheric scattering.

The Thematic Mapper is mounted on the Landsat 5 satellite, orbiting about 400 miles above the earth, and can distinguish features on the earth's surface as small as 30 meters (98 feet) across. The satellite follows a sun-synchronous orbit pattern so that images of regions can be compared through time under the same lighting conditions. It takes 233 orbits in 16 days to completely cover the earth. Each image is almost square and covers approximately 10,000 square miles. Continuous strips of imagery are acquired along the orbital path and transmitted to a ground receiving station where the data is stored on magnetic tapes. In that form, the data can be manipulated digitally by computers to produce the exact blend of spectral bands required for a particular study.

A major advantage to satellite imagery is that large areas can be scanned at one time, so researchers and students can see the "big picture." A prime example is the Brevard Fault Zone which passes through Oconee County in South Carolina.
aerial photography will not show this feature clearly, but the satellite image provides a very distinctive lineament, or straight line pattern, running all the way from Georgia into North Carolina. This large areal coverage permits easy comparison with the state base maps. The Landsat images used in SC MAPS have a scale of 1:332,640, which is very close to the scale of the state base maps which is 1:500,000. The interpretation of infrared satellite images is basically carried out in the same manner as the interpretation of infrared aerial photographs. Even though the data acquisition methods are different, the resulting cartographic products can be analyzed using the same procedures.

Interpreting Infrared Images

Images acquired from high altitude aircraft or satellites are valuable sources of information and provide important tools for scientists to study the earth’s landforms, geology, and vegetation, as well as its land uses and abuses! Red objects with low levels of near-infrared reflectance may appear green. Yellow objects as well as other light colored objects, such as sand or light soil will appear white. On color infrared film, healthy green vegetation appears red because live vegetation reflects highly in the infrared wavelengths. Bright red may indicate winter crops such as rye, wheat, or oats. Evergreen trees and pine forests will also appear red. Fallow fields will appear greenish-white. Dormant vegetation, such as deciduous hardwood trees of oak, hickory, and gum, appear bluish-gray. Dead or unhealthy vegetation may appear either light red or a light shade of blue-green (cyan). Often, the maximum differentiation in vegetation, such as between hardwoods and pines, occurs when film is taken in winter (leaf-off) season. Therefore, to be most effective, all the SC MAPS infrared photographs were taken during the winter months so that upland pine and river bottom hardwood forests could be easily distinguished. Drainage patterns for an area can also be derived by combining knowledge of specific tree habitats with color keys for infrared images.

Clear water absorbs much of the near-infrared wavelengths and appears black on the photo. Sediment loads carried by rivers can also be detected. Water with different degrees of suspended sediment in it will appear in different shades of blue—usually the lighter the blue, the more sediment in the water. Because the film is very sensitive to water, variations in soil moisture are readily apparent. The sensitivity to moisture makes this type of film especially helpful in identifying and classifying wetlands, which often appear dark green to black. Urban and other built-up areas usually appear white or in some shade of blue-gray.

The identification of land cover features on color infrared imagery is particularly dependent upon the interpreter’s knowledge of what is on the ground and how it appears on the photograph at a particular time of the year. The interpreter can use common sense knowledge of ground features to identify them in the photography by color, texture, shape, and size. Locating and interpreting distinct landform features can easily be accomplished by using these infrared photographs. Granite outcroppings, Carolina Bays, golf courses, sand ridges, beach overwash, and remnant rice fields all appear as very distinct features on these infrared photographs. Land use features such as roads, buildings, airports, rock quarries and power line right-of-ways can also be easily recognized.

Some other interesting features on the earth’s surface can be found in color infrared aerial photographs. One is cemeteries which usually are a combination of lawns and tombstones, with a few scattered trees. These appear light red with tiny off-white specks and occasional red tree crowns. Another feature easily recognized is golf
courses, which appear as bright red or pink "links" typical of the standard course shape, with small light beige sand traps and rich red putting "greens." Sometimes polluted areas have an unusual or rare color appearance on the photograph such as yellow/green. Features with certain shapes are easily detected, such as stadiums, race tracks, baseball diamonds, railroads, and parking lots.

Figure 3: Interpreting Infrared Images

<table>
<thead>
<tr>
<th>COLOR KEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLOR</td>
</tr>
<tr>
<td>shades of red</td>
</tr>
<tr>
<td>bright red</td>
</tr>
<tr>
<td>darker red</td>
</tr>
<tr>
<td>dark red</td>
</tr>
<tr>
<td>bluish-gray</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>light blue</td>
</tr>
<tr>
<td>pinkish</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>white</td>
</tr>
<tr>
<td>gray</td>
</tr>
<tr>
<td>ribbon of mixed colors</td>
</tr>
<tr>
<td>shades of blue to black</td>
</tr>
<tr>
<td>light blue</td>
</tr>
<tr>
<td>blue</td>
</tr>
<tr>
<td>dark blue to black</td>
</tr>
<tr>
<td>dark green-blackish</td>
</tr>
</tbody>
</table>
CONTENTS OF SC MAPS PORTFOLIO

The SC MAPS portfolio contains six copies of each of the following cartographic products: fourteen infrared aerial lithographs (twelve aerial photographs and two satellite images) printed back to back, twelve topographic maps printed back to back, two South Carolina state base maps (shaded relief and highways) printed back to back, two special purpose maps (geologic and soils) printed back to back, one land use/land cover map printed on one side, and one transparent plastic grid with one-inch squares. The total package of 216 laminated products is accommodated in two large cardboard portfolios, 44 inches by 31 inches in dimension. All lamination is .3 mils. Products are designed for continuous student use with wipe-off pens and are sufficient in number for groups of 3 to 5 students to share map sets while working in a cooperative learning format within the typical middle school classroom.

Some of the eighteen study sites are still under development and cartographic products for these sites have not yet been printed. Other auxiliary materials, such as slide sets and answer keys for performance task questions, are available through the SC MAPS Distribution Facility at the Cartographic Information Center of the South Carolina Department of Natural Resources. Additional copies of any of the cartographic products may also be purchased through that office. Price lists are available upon request. The address and phone number are provided on the acknowledgments page of this teaching manual.

96 SC MAPS Lithographs (back to back printing, six copies, 9X2X6)
6 @ Table Rock (front) & Coastal Satellite Image (back)
6 @ Forty Acre Rock (front) & Myrtle Beach (back)
6 @ Columbia (front) & Silverstreet (back)
6 @ Graniteville (front) & Winyah Bay (back)
6 @ Congaree (front) & North Inlet (back)
6 @ Lake Marion (front) & Upstate Satellite Image (back)
6 @ Woods Bay (front) & Charleston (back)
6 @ Lake Jocassee (front) & Savannah River Site (back)
6 @ Kings Mtn (front) & Sugarloaf Mtn (back)

84 SC MAPS Topographic Maps (back to back printing, six copies, 8X2X6)
6 @ Table Rock (front) & ACE Basin (back)
6 @ Forty Acre Rock (front) & Myrtle Beach (back)
6 @ Columbia (front) & Silverstreet (back)
6 @ Graniteville (front) & Lake Marion (back)
6 @ Congaree (front) & North Inlet (back)
6 @ Woods Bay (front) & Charleston (back)
6 @ Lake Jocassee (front) & Savannah River Site (back)
6 @ Kings Mtn (front) & Sugarloaf Mtn (back)
12 SC MAPS State Base Maps (back to back printing, six copies, 1X2X6)
   6 @ Shaded Relief (front) & Highways (back)

12 SC MAPS Special Purpose Maps (back to back printing, six copies, 1X2X6)
   6 @ State Soil Map (front) & Geologic and Mineral Resource Map (back)

6 SC MAPS Land Use/Land Cover Map (printed on one side, six copies, 1X1X6)
   6 @ Land Use/Land Cover Map (front) & blank (back)

6 SC MAPS Transparent Grid Overlay (one-inch squares, six copies, 1X2X6)
   6 @ Transparent Grid Overlay

TOTAL = 216 Cartographic Products in SC MAPS Classroom Sets
abolitionist - a person in favor of putting an end to slavery
alluvium - unconsolidated material that is transported and deposited by a river
antebellum - refers to the time period before the American Civil War
aquifer - a body of permeable rock capable of holding and transporting significant amounts of groundwater, usually underlain by impermeable material
Back Country - a region that is unsettled; distant from largely populated areas
barrier islands - elongated ridges of sand offshore of a coastline and above sea level
batholiths - a large body of formerly molten rock that had pushed its way into the earth's crust from below and then solidified
Blue Ridge - the sparsely populated, relatively mountainous region of South Carolina which is underlain by igneous and metamorphic crystalline rock and is characterized by recreational land use
beach renourishment - the addition of new sand to beach areas which have experienced severe coastal erosion and subsequent loss of sand
Carolina Bay - a shallow, elliptical surface depression found in the Coastal Plain
Coastal Plain - the relatively flat region of South Carolina which is underlain by Cretaceous and Tertiary sedimentary rocks and is characterized by forests and agriculture as primary land uses
Coastal Zone - the relatively flat region of South Carolina which lies along the Atlantic Ocean, is underlain by unconsolidated Quaternary sedimentary rocks, is characterized by active coastal processes and has tourism as the major land use
cuspatc delta - a triangular shaped delta
colluvium - unconsolidated weathered material transported by gravity down a hill slope
delta - a low-lying depositional landform formed when sediment laden river currents enter an open body of water, slow down, and drop their sediment load
dendritic drainage pattern - a geometric pattern formed by rivers and streams which resembles the design on the veins of a leaf
detritus - material derived from preexisting rocks, formed by erosion or weathering; also loose fragments of dead organic material which accumulate in marshes or swampland
dike - thin, flat, formerly molten rock that has pushed into the crust of the earth from below cutting across previously existing layers, also earthen or other dam which holds back water to form a reservoir
disappearing streams - streams that disappear into the ground due to dissolution of limestone or other soluble rock in areas of Karst Topography, and which may possibly reappear or re-emerge from underground caverns
dissolution - the dissolving of rock or other material through the action of groundwater, surface water, or chemical agents

downfaulted basins - low areas between parallel fault zones formed by rocks breaking and subsiding or sliding downward relative to the surrounding landscape

escarpment - a linear cliff-like ridge of land or exposed rock commonly formed by faulting or fracturing of the earth's crust or by differential erosion of rock

estuary - that part of the mouth or lower course of a river in which its current meets the sea's tides; there is a mixing of fresh and salt water in this area

Fall Line Zone - geologic boundary between Piedmont and Coastal Plain, characterized by waterfalls or rapids in the rivers and change in stream gradient

fault - a fracture in a rock along which there is or has been an observable displacement

floodplain - the low-lying, level area that is periodically flooded on both sides of a river; it is made up of unconsolidated sediment deposited by the river

flotilla - a large number of small naval vessels

folds - bends or curves visible in layered rock

fossiliferous - bearing or containing intact or fragmented fossil plants and animals, or other evidence of past life; usually refers to rock

Grand Strand - the wide, crescent-shaped beach stretching from the North Carolina border to Winyah Bay; noted for tourist activity

groin - a breakwater made from rock, concrete, wood, or metal erected on a beach to inhibit the movement of sand to protect against longshore drift

habitat - the particular local environment in which a species of plant or animal lives

hydrolysis - a chemical process which occurs during weathering of minerals in rock whereby a compound reacts with water and is changed into a different material giving a byproduct of dissolved ions which are carried away by groundwater

igneous intrusion - any mass of formerly molten rock that has pushed into the crust of the earth from below and solidified

igneous - rocks that have formed by the cooling and solidification of molten material

indigo - plant in the legume family used for obtaining blue dye

jetty - a pier or structure of stones or wood projecting into the sea to protect a harbor from wave damage by deflecting the current

kaolin clay - a fine white clay produced by the alteration of alkali feldspar minerals in crystalline rocks, used in ceramics, paper, pharmaceuticals, and other products

Karst - a landscape characterized by underground caverns, disappearing streams, and surface sinkholes formed in regions of limestone or other soluble bedrock

landform - term referring to a landscape feature on the earth's surface which has been produced by geological processes, i.e. hills, valleys, streams, terraces, etc.

limestone - a sedimentary rock composed primarily of the mineral calcite (calcium carbonate) which often contains fossils and produces Karst Topography
lithographs - a picture produced by inking a specially prepared surface and then pressing the surface onto paper, or, in SC MAPS, the infrared color images and photographs printed from aerial photographic film or satellite imagery

loam - a soil containing sand, silt, clay and organic matter

Low Country - another name for the Coastal Plain and Coastal Zone of South Carolina

maritime forests - refers to a forest whose growth and microclimate are influenced by its proximity to the ocean

marsh- a grassy, saturated, poorly drained area intermittently or permanently water-covered

meander - a stream channel bend that increases its curvature through time and slowly migrates back and forth across its floodplain

metamorphic - referring to rocks that have changed in texture or composition due to the effects of heat and/or pressure

metamorphism - the process whereby rocks undergo physical or chemical changes as a result of heat and/or pressure

Midlands - a name given to the central portion of South Carolina, particularly the area around Columbia, because of its central location in the state; sometimes used as another name for the Sandhills Region

monadnock- isolated hill or mountain formed by erosion, an eroional remnant

niche - the function or position of an organism within its ecological community

oxbow lake - a horseshoe-shaped lake formed in an abandoned meander loop

oxidation - chemical process that occurs when a substance is combined with oxygen

perennial streams - streams that flow year-round without ever drying up

permeability - the ability of rock, sediment, or soil to permit fluids to flow through it

pettiagua - a long, hollowed-out flat boat similar to a canoe

Piedmont - the gently rolling, moderate elevation, foothills region of South Carolina underlain by igneous and metamorphic crystalline rocks and characterized by industrial, agricultural, and forestry related land uses

point bar - low lying mound of sand and/or gravel deposited on the inner margins of meander bends where stream velocity is lowest

porosity - the volume of the void spaces within a rock or soil, expressed as a percentage of the total volume

postbellum - the period after the American Civil War

pumped-storage - the type of hydroelectric power generation in which water is pumped from a lower elevation lake to a higher elevation lake during the night when power demand is low, then allowed to flow back into the lower lake through turbines to generate electricity during periods of high power demand
rapids - shallow, rocky areas in a stream channel which contain small waterfalls or rough water which is not navigable for boats, but is an easy place to cross

rectangular drainage pattern - a geometric arrangement of stream courses in which tributaries flow into larger streams at right angles; this type of pattern is usually controlled by faults or fractures in the underlying rock

regolith - any loose material overlying bedrock

relief - a measure of the difference in elevation between the highest and the lowest points in a specific localized area

remnant island - a coastal island which is thought to have originally been part of the mainland until it was separated from the shore by erosional processes

reservoir - a lake-like body of water formed by the blocking of streams by artificially constructed dams or embankments

rift zone - a system of parallel fractures in the earth's crust characterized by normal faults and extension of the land surface; often associated with basaltic lava extrusion and usually precedes the opening of a new ocean basin

salt marsh - a tract of low elevation wetlands, usually along the ocean, with a high salt concentration in the water

Sandhills - the central hilly region of South Carolina underlain by Cretaceous and Tertiary sedimentary rocks and characterized by poor soils and mining operations as the major land use

saprolite - partially decomposed rock which remains in its original location

seawall - a strong wall or embankment along the beach to prevent the encroachment of the sea, acts as a breakwater, etc.

sinkhole - steep-sided depression or basin found in areas of Karst Topography; caused by solution of limestone bedrock near the surface or by collapse of a cavern roof

sinkhole lakes - lakes formed in the portion of the hole formed by the collapse of a cave which is below the groundwater table

slough - low, swampy depression in a floodplain; usually filled with mud

swamp - an area having shrubs and trees, intermittently or permanently water-covered

tectonic - pertaining to the broader large scale structural features of the earth, how they originated, and how they relate to mountain building episodes

terrace - nearly level surface, relatively narrow, bordering a stream or body of water and terminating in a steep bank

tidal channel levee - a raised embankment next to a tidal channel, showing a gentle slope away from the channel; results from periodic overbank flooding due to the tidal influence on the channel.

tidal inlet - waterway connecting open water to a lagoon, bay, or tidal flat
topography - the general shape and physical features of the landscape

Tories - supporters of England during the American Revolutionary War

transgressive barrier island - narrow sand ridge built up seaward of the coastline; very unstable; contains sparse vegetation

Up Country - in South Carolina, refers to the Upstate; or in general a mountainous area

watershed - the land area drained by a system of rivers

weathering - the chemical and physical breakdown of rocks by rain, wind, snow, etc.

wetlands - a general term, used by specialists in wildlife management, for a group of wet habitats

xerophytic - adapted to very dry conditions
SECTION 1
SOUTH CAROLINA'S INTRIGUING LANDSCAPE (STATEWIDE OVERVIEW)

Index Map to Study Sites

<table>
<thead>
<tr>
<th></th>
<th>Study Site Description</th>
<th></th>
<th>Study Site Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A</td>
<td>Table Rock (Mountains)</td>
<td>5B</td>
<td>Santee Cooper Project (Engineering &amp; Canals)</td>
</tr>
<tr>
<td>2B</td>
<td>Lake Jocassee Region (Energy Production)</td>
<td>6A</td>
<td>Congaree Swamp (Pristine Forest)</td>
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<tr>
<td>3A</td>
<td>Forty Acre Rock (Granite Outcropping)</td>
<td>7A</td>
<td>Lake Marion (Limestone Outcropping)</td>
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<td>3B</td>
<td>Silverstreet (Agriculture)</td>
<td>8A</td>
<td>Woods Bay (Preserved Carolina Bay)</td>
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<tr>
<td>3C</td>
<td>Kings Mountain (Historical Battleground)</td>
<td>9A</td>
<td>Charleston (Historic Port)</td>
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<td>4A</td>
<td>Columbia (Metropolitan Area)</td>
<td>9B</td>
<td>Myrtle Beach (Tourist Area)</td>
</tr>
<tr>
<td>4B</td>
<td>Graniteville (Mining Area)</td>
<td>9C</td>
<td>The ACE Basin (Wildlife &amp; Sea Island Culture)</td>
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<tr>
<td>4C</td>
<td>Sugarloaf Mountain (Wildlife Refuge)</td>
<td>10A</td>
<td>Winyah Bay (Rice Culture)</td>
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<tr>
<td>5A</td>
<td>Savannah River Site (Habitat Restoration)</td>
<td>10B</td>
<td>North Inlet (Hurricanes)</td>
</tr>
</tbody>
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**SOUTH CAROLINA'S INTRIGUING LANDSCAPE (STATEWIDE OVERVIEW)**

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5. locate and research railroad tunnels
SECTION 1

SOUTH CAROLINA'S INTRIGUING LANDSCAPE (STATEWIDE OVERVIEW)

POWER THINKING ACTIVITY - "The Hydrophobic Horse"

You are an explorer arriving in the Carolina Colony in the summer of 1730. Your mission is to travel from the coast, the lowest point in the colony, to Sassafras Mountain, the highest point, in what will one day be the state of South Carolina. Use the STATE BASE MAP #1, SHADED RELIEF, and a wipe-off pen to trace your path. (Sassafras Mountain is located in the northwestern section of this map.) You may land your ship anywhere you wish along the coastline; however you have discovered that your horse, whom you have brought with you across the ocean, has developed an absolute hatred of water and will not cross water again under any circumstances. Find at least one route by which you can travel all the way from the coast to Sassafras Mountain without crossing water. You may however cross swamps because a summertime drought has left most swampland temporarily dry.

PERFORMANCE OBJECTIVES

1. Recognize and interpret evidence of geological events that shaped the state's five landform regions.
2. Examine the impact of the state's river systems, watershed areas, and drainage patterns on early settlements as well as on today's economy.
3. Identify and retell stories about origins of South Carolina place names.
4. Relate the topography of the state to historical events and economic growth.
5. Use diaries to compare and contrast early customs, modes of travel, political concerns, descriptions of landforms, and location of towns with those of today.
6. Compare early transportation systems and their role in the development of towns with modern interstate highways and their economic impact on major cities of today.
7. Analyze the impact of manufacturing, agriculture, and tourism on the state's natural resources.
8. Use real world situations to illustrate concepts of measuring area, perimeter, and length.
9. Recognize, examine, and interpret the meaning of state base map and topographic map symbols.
BACKGROUND INFORMATION

Description of Landforms, Drainage Patterns, and Geological Processes

South Carolina’s Five Landform Regions

South Carolina literally stretches from the mountains to the sea. Along the way it incorporates many distinctive regions, landscapes, cultures, and histories, each of which has its own fascinating story to tell. Yet each of these stories is related in some way to the underlying geology which provides the framework for understanding past and current economic trends, population distribution, agricultural choices, and land use patterns. South Carolina is known neither as a very large nor a very small state. It is not particularly famous nor unusually commonplace among other states. In terms of geographic, cultural, and historical diversity, however, South Carolina definitely qualifies as a special place, extremely interesting, intriguing, and unique to both residents and visitors alike. Each unique landform region has had a lasting impact on the state, not only in terms of its physical geography, but also on its human and biologic communities.

Figure 1-1: Landform Regions of South Carolina
There are many possible ways to subdivide South Carolina into geographic landform regions. Geologists tend to use rock type as the defining characteristic, while geographers look more towards common economic and cultural ties to define a region. Political scientists, historians, soil scientists, and linguistic experts all have their own criteria for establishing regional boundaries. Some approaches recognize as few as three regions in South Carolina while others assign six or more categories to the same area. The SC MAPS curriculum has selected landscape characteristics and land use patterns as the most important basic criteria for subdividing the state and has used this standard to establish five distinct landform regions for South Carolina:

- **Blue Ridge** - characterized by mountains and recreational land use
- **Piedmont** - characterized by low rolling hills, industry, agriculture, and forests
- **Sandhills/Midlands** - characterized by sandy hills and poor soils
- **Coastal Plain** - characterized by flat land, forests, and agriculture
- **Coastal Zone** - characterized by active coastal processes and tourism

These regions essentially run in broad bands parallel to the Atlantic Ocean coastline. Likewise, maps showing the distribution of geologic formations, vegetation, climate zones, and soils project this same banded pattern. Elevations decrease steadily from over 3000 feet in the Blue Ridge Mountains to sea level at the coast. Consequently, most major rivers run from northwest to southeast, crossing several landform regions on their way to the ocean. Boundaries between regions are quite clear and easy to distinguish in some parts of the state, but are very arbitrary in others. For all statewide maps, the lines shown represent the best approximations of regional boundaries at the given scale of the map.

**Differences Between Piedmont and Coastal Rivers**

All stream sediment is formed originally from the disintegration of solid rock by both chemical and physical weathering processes. Physical processes, such as the freezing of water and the growth of plant roots into cracks, tend to break rocks into smaller and smaller fragments. Chemical processes, such as oxidation and hydrolysis (chemical reactions involving water), alter the original minerals and produce soluble products which are carried off in solution. Runoff from rainfall carries these products (rock fragments, sand, clay, and dissolved ions) into streams where water currents are able to transport the material for great distances.

The largest sediment grain sizes are normally found in the mountains where stream energy is the highest. As grains move downstream, they are progressively rounded, sorted and made smaller until they reach silt or clay size. Larger grains roll or slide along the stream bottom while finer sediment is carried in suspension. The dissolved materials eventually are carried to the ocean where they add to the total salt content of the ocean. In areas of extensive erosion, such as the Blue Ridge and Piedmont regions, every rainstorm adds more silt and mud to the stream system to be carried farther towards the ocean. Rivers in these regions have enough energy to erode and downcut the landscape and therefore occupy relatively narrow valleys with small floodplains and fairly straight channel paths. Stream courses are fairly constant through time and are usually underlain by solid rock.
In contrast, streams which originate in the Coastal Plain, below the Fall Line Zone, generally have much lower energy and flow more slowly. As a result, they are able to carry much less sediment. Rainfall also runs off the land very slowly because land slopes are low, a fact which limits the amount of local erosion which can occur. Any sediment which is introduced into these streams usually gets deposited very rapidly into sandbars or mudflats associated with very wide, swampy floodplains. River courses are usually meandering and tend to change position frequently within the floodplain. It is very unusual to find rocks along the river bank or anywhere else on the floodplain. Such rivers are often stained a dark color by tannic acid derived from the decomposition of organic materials along the river course.

Drainage Patterns and Watersheds

All land areas which drain into a particular river system are said to be part of that river's drainage basin, or watershed. Each watershed is separated from other surrounding watersheds by higher elevation ridgelines called drainage divides. Every stream, no matter how small, has its own drainage basin from which it gathers water from runoff and sediment from erosion. Several small tributary watersheds, when taken together, serve as the combined watershed area for larger streams. In general, larger streams tend to have larger total watersheds. For example, the Santee River, the largest in the state, has by far the biggest watershed area in South Carolina.

South Carolina rivers, in contrast to those in other parts of the country, often undergo name changes as they travel from the mountains towards the sea. In the Santee River drainage system, for example, the Broad and Saluda rivers join to form the Congaree River, while the Catawba River changes its name to the Wateree River. The Congaree and Wateree rivers then join downstream to form the Santee River. In actuality, this river is the longest on the east coast, but this fact is relatively unknown outside of South Carolina because of the many name changes the river experiences.

Three major river systems, the Savannah, Santee, and Pee Dee, cross the entire state, carrying sediment eroded from the Appalachian Mountains to be deposited on the beaches and barrier islands along the coast. Together these three river systems drain about 80% of the state and are characterized by having large quantities of suspended silt and red clay carried in the water flow. These rivers undergo a dramatic shift in flow behavior and erosional and depositional dynamics as they pass through the Fall Line Zone from the Piedmont into the Coastal Plain.

Many smaller river systems, such as the Edisto, Ashley, and Coosawhatchie rivers, which originate in the Coastal Plain, are associated with comparatively small watersheds which tend to drain into the ocean rather than into other rivers. A few of these rivers in the Coastal Zone Region may be quite wide, but also very short. These are essentially glorified tidal channels which have no significant drainage basin other than the surrounding marsh and tidal flat areas. For the purposes of the SC MAPS activities, the watersheds of all Coastal Plain rivers are lumped together into a single category and are referred to as the Coastal Plain Drainage Basin.
Figure 1-2: State Map of Major Drainage Basins

SAVANNAH DRAINAGE BASIN
1 - Chattooga R.
2 - Tugalo R.
3 - Savannah R.
4 - New R.
a - Tugalo Lake
b - Lake Jocassee
c - Lake Keowee
d - Hartwell Reservoir
e - Secession Lake
f - Russell Reservoir
g - Clark Hill (Thumond) Res.
h - Par Pond

PEE DEE DRAINAGE BASIN
13 - Black R.
14 - Lynches R.
15 - Black Creek
16 - Pee Dee R.
17 - Little Pee Dee R.
18 - Waccamaw R.
s - Lake Robinson

SANTEE DRAINAGE BASIN
5 - Saluda R.
6 - Enoree R.
7 - Pacolet R.
8 - Broad R.
9 - Congaree R.
10 - Catawba R.
11 - Wateree R.
12 - Santee R.
i - Table Rock Reservoir
j - Poinsett Reservoir
k - Lake Greenwood
l - Lake Murray
m - Lake William C. Bowen
n - Lake Wylie
o - Fishing Creek Reservoir
p - Wateree Lake
q - Lake Marion

COASTAL PLAIN DRAINAGE BASIN
19 - South Fork Edisto R.
20 - North Fork Edisto R.
21 - Salkehatchie R.
22 - Coosawhatchie R.
23 - Ashepoo R.
24 - Edisto R.
25 - Stono R.
26 - Ashley R.
27 - Cooper R.
28 - Wando R.
29 - Coosaw R.
30 - Broad R.
31 - Combahee R.
r - Lake Moultrie
With the exception of oxbow lakes, sinkhole lakes, and Carolina Bay lakes, all of which are small in area, all lakes in South Carolina are actually man-made reservoirs. Of the three largest river systems in South Carolina, only the Pee Dee has remained a free-flowing river throughout the 20th century. Major dams and reservoirs can be found all along the other systems in all parts of the state. They provide hydroelectric power, municipal water supplies, and opportunities for recreation and tourism. Dams can also have adverse effects on a region and may cause an increase in water loss due to evaporation, change local climates, and act as sediment traps which greatly reduce the flow of sand to coastal regions. As a result, parts of the South Carolina coast are literally starved for sand and are experiencing severe beach erosion.

Geological Events that Shaped South Carolina's Landscape

The primary factor determining landscape features in South Carolina is the underlying geology. Differences in rock types and rock structures are responsible for many of the differences we see in the five major landform regions. The "Geologic Cross-Section of South Carolina," Figure 1-5, relates the landform regions to the occurrence of specific underlying rock belts. Figure 1-6, "The Geologic Time Scale and South Carolina," relates periods and epochs of geologic time to South Carolina events.

Most of the Blue Ridge Region, certainly the portion northwest of the Brevard Fault Zone in Oconee County, was the site of marine deposition of sandstones and shales along the shoreline of a much smaller North American continent during the Precambrian Eon over 600 million years ago. The Piedmont Region at 600 million years ago was a separate landmass, a smaller continental fragment, which had no connection with the North American continent. The Sand Hills and Coastal Plain sediments did not even exist at that time. Roughly 450 million years ago, during the Ordovician Period, the Piedmont landmass collided with the continental margin producing folds, faults, igneous intrusions (plutons), and extensive metamorphism, significantly changing the textures of the original sediments. About 300 million years ago in the Pennsylvanian Period, the continent of Africa collided with the Piedmont producing similar effects only on a much larger scale. Large segments of the Piedmont and Blue Ridge were overthrust westward onto themselves and the adjacent North American continent.

As a result of these collisions, most of the rocks in the Piedmont and Blue Ridge are metamorphic. The original sandstones and shales have been converted into gneisses and schists. Iron-rich volcanic rocks have been changed to slate and amphibolite, a dark gneiss rich in the mineral amphibole. Igneous intrusions have produced many large areas of granite which are currently mined in several parts of the state. Small deposits of limestone have been turned into marble. Many of these rocks are fairly resistant to erosion but the iron-rich schists and amphibolites are more susceptible to chemical weathering. These rocks breakdown to form thick soils and a half rock/half soil substance referred to as saprolite. The red clay common to the Piedmont is a direct result of such chemical weathering, specifically the oxidation of iron minerals.
Approximately 150 million years ago, during the Jurassic Period, the supercontinent which formed from the collision of Africa and North America began to separate. Just prior to fragmentation, tectonic activity along the developing rift zone caused a series of downfaulted basins to form along a line from Georgia to New England. These basins filled with river and lake sediments of Triassic and Jurassic age as well as intrusive basaltic sills and dikes (layers of igneous rock contained within other rock types). A few of these so-called Triassic Basins can still be found in South Carolina; exposed at the surface in Chesterfield County, and buried beneath Coastal Plain sediments in Barnwell County.

Figure 1-5: Geologic Cross-Section of South Carolina

**CROSS-SECTION OF SOUTH CAROLINA**

- BLUE RIDGE = igneous & metamorphic rock
- PIEDMONT = igneous & metamorphic rock
- INNER PIEDMONT BELT = severely deformed metamorphic rock
- KINGS MOUNTAIN BELT = less deformed mineralized rock
- CHARLOTTE BELT = metamorphic with many igneous intrusions
- CAROLINA SLATE BELT = slightly metamorphosed mudstones
- TRIASSIC BASINS = sandstone, shale, basaltic sills and dikes
- SANDHILLS/MIDLANDS = sandstone & kaolin, sedimentary rock
- COASTAL PLAIN = sandstone, limestone & shale, sedimentary rock
- COASTAL ZONE = recent sediments, mostly sand with some mud
### Figure 1-6: The Geologic Time Scale and South Carolina

<table>
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<tr>
<th>AGE</th>
<th>ERA</th>
<th>PERIOD</th>
<th>EPOCH</th>
<th>SOUTH CAROLINA EVENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>.01</td>
<td>CENOZOIC</td>
<td>Quaternary</td>
<td>Holocene</td>
<td>barrier islands form along modern coastline; Charleston earthquake of 1886 occurs</td>
</tr>
<tr>
<td>1.6</td>
<td>CENOZOIC</td>
<td>Quaternary</td>
<td>Pleistocene</td>
<td>alternating rise and fall of sea level (due to ice ages) produces beach ridges along coastal zone</td>
</tr>
<tr>
<td>5.3</td>
<td>CENOZOIC</td>
<td>Tertiary</td>
<td>Pliocene</td>
<td>sea levels rise temporarily to form Orangeburg Scarp, Carolina Bays develop in Coastal Plain</td>
</tr>
<tr>
<td>22.7</td>
<td>CENOZOIC</td>
<td>Tertiary</td>
<td>Miocene</td>
<td>renewed uplift of Appalachian Mountains produces large amounts of terrestrial stream sediment</td>
</tr>
<tr>
<td>36.8</td>
<td>CENOZOIC</td>
<td>Tertiary</td>
<td>Oligocene</td>
<td>falling sea level (due to formation of Antarctic ice cap) exposes parts of South Carolina to extensive erosion</td>
</tr>
<tr>
<td>57.8</td>
<td>CENOZOIC</td>
<td>Tertiary</td>
<td>Eocene</td>
<td>rising sea level deposits marine sediments over most of state - Santee Limestone forms in Coastal Plain</td>
</tr>
<tr>
<td>66.4</td>
<td>CENOZOIC</td>
<td>Tertiary</td>
<td>Paleocene</td>
<td>Cape Fear Arch is center of tectonic uplift along NC border; tectonic subsidence occurs along GA border</td>
</tr>
<tr>
<td>144</td>
<td>Mesozoic</td>
<td>Cretaceous</td>
<td>Long-term stable shoreline under higher sea level conditions produces sandhills; kaolin deposits form</td>
<td></td>
</tr>
<tr>
<td>208</td>
<td>Mesozoic</td>
<td>Jurassic</td>
<td>Atlantic Ocean opens as North America and Africa drift apart, first Coastal Plain sediments, diabase dikes form</td>
<td></td>
</tr>
<tr>
<td>245</td>
<td>Mesozoic</td>
<td>Triassic</td>
<td>Tectonic rifting of supercontinent Pangea produces fault basins, which fill with stream and lake deposits</td>
<td></td>
</tr>
<tr>
<td>286</td>
<td>Paleozoic</td>
<td>Permian</td>
<td>Allegheny Orogeny ends as Blue Ridge region is pushed westward in a series of thrust faults</td>
<td></td>
</tr>
<tr>
<td>320</td>
<td>Paleozoic</td>
<td>Pennsylvanian</td>
<td>Allegheny Orogeny begins as African continent collides with North America, extensive metamorphism</td>
<td></td>
</tr>
<tr>
<td>360</td>
<td>Paleozoic</td>
<td>Mississippian</td>
<td>African continent approaches North America, volcanic activity and igneous intrusions continue</td>
<td></td>
</tr>
<tr>
<td>408</td>
<td>Paleozoic</td>
<td>Devonian</td>
<td>Uplift of land in response to tectonic activity farther north, igneous intrusions and metamorphism occur</td>
<td></td>
</tr>
<tr>
<td>438</td>
<td>Paleozoic</td>
<td>Silurian</td>
<td>Extensive erosion of uplifted land with deposition into early ocean covering parts of Piedmont</td>
<td></td>
</tr>
<tr>
<td>505</td>
<td>Paleozoic</td>
<td>Ordovician</td>
<td>Piedmont terrane collides with North American continent, volcanic activity and metamorphism occur</td>
<td></td>
</tr>
<tr>
<td>570</td>
<td>Paleozoic</td>
<td>Cambrian</td>
<td>Blue Ridge area is at edge of continent, Piedmont is small separate landmass, marine deposition occurs</td>
<td></td>
</tr>
</tbody>
</table>

* ages in millions of years  * based on chart in Carolina Rocks, by Carolyn Murphy, Sandlapper Publications
As the Atlantic Ocean formed and grew wider, Africa and North America continued to move apart from each other. The break was not a clean one, as part of the African crust remained attached to the Piedmont region. This African crust was soon covered over by sediments derived from the mountains to the west. The Atlantic shoreline during the Cretaceous Period, about 100 million years ago, went through the middle of the state and is probably responsible for the sand deposited in what we now call the Sandhills. Offshore, marine deposits were laid down over the exposed African crust. These deposits were the beginning of the Coastal Plain sediments which are now visible between Columbia and the coast. As the Blue Ridge Mountains continued to erode, more and more sediment was deposited on the Coastal Plain. Sea level was dropping as this deposition occurred, causing the shoreline position to retreat to the vicinity of its present location. In addition to beach sand deposits, the Coastal Plain also contains shallow-water limestone deposits and offshore sandstones and shales.

The retreat of the shoreline to its present position occurred in gradual stages marked by terraces or escarpments carved out of Coastal Plain sediments by waves. The most noticeable of these is the Orangeburg Scarp (Citronelle Escarpment) which formed sometime between the Oligocene and Pliocene Epochs of geologic time. From that escarpment to the present shoreline, Coastal Plain sediments are extremely flat and only slightly modified by subsequent erosion. North-westward of the Orangeburg Scarp, modern erosion by streams has created a more rolling topography and wide floodplains with meander belts and other features of river migration.

The final geologic episode to affect the state was the ice age of the Pleistocene Epoch. Although glacial ice did not advance as far south as South Carolina, the alternating advances and retreats of the continental ice mass caused massive fluctuations in sea level which left many former beach ridges exposed along the Coastal Zone. Some of these ridges were significant enough to cause the diversion of rivers and tidal inlets. Sharp bends, such as seen along the Black River not far from its mouth, are easily identified on maps and photographs and are probably a result of blocked drainage due to sand ridges. Other interesting enigmas, such as the Carolina Bays, which are elongated depressions partially encircled by sandy ridges, can be found in the Coastal Plain region and probably date to Pliocene or Pleistocene time.

The geological events which shaped South Carolina's land area have also influenced the topography and structure of the continental shelf off the coast. Erosion, sedimentation, and other physical and biological interactions have resulted in an offshore ocean environment which is increasingly important to the economy of South Carolina.
Figure 1-7: Geologic Map of South Carolina
Native Americans

The history of South Carolina is as diverse as its geography. The state's first inhabitants, mistakenly called Indians by European explorers, did not function as a single cultural group, but instead practiced a wide variety of customs and traditions. Twenty-eight different nations (formerly called tribes) lived in the area identified today as South Carolina: nations with names like Edisto, Catawba, Yamassee, Kiawah, and Cherokee. These people learned to utilize the seasonal diversity of their environment. They planted corn, squash, beans, pumpkins, and tobacco in the spring. They practiced intensive food gathering in the fall, collecting nuts and berries. Hunting and fishing served to supplement their agricultural and food gathering activities.

The arrival of the Europeans in the 16th century had a dramatic impact upon these Native American peoples and their cultures. Wars and the introduction of new diseases greatly reduced their numbers. However, many places in the state still carry the names and perpetuate the memories of these long vanished communities.

Figure 1-8: Map of Native American Nations
Early Explorers

Beginning in the 16th century, Europeans came to explore and colonize Carolina. Lucas Vasquez de Allyon attempted to colonize Carolina in 1526; he died and his colony was abandoned in 1527. In 1540 Hernando De Soto traveled throughout the Upper Coastal Plain of western South Carolina near the Savannah River, and noticed glimmering flecks of what he believed was silver. This shiny material was later found to be mica. However, during the time, De Soto gave the name Silver Bluff to this hilly section of what is now Aiken County. Today, in Aiken County, Silver Bluff High School carries this 16th century name proudly into the 21st century.

In 1562 French Huguenots tried but failed to establish a colony on Parris Island. Later, Menendez de Aviles successfully established a Spanish colony on Parris Island in 1566 known as Santa Elena. This settlement was considered to be part of Spanish Florida. However, after approximately twenty years, Spain withdrew from Santa Elena, pulling her forces back to St. Augustine, Florida. It would be 83 years before Europeans again came to Carolina to colonize.

The English Influence

In 1670, the first English settlers arrived under a charter granted by King Charles II of England to what is now the Charleston area. The colony was named "Carolina" in honor of the King (Charles's name in Latin was Carolus). In the mid-1700's, the trade in deer skins and native slaves was a major business of the colony. Originally, control of Carolina was granted to the Eight Lords Proprietors. Colonial dissatisfaction with proprietary rule led to a revolt against the proprietors in 1719. In 1729, after ten years of negotiation with the proprietors, Carolina became a Royal Colony and was divided into separate North and South Carolina colonies.

The colonial prosperity of Carolina was eventually built upon the cultivation of rice and indigo by slave labor. Rice cultivation was confined to the freshwater swamps along the coastal rivers. Indigo was first successfully produced in similar environments by Eliza Lucas Pinckney who shared her knowledge with other planters. Both crops were labor intensive and led to increased reliance on African slavery in the colony. These black Carolinians enriched the state with their language (Gullah), crafts, music, and folk stories, as well as their physical labor which produced the rice and indigo.

Natural Features as Effective State and County Boundaries

For as long as people have been creating political divisions among themselves, for governmental or other purposes, a major point of controversy has always been where to place the boundary lines for the town, county, state, or nation. For centuries, countries have argued and even gone to war over disputed territory and border lines. Within the United States of America, states have occasionally taken each other to court over questions of political jurisdiction. Even South Carolina has had its share of boundary disputes, the most recent one being with the state of Georgia over an island in the Savannah River not far from the city of Savannah, Georgia. That dispute was not finally settled until the 1980's, with South Carolina winning most of its claim.
Rivers have long been used as boundaries between counties, states, countries or even individual land holdings. Where rivers are primarily erosional, such as in the Blue Ridge and Piedmont regions, channels and riverbanks tend to stay in one place and form easily recognizable boundaries. An obvious advantage is that everyone knows where the boundary is located without having to hire a surveyor. A disadvantage is that a town might have no control over what another political unit did on the other side of the river, a situation that could cause major pollution problems. Coastal rivers present a variety of special boundary problems because their channels don't remain in one place, but rather meander continually over wide floodplains. There are several examples of land now located on the South Carolina side of the Savannah River which once belonged to Georgia. After a few more shifts of the river channel, those landowners might even find themselves back on the Georgia side of the river.

Oceans and lakes at first seem like perfect boundary lines, but even here some problems may arise. Although nobody disputes where the ocean begins, most beaches tend to shift position as sand is gradually eroded and re-distributed along the shoreline. **Tidal inlets** also tend to migrate through time. Hurricanes and other major storms can cause rapid changes in shoreline configurations. Lakes are temporary features which gradually fill up with sediment. When new land is produced, it is not always clear to whom it belongs or to whom the tax bill should be sent.

The final type of natural feature commonly used as a political boundary line is the drainage divide. This high ridgeline separating two or more major watersheds is relatively easy to locate, although not always clearly visible to the untrained observer. The advantage of a drainage divide is that it is a topographic barrier and that all water stays on the same side as it originally fell. There is no possibility of water pollution crossing the border. However, when drainage divides are used as boundaries one problem arises; their irregular shape and rugged topography makes surveying boundary lines very difficult in places.

Drainage divides can also serve as effective cultural boundaries. Because of easy transportation up and down the state's river systems, local customs tended to spread within drainage basins much more quickly than across them. A good example of landform control of cultural traits is the regional distribution of barbecue sauce recipes seen in the Figure 1-9, "Barbecue Regions of South Carolina", found in the Background Information.
Historical Reasons for Placement of State and County Boundaries

The original borders of South Carolina actually encompassed a much larger area than the state occupies today. The 1665 land grant given by King Charles II to the eight Lords Proprietors, noblemen in the King's court, included all the land in North America between twenty-nine degrees north latitude and thirty-six and one half degrees north latitude. It also stretched all the way from the Atlantic Ocean to the Pacific Ocean. By 1729, however, the Carolina colony had been split into northern and southern halves and in 1732, the colony of Georgia was established.

The Savannah River was designated as the western boundary of South Carolina, but a dispute soon arose with Georgia over land located in present day Oconee County. Several tributaries of about equal size enter the Savannah River in this region and there was serious controversy over which branch should be used as the border. That dispute was eventually settled in 1787 when the Chattooga River was designated the permanent boundary.
The present day boundary with North Carolina is so irregular because of a series of surveying errors and later corrections. According to the agreement in 1735, the boundary was to start at a point thirty miles southwest of the mouth of the Cape Fear River and was to extend diagonally northwest until it reached the thirty-five degree latitude line. At that point the boundary would follow the latitude line westward to the Pacific Ocean. Unfortunately for South Carolina, the surveyors missed their mark by about eleven miles and the boundary was run incorrectly all the way to the Catawba River. During the later westward extension of this boundary, surveyors tried to compensate South Carolina by running the line about seventeen miles north of the thirty-five degree latitude line. Although this line was straight, it was not perfectly parallel to the latitude line. The final surveying of the extreme northwestern boundary of the state was completed in 1815 when Andrew Ellicott ran a straight line from the ridgeline near Sassafrass Mountain to the point where the Chattooga River crosses the thirty-five degree latitude line.

How Places Get Their Names

In most cases, cities, counties, towns, and other such places are named after famous people, local or otherwise. For example, Charleston was originally named for King Charles of England, who gave out land grants in the Carolina colony; Columbia was named for Christopher Columbus, the discoverer of America; and Laurens was named for Henry Laurens, a Colonel in the Revolutionary War who was a local hero. Occasionally, people will be remembered by their titles instead of their names. For example, Camden was named for Charles Pratt, a British legislator who had the hereditary title "Lord Camden." Sometimes the spelling of a town's name will change through time, such as with Paris Mountain, which was originally named for Richard Pearis. Many towns are named by simply adding "ville," "burg," "boro," or "town" to a person's name. Examples are Bennettsville, Blacksburg, Walterboro, and Georgetown.

Many towns in South Carolina are named for local features or buildings, such as Cowpens (a corral for cattle), Boiling Springs (a water source), Windy Hill (where George Washington's hat blew away), and St. Matthews (a local church). Others are named for far away places, such as York (a town in Pennsylvania and in England), Rimini (an Italian seaport), and Abbeville (a town in France). Still others represent foreign names or phrases, such as Pomaria (Latin for "plants"), and Walhalla (German for "garden of the gods"). The most commonly used "foreign" words are actually Native American in origin, either purely descriptive terms like Pocataligo ("gathering place") and Cheraw ("fire town"), or commemorating national names or heroes like Cherokee (named for the nation) and Jocassee (a famous heroine).

Perhaps the most interesting names belong to places with unique local legends. Mount Willing in Saluda County was named for a revolutionary war gathering at a tavern where a leader called the townspeople to battle by yelling "Let's mount" and another answered in response "Willing." Round O in Colleton County was named for a blue circle of paint marked on the chest of a well liked native warrior. Almost every place in South Carolina that has a name also has an interesting story to go with it. And occasionally, names change. Townspeople successfully petitioned the state legislature to change Polecat to Montmorenci, Seigler to Eureka, and Frog Level to Prosperity.
How Kingstree Got Its Name
Taken from History of Williamsburg by William Willis Boddie

Some explorer, whose name has been lost long before 1780, laboriously rowed his pettiagua from Winyaw Bay up the sinuous channel of Black River to a large white pine tree on the north bank, which he marked and called the "King's Tree". This explorer went no further westward up the river but returned to Charleston and reported to the Colonial Governor that he had worked his way up the Wee Nee River for more than a hundred miles to a place where he found a white pine tree, one like those growing on the New England hills, and that he had chopped into the sap of this "King's Tree" a broad arrow just as the King's trees in New England had been marked. This explorer told wonderful tales about the King's Tree, and the "King's Tree" became a basal point in the "back country".

White pine trees grow normally only on highlands in Northern latitudes. It was purely by chance that this white pine tree, christened by that nameless explorer the "King's Tree", grew in Williamsburg. Only to the poet's mind can its history be known. Possibly some Indian brave, coming southward from the Great Lakes, camped on this bluff on the Wee Nee River and unwittingly dropped the seed that grew into the King's Tree. Or did some old bald eagle, bloody from his battle in the mountains, rest a while on this spot, and in a cooling shower, have washed from his matted feathers the little bit of life that grew into the King's Tree?

This white pine tree on the Wee Nee River possibly caused King George to reserve in every grant of land in these parts all white pine trees forever as the sole property of the King. In those days of sailing ships, white pine made the best masts available and the King kept them for his own. Few of these white pines trees had ever grown in Williamsburg and none of them ever went into a ship flying a Royal Banner.

The American Revolution and South Carolina

The American Revolution brought new challenges to South Carolina. Charles Towne's defenders successfully defeated an invading British fleet in June of 1776 at the battle of Fort Moultrie, but in May of 1780 the city surrendered to another British invasion force after a siege by English General Sir Henry Clinton. The state was the scene of several violent struggles between Patriots (like the Partisans Thomas Sumter, Francis Marion and Andrew Pickens) and Loyalists (like Tories William Wragg and other South Carolina citizens who supported the British). During the American Revolution the Patriots gradually gained the upper hand. With peace in 1783, South Carolina became part of a new country.
Colonial Prosperity Through Rice, Indigo, and Cotton

After the Revolutionary War South, Carolinians moved quickly to rebuild their economy. But first, the planters needed a new staple crop. Because of the war, England would no longer purchase indigo, and rice cultivation was limited to the coastal region. Eli Whitney’s invention of the cotton gin in 1794 led to the spread of the cotton culture throughout the state. Like rice, cotton cultivation was labor intensive and based upon slave labor. As a result of this expansion of commerce throughout the state, it became obvious that the State Capitol could not remain permanently in Charleston. Finally, in 1786, in response to political pressure from Up Country settlers, a more central location, at the confluence of the Saluda and Broad rivers (banks of the Congaree River) was chosen, and the building of the City of Columbia began.
President George Washington’s Southern Tour

"Nothing would give me more pleasure than to visit all the Southern States" was the reply President George Washington made to the invitation extended to him by Governor Charles Pinckney of South Carolina. George Washington had just been inaugurated as the first president of the United States in 1789, but he had never been south of his home state of Virginia. Before he headed south, he outlined his specific goals for his southern tour. He wanted to:

- See how much support there was for a General Government,
- Determine the growth and extent of agriculture,
- See the land,
- Find out if the Country had recovered from the ravages of the Revolutionary War, and
- Confront the Up Country farmers in the southern states about the bill he had just signed, The Duties on Distilled Spirits Act, often referred to as the "Whiskey Tax."

The "Whiskey Tax" had just been passed by both houses of Congress and signed by Washington into law. Alexander Hamilton, the Secretary of Treasury, had recommended the bill calling for an excise tax (duty) on distilled spirits (whisky) as it entered the country. The revenue generated was designed to retire the Revolutionary War debts. Washington was afraid that taxation of this nature would cause a "whiskey rebellion." It was thought by Capitol leaders that this tax would be hard to collect in the Back Country of the south. With this in mind, he wanted to see if this type of taxation could be enforced. In addition, Washington wanted to promote the new federal union and hoped that his personal popularity would help to unite the newly formed country.

President Washington traveled in a cream colored coach pulled by four horses. He was accompanied by a two-horse baggage wagon, four horses for his outriders, and a white riding horse for himself. Years later he was remembered for his "white chariot." He had originally planned to compensate tavern keepers for food and lodging, but even then southern hospitality was the custom. He accepted many invitations to dine and lodge with plantation owners primarily because there were few lodging houses along his route. Washington kept a journal describing the people he met on his journey, the landscape, time, and distance he traveled. Many of the people he visited are remembered today because of their role in shaping the destiny of South Carolina.

Washington liked to get up early and be on his way by sunrise. He would usually travel about 10-20 miles before stopping for breakfast. About noon on April 27, 1791, President George Washington entered South Carolina from North Carolina near Calabash. The following account of Washington's southern tour is excerpted from his diary.
Diary of the First Presidential Visit to the Palmetto State
Washington's Southern Tour Through Coastal Zone
Excerpted from a pamphlet prepared by A.S. Salley,
a former South Carolina State Historian
[ ] Indicates editorial notes inserted by SC MAPS authors
( ) Indicates editorial notes inserted by A.S. Salley
Highway numbers given in the editorial notes are included for
reference only. There were no numbered highways in the 1700's. What we now
know as US Hwy. 17 was originally called the King's Highway and followed
approximately the same route as the modern road.

Entry for Wednesday, April 27, 1791
. . . crossed the boundary line between Nor. & South Carolina abt. half after
12 o'clock . . . dined at a private house (one Cochran's) about 2 miles farther--
and lodged at Mr. Vareen's 14 miles more and 2 miles short of the long bay.--To
this house we were directed as a Tavern, but the proprietor of it either did not
keep one, or would not acknowledge it--we therefore were entertained (& very
kindly) without being able to make compensation.

Editorial Notes
[On his coastal tour, Washington and his entourage entered South Carolina
on what is now US Hwy. 118 just east of US Hwy. 17. After dining at Cochran's
house, Little River, he left riding along what is now US Hwy. 17 to Jeremiah
Vareen's house two miles north of Singleton's Swash. A swash is a narrow
channel through which tidewater flows making it dangerous to cross at high tide.
Singleton's Swash marks the beginning of Long Bay or Myrtle Beach as we call it
today. Mr. Vareen's house was near the intersection of Hwy. 17 and Lake
Arrowhead Road. Both James Cochran and Jeremiah Vareen were
Revolutionary War veterans.]

Entry for Thursday, April 28, 1791
Mr. Vareen piloted us across the Swash (which at high water is impassable,
& at times, by the shifting of the Sands is dangerous) on the long Beach of the
Ocean; and it being at a proper time of the tide we passed along it with ease and
celerity to the place of quitting it, which is estimated 16 miles.--five miles farther
we got dinner and fed our horses at a Mr. Pawley's private house, no public one
being on the Road;--and being met on the Road, & kindly invited by a Doctor
Flagg to his house, we lodged there; it being about 10 miles from Pawley's & 33
from Vareen's.

Editorial Notes
[From Singleton's Swash, Washington traveled 16 miles along US Hwy. 17,
Kings Hwy., which was 50 paces or walking steps from the Atlantic Ocean. He
stopped to rest his horses and eat dinner with George Pawley at his house
located at Garden City. From there, he continued on US Hwy. 17, which
parallels the Waccamaw River. Inland, facing the river, were several rice
plantations. Dr. Henry Collins Flagg met Washington's party at the small road
leading to Brookgreen Plantation. The Flagg family produced a line of medical
doctors including Dr. J. Ward Flagg who wrote an account of "The Hurricane of
1893" which is included in SC MAPS Section 10B. Alligator Pool fountain at
Brookgreen Gardens marks the site of the house where George Washington
spent the night.]
Entry for Friday, April 29, 1791

We left Doctr. Flagg's about 6 o'clock, and arrived at Captn. Wm. Alston's on the Waggageau [Waccamaw River] to Breakfast. Captn. Alston is a Gentleman of large fortune and esteemed one of the neatest Rice planters in the State of So. Carolina and a proprietor of the most valuable ground for the culture of this article.--His house which is large, new, and elegantly furnished stands on a sand hill, high for the Country, with his Rice Fields below; the contrast of which with the lands back of it, and the Sand & piney barrens through which we had passed is scarcely to be conceived.

At Captn. Alston's we were met by General Moultrie, Col. Washington & Mr. Rutledge (son of the present Chief Justice of So. Carolina) who had come out that far to escort me to town.--We dined and lodged at this Gentlemans and Boats being provided we the next mornin o'clock to leave.

Editorial Notes

[Also living in the Waccamaw Neck was William Alston, who owned Clifton Plantation, located just off of US Hwy. 17. Washington ate breakfast with Alston, who served as a captain in the South Carolina Militia during the Revolutionary War. The Charleston reception committee greeting Washington included Major-General William Moultrie, Revolutionary War hero and former governor; Colonel William Washington, cousin of the president and also a Revolutionary War hero; and John Rutledge, Jr., son of the Revolutionary War governor and former Justice of the United States Supreme Court.]

Entry for Saturday, April 30, 1791

Crossed the Waggageau [Waccamaw River] to Georgetown by descending the River three miles--at this place we were rec'd. under a Salute of Cannon, & by a Company of Infantry handsomely uniformed.--I dined with the Citizens in public; and in the afternoon, was introduced to upwards of 50 ladies who had assembled (at a Tea party) on the occasion.

Editorial Notes

[George Washington was rowed across the Waccamaw River to Georgetown by seven captains of vessels, dressed in round hats trimmed with gold lace, blue coats, and white jackets riding in an elegantly painted boat. He stayed at the Stewart-Parker house, which is still standing today in the historic district of Georgetown. At Prince George's Lodge, he addressed the Masonic Order and attended a party given to him by more that 50 Georgetown ladies.]

Entry for Sunday, May 1, 1791

Left Georgetown about 6 o'clock and crossing the Santee Creek at the town, and the Santee River 12 miles from it, at Lynch's Island, we breakfasted and dined at Mrs. Horry's about 15 miles from Georgetown & lodged at the Plantation of Mr. Manigold about 19 miles farther.

Editorial Notes

[Washington left Georgetown on US Hwy. 17 crossing the Sampit River. He continued on this road crossing the North Santee and South Santee rivers on the Santee Delta and arriving for breakfast at Hampton Plantation, now Hampton State Park, just west of US Hwy. 17. Greeting him were Mrs. (Daniel) Harriott Pinckney Horry and her mother Eliza Lucas Pinckney. Colonel Daniel Horry had been a rice planter, sportsman, and Revolutionary War cavalryman until his death in 1785. Eliza Lucas Pinckney is credited with becoming a successful lady planter and introducing indigo as a new cash crop to the Low Country. George]
Washington voluntarily served as a pallbearer at her funeral when she died in Philadelphia in 1793. See SC MAPS Section 9: Coastal Zone Overview, to find out more about Eliza Lucas Pinckney's contribution to the state. That night he lodged with Joseph Manigault at his plantation on Awendaw Creek just off of US Hwy. 17. Salt Hope Plantation is now part of the Cape Romain National Wildlife Refuge.]  

Entry for Monday, May 2, 1791

Breakfasted at the Country Seat of Govr. Pinckney (Snee Farm) about 18 miles from our lodging place, & then came to the ferry at Haddrel's point [Mt. Pleasant], 6 miles further where I was met by the Recorder of the City, Genl. Pinckney & Edward Rutledge, Esqr. in a 12 oared barge rowed by 12 American Captains of Ships, most elegantly dressed.--There were a great number of other Boats with Gentlemen and ladies in them;--and two Boats with Music; all of whom attended me across, and on the passage were met by a number of others.--As we approached the town a salute with artillery commenced, and at the Wharf I was met by the Governor, and Lt. Governor . . . two Senators of the State, Wardens of the City . . . conducted to the Exchange where they passed by in procession . . .

It may as well in this as in any other place, he observed, that the Country from Wilmington through which the Road passes, is, except in very small spots, much the same as what has already been described; that is to say, sand & pine barrens---with very few inhabitants---we were indeed informed that at some distance from the Road on both sides the land was of a better quality, & thicker settled, but this could only be on the Rivers & larger waters---for a perfect sameness seems to run through all the rest of the Country---on these---especially the swamps and low lands on the Rivers, the Soil is very rich; and productive when reclaimed; but to do this is both laborious and expensive.---The Rice planters have two modes of watering their fields---the first by the tide---the other by reservoirs drawn from the adjacent lands.---The former is best because most certain.

Editorial Notes

[Governor Pinckney's County Seat was a small estate in Christ Church Parish called Snee Farm just north of Mt. Pleasant on US Hwy. 17. This farm is currently under the jurisdiction of the National Park Service. Washington later wrote that he thought the road from Georgetown to Charleston was the most beautiful in the United States. Washington's entrance to Charleston was a gala event with the flotilla leaving Haddrel's Point at Mt. Pleasant. A group of dignitaries escorted Washington across the bay in an elegant twelve-oared barge. Accompanying him was St. Philip's Church Choir singing and playing instruments from two other boats. East Bay Street was lined with spectators, while others watched from windows and balconies. The Charleston Artillery Battalion fired a 15 gun federal salute and the bells at St. Michael's Church rang. The clock tower of St. Philip's Church indicated the time as 2 p.m. It was Monday, May 2, 1791. The Exchange building where Washington was entertained is located at East Bay and Broad Streets. Today, it is a museum operated by the Daughters of the American Revolution and is called The Old Exchange and Provost Dungeon.

President George Washington was elegantly entertained in Charleston where he spent the week of May 2-9, 1791. While there, several balls were held in his honor. He took special note to mention the "elegantly dressed and handsome
ladies.” He dined with citizens at a public dinner and was entertained by the elite Society of the Cincinnati, visited Fort Johnson and Fort Moultrie by boat, ate breakfast with orphans, and attended services at both St. Philip's and St. Michael's Episcopal Churches. On Monday May 9, he crossed over the Ashley River on Hampton’s Bridge, US Hwy. 17, and headed to Savannah.]

**Entry for Monday, May 9, 1791**

> At six o'clock I recommenced my journey for Savannah; attended by a Corps of the Cincinnati and most of the principal Gentlemen of the city as far as the bridge over Ashley River, where we breakfasted, and proceeded to Col. W. Washington at Sandy-hill with a select party of particular friends--distance from Charleston 28 miles.

**Editorial Notes**

[Washington stayed at Sandy Hill Plantation just south of US Hwy. 17 with his cousin Col. William Washington, who had married an heiress of a rice plantation. Even though William had only lived in South Carolina a short time, he had become a very successful rice planter.]

**Entry for Tuesday, May 10, 1791**

> . . . breakfasting at Judge Bee’s 12 miles from Sandy Hill, lodged at Mr. Obrain Smith’s Duharra plantation 18 or 20 miles further on.

**Editorial Notes**

[Judge Thomas Bee’s plantation was on the road to Jacksonboro now US Hwy. 17. From there, Washington left present day US Hwy. 17 and turned onto what would become Hwy. 64 heading northwestward. About midway to Walterboro, he turned left on Hwy. 41 and went through Ritter then south to Duharra Plantation.]

**Entry for Wednesday, May 11, 1791**

> After an early breakfast at Mr. [O’Brien] Smiths [Duharra Plantation] we rode 20 miles to a place called Pokitelileo where dinner was provided by the Parishoners of Prince William . . . . After dinner we proceeded 16 miles farther to Judge Hayward’s where we lodged [White Hall Plantation] . . . . there being no public houses on the Road and my distance to get to these private ones increased at least 10 or 12 miles between Charleston and Savannah.

**Editorial Notes**

[Washington spent the night at Duharra Plantation owned by O’Brien Smith. He went back to Hwy. 41 and turned south on US Hwy. 17 Alt. He passed through Yemassee and then Pocotaligo, where US Hwy. 17 and US Hwy. 17 Alt. merge and follow present day I-95. Originally, Pocotaligo was a trading post for the Yemassee. It is located at the intersection of US Hwy. 17 and the Beaufort highway. From there, Washington followed present day I-95 to Coosawhatchie, where he took Hwy. 462 to White Hall Plantation. George Washington stayed at two of Judge Thomas Hayward's homes, a town house located on Church Street in Charleston and White Hall Plantation on Euhaw Creek in Jasper County. Thomas Hayward is one of the two signers of the Declaration of Independence from South Carolina.]

**Entry for Thursday, May 12, 1791**

> By five o'clock we set out from Judge Hayward's, and the road to Purisburgh 22 miles to breakfast.
At that place I was met by . . . from the city of Savanna to conduct me thither.

Editorial Notes
[Leaving White Hall Plantation, Washington took Hwy. 278 to Grahamville turning on Hwy. 13 and then taking Hwy. 169 to Purryburg on the Savannah River. He left South Carolina between ten and eleven o'clock, and was escorted across the Savannah River in a handsome eight-oared presidential barge followed by a flotilla carrying his coach and baggage wagon. He landed at Mulberry Grove plantation and dined with Catherine Greene, widow of General Nathanael Greene, Revolutionary War general.

From May 12-21, 1791, George Washington toured Georgia, visiting Savannah, Waynesboro, and Augusta, before returning to South Carolina on May 21, 1791.]

Diary of the First Presidential Visit to the Palmetto State
Washington's Southern Tour Through the Sandhills

[ ] Indicates editorial notes inserted by SC MAPS authors
( ) Indicates editorial notes inserted by A.S. Salley

Entry for Saturday, May 21, 1791
Left Augusta about 6 o'clock, and takg. leave of the Governor & principal Gentlemen of the place at the bridge over Savanna River, where they had assembled for the purpose, I proceeded in Company with Col. Hampton & Taylor, & Mr. Lithgow a committee from Columbia, (who had come on to meet & conduct me to that place) & a Mr. Jameson from the Village of Granby on my Rout.

Editorial Notes
[A three gun salute was fired as George Washington reentered South Carolina from Augusta over Hampton's Bridge, spanning the Savannah River. He was escorted by a four member delegation: Colonel Wade Hampton, Colonel Thomas Taylor, Robert Lithgow from Columbia, and Archibald Jamison from Granby. Wade Hampton was a business man, Revolutionary War Colonel, planter, and owner of Hampton's Bridge and the Congaree River Ferry. His family had settled on the Tyger River in Spartanburg County when he was a child. After his parents were murdered by a Cherokee war party, he moved to the fork between the Congaree and Wateree rivers. Later, Hampton served as a major general in the United States Army during the War of 1812. Hampton's Bridge, 800 feet long and 16 feet wide, opened in 1790 but was later swept away by a flood in 1796. Colonel Thomas Taylor, planter and business man, often called the "Father of Columbia" sold his plantation to the state as the site for the new Capitol when it was moved from Charleston to Columbia. He served as a colonel in the militia during the Revolutionary War. Mr. Robert Lithgow was the newly elected Richland County Judge; and Archibald Jamieson had the contract to build a bridge over a creek south of Granby, thereby upgrading the Charleston-Orangeburg-Columbia road.

Washington's party left North Augusta on US Hwy. 25 and dined at Pine House Tavern just west of Trenton. Like at all of his stops, a crowd of local citizens gathered to shake hands and speak with him. He knew that there would be opposition to the excise tax, which had just been passed by Congress. Prior to his arrival, the Edgefield County Grand Jury had drafted this statement, "We are of the opinion that all Excise Laws . . . are repugnant to the Conditions &
Liberties of a free people. . . . Excise will bear very & unequally hard on the Inhabitants of the Southern States." About the same time, an Abbeville County Grand Jury had argued that the law would favor northern commercial distilleries and breweries. As Washington continued on his goodwill tour, he was quoted in the "Independent Gazetteer and Agricultural Repository," Philadelphia, PA, 11 June 1791, as saying, "The discontent which it was supposed the last Revenue Act would create, . . . subside as fast as the law is explained." He felt that the "Whiskey Tax" could be enforced and that his mission had been successful.

From Trenton, Washington followed Hwy. 75 to Ridge Spring and Hwy. 23 to Batesburg. At a crossroads between Batesburg and Leesville near present-day Hwy. 41, Washington spoke to a group of people. From Leesville, he followed present day Hwy. 330 and Hwy. 261 to Gilbert, where he may have eaten breakfast. He then traveled Hwy. 60 to Hwy. 70 and took US Hwy. 1 on into West Columbia.

Entry for Sunday, May 22, 1791

Rode about 21 miles to breakfast, and passing through the village to Granby just below the falls in the Congaree (which was passed in a flat bottomed boat at a Rope Ferry.) I lodged at Columbia, the newly adopted Seat of the Government of South Carolina about 3 miles from it, on the No. side of the river, and 27 miles from my breakfasting stage.

The whole Road from Augusta to Columbia is a pine barren of the worst sort, being hilly as well as poor.--This circumstance added to the distance, length of the stages, want of water and heat of the day, foundered one of my horses very badly.

Beyond Granby 4 miles I was met by sevl. Gentlemen of that place & Wynn'sborough [Winnsboro]; and on the banks of the River on the No. side by a number of others, who escorted me to Columbia.

Editorial Notes

[Washington's diary is not clear where he lodged for the night or ate breakfast. Four miles east of Lexington, where he reached what is now US Hwy. 1, stands a Sycamore tree marking the place where many historians believe Washington talked with local residents while resting his foundering horse. When US Hwy. 1 was widened in 1972, a roadside park was created and a cutting from a descendent of the original tree was planted marking the site.

Washington left US Hwy. 1 at Leaphart Road and passed through the town of Granby. At sunset, Washington crossed the Congaree River at Fridig's Landing located south of Granby. Wade Hampton and his brothers had acquired the franchise for the ferry crossing and named it Hampton's Ferry. They had equipped it with a rope and three flat-bottomed boats enabling Washington and his entourage to have a safe and speedy trip across the river to Columbia. Records indicate that crowds lined the Congaree River on both sides anxiously awaiting the President's arrival.

A procession formed as President George Washington mounted his white charger followed by his cream-colored coach drawn by four bay horses. The coachman and footmen were all formally dressed in blanket coats, white and orange liveries, jockey caps, buckskins, and boots. The baggage wagon followed this procession to the State House. From there Washington was taken to a house prepared for his arrival.]
Entry for Monday, May 23, 1791

Dined at a public dinner in the State house with a number of Gentlemen & ladies of the Town of Columbia, & Country round about to the amt. of more than 150, of which 50 or 60 were of the latter.

Editorial Notes
[Washington dressed in black-velvet formal wear to greet the guests. Sixteen after-dinner toasts were made identifying hopes for the future and concerns of the times. Topics of some of these toasts were:

- "A speedy establishment of a central federal city;"
- "The federal legislature--may their virtues and abilities be as much admired abroad, as they are respected at home;"
- "Sufficient means and speedy measures for opening the inland navigation of America;"
- "Increase to our exports, and decrease to our imports;" and
- "An increase of well established seminaries of learning."
]

Entry for Tuesday, May 24, 1791

The condition of my foundered horse obliged me to remain at this place, contrary to my intention, this day also.

Columbia is laid out upon a large scale; but in my opinion, had better been placed on the River below the falls.--It is now an uncleared wood, with very few houses in it, and those all wooden ones--The State House (which is also of wood) is a large and commodious building, but unfinished--The Town is on dry, but cannot be called high ground, and though surrounded by Piney & Sandy land is, itself, good--The State House is near two miles from the River at the confluence of the Broad & Saluda. From Granby the River is navigable for Craft which will, when the River is a little swelled, carry 3000 bushels of Grain--when at its usual heighth less, and always some.--The River from hence to the Wateree below which it takes the name of the Santee is very crooked; it being, according to the computed distance near 400 miles--Columbia from Charleston is 130 miles.

Editorial Notes
[The original State House was a wooden structure located with the west front facing Assembly Street and the east front facing Richardson Street (Main Street). It was burned during the Civil War. Major John R. Niernsee designed the blue-granite State House which now stands on this site.]
**Entry for Wednesday, May 25, 1791**

Set out at 4 o'clock for Camden—(the foundered horse being led slowly on)—breakfasted at an indifferent house 22 miles from the town, (the first we came to) and reached Camden about two o'clock, 14 miles further, when an address was rec'd. & answered.--Dined (late with a number of Gentlemen & Ladies at a public dinner.--The Road from Columbia to Camden, excepting a mile or two at each place, goes over the most miserable pine barren I ever saw, being quite a white sand & very hilly.--On the Wateree within a mile & half of which the town stands and lands are very good,--they Culture corn, Tobacco & Indigo.--Vessels carrying 50 or 60 Hhds. of Tobo. come up to the Ferry at this place at which there is a Tobacco Whare-house.

**Editorial Notes**

[Washington left Columbia on the Old Camden Road, US Hwy. 12, which went through Forest Acres and Fort Jackson. It now feeds into I-20. He entered Camden on current US Hwy. 521. A dinner was held in his honor and he toasted the memory of General Nathanael Greene and Baron de Kalb who were local heroes of the Revolutionary War.]

**Entry for Thursday, May 26, 1791**

After viewing the british works about Camden I set out for Charlotte--on my way--two miles from Town--I examined the ground on wch. Genl. Green & Lord Rawdon had their action.--The ground had but just been taken by the former--was well chosen--but he not well established in it before he was attacked; which by capturing a Videt was, in some measure by surprise--Six miles further on I came to the ground where Genl. Gates & Lord Cronwallis had their Engagement wch. terminated so unfavourably for the former.

Camden is a small place with appearances of some new buildings.--It was much injured by the British Whilst in their possession.

After halting at one Sutton's 14 m from Camden I lodged at James Ingrams 12 miles farther.

**Editorial Notes**

[Washington toured Revolutionary War battlefields evaluating the tactical performance of Generals Horatio Gates, Nathanael Greene, Lord Cornwallis, and Lord Francis Rawdon. Leaving Camden, he followed US Hwy. 521 to Hwy. 58. Between Kershaw and Heath Springs in Lancaster County and just off of Hwy. 58 is the Hanging Rock Battlefield. It was the site of a fortified British post where General Thomas Sumter destroyed a regiment. Washington stayed with James and Margaret Ingram on their 2000 acre plantation near the Hanging Rock Battlefield. No doubt Washington toured this site.

Just past Heath Springs, Washington took present day Hwy. 36, not shown on the state base map, to Hwy. 9, where he turned left going to Lancaster. From there, he followed US Hwy. 521 to Charlotte, North Carolina.]

**Entry for Friday, May 27, 1791**

Left Ingrams about 4 o'clock, and breakfasting at one Barr's 18 miles distant lodged at Majr. Crawford's 8 miles farther--About 2 miles this place I came to the corner where the No. Carolina line comes to the Rd.--from whence the Road is the boundary for 12 miles more.--At Majr. Crawford's I was met by some of the chiefs of the Catawba nation who seemed to be under apprehension that some attempts were making, or would be made to deprive them of part of the 40,000 Acres wch. was secured to them by Treaty and wch. is bounded by this Road.
1818 Internal Improvement Act and the Building of Canals

George Washington's diary left an interesting picture of the state's landform regions and transportation as he traveled across the state. In order to continue the growth of successful plantations, a means of transportation had to be available for planters to get produce to the market in Charleston. Early transportation within the state had followed many of the rivers and streams. In an effort to take further advantage of these natural waterways, a system of canals was proposed. The first attempt was the construction of the Santee Canal in the 1790's.

Figure 1-11: Map of South Carolina Canals

South Carolina Canals in the Early 1800's

= city
= canal
modified from Kovacik & Winberry

SCALE = statute miles
This was followed in 1818 by a full scale appropriation of funds from the South Carolina General Assembly, which passed the Internal Improvement Act that provided for a state-supported system of internal improvements in transportation. One significant result of this act was the construction of a number of canals throughout the state, which included the Columbia Canal, Wateree Canal, Catawba Canal, Landsford Canal, Dreher's Canal, and Lockhart's Canal. A portion of the 1818 Act is reprinted here to provide an insight into the measures that early South Carolinians were taking to improve navigation so they could transport their produce across various natural barriers to the port of Charleston.

**Excerpt From 1818 Internal Improvement Act**

. . . And be it further enacted, that from and after the passing of this Act, it shall be the duty of the board of public works, as soon as circumstances will permit, to lay off, open and make, upon the most approved plan, a great road from Charleston to Columbia, and thence along the ridge between Broad and Saluda Rivers, and across the Saluda mountain, to the North Carolina boundary; and also, to devise and adopt all such means as they may deem expedient, to render navigable Great Pedee, as far as the North Carolina boundary, together with all such tributary streams of the said river, as they may judge expedient—and in like manner to devise and adopt all such means as they may judge expedient, to render navigable Santee, Wateree, Catawba, Broad and Saluda rivers, as well as their tributary streams—and in like manner to proceed, in conjunction with the commissioners appointed by the State of Georgia, to devise and adopt all such means as they deem expedient, to render navigable Savannah river, from Augusta to the confluence of Toogooloo and Keowee, and the Keowee as far as they may deem expedient; and to adopt all such measures as may be necessary to ascertain the practicability of opening a communication by canal or canals between the Savannah and the waters of Broad river, and between the Edisto and the waters of Ashley river—and in like manner to devise and adopt all such means as they shall deem expedient, to render Keowee navigable—and in like manner to proceed in devising and adopting all such means as they may deem expedient, to render navigable, the Waccamaw, Little Pedee, Black River, Edisto, and the tributary streams of the last mentioned river, and both branches thereof—and likewise the Combahee, the Great and Little Saltketcher rivers—and generally, to render navigable such other streams and water courses, and to improve and construct all such cuts, as may facilitate the navigation of the State.

One of the few remaining functional canals is the Columbia Canal on the Broad and Congaree rivers which is now used for hydroelectric power. Another one is Landsford's Canal, which has been partially restored and is maintained as part of the South Carolina State Park System. Most of the canals were built to bypass a rocky section or shoal of a river. In a number of instances, the rivers did not always have enough water for navigation, and the canal system was never very successful. With the advent of the railroads, the canal system became obsolete. Transportation in the state has undergone many stages of development over the years from the early canals to railroads, hard surface "farm to market roads" to interstate highways all leading up to today's fine modern transportation system.
The Coming of the Railroads

Before the coming of the railroads South Carolinians used rivers, linked by canals, as their major transportation system. However, as the Up Country developed and grew more cotton, Charlestonians realized the need for a more efficient system, essentially one that would bring more crops through their South Carolina port. The South Carolina railroad from Charleston to Hamburg was the first step in achieving that goal. Completed in 1833, the 136 mile track to the Savannah River attempted to draw crops from the Up Country through the port at Charleston instead of the port at Savannah, Georgia.

Nine years elapsed before another rail route was developed, this one from Branchville to Columbia. By 1848, the line had been extended to Camden. The 1850's saw the greatest activity with the completion of 739 more miles of track. Private companies were responsible for this construction, but the state aided the railroads by buying stock or guaranteeing bonds. Although railroads spurred the economic growth of the state by making it easier to get the cotton crops to market, the rail system also made importing food and manufactured items simpler. Consequently, the state neglected to diversify itself agriculturally and industrially.

The only truly disastrous railroad enterprise was the Blue Ridge Railroad on which the state risked millions of dollars. The Blue Ridge Railroad was a multi-state project to connect Charleston with Cincinnati, Ohio. Rather than run the rails over the mountains in the northwest corner of the state, the engineers planned to run the trains through three tunnels to Rabun Gap in northeastern Georgia. The first tunnel was called Saddle Tunnel and was to have been 616 feet long. Workers, mostly Irish immigrants, began cutting through hard blue granite with sledge hammers from both ends in 1856. They were within 200 feet of each other when the work was halted. The second, the 385 foot Middle Tunnel, was completed. Stumphouse Tunnel, the third and longest at 5,863 feet, was not far from completion when lack of money halted work in 1859. The Civil War broke out before additional funds could be raised, and following the war the state was in no position to resume work; the dream of connecting Cincinnati to Wilmington, Charleston, and Savannah died. The northern end of Stumphouse Tunnel is now under water in Crystal Lake, while the southern end is accessible to the public although actual entry into the tunnel is no longer permitted. For many years Clemson University successfully used the tunnel to age blue cheese since the temperature and humidity inside the tunnel matches that found in French caves where the famous Roquefort cheese is produced.

The growth of Columbia exemplifies the importance of railroads to the development of the state. Although four major roads, together with the Columbia Canal and the Congaree River, provided the capital with transportation links to other parts of the state, the town did not really begin to expand until the 1850's. In 1840, Columbia's population totaled 4,340. By 1860, the town had almost doubled in size and had 8,052 inhabitants. One direct cause of this expansion was the arrival of the first railroad line in 1842. This line, with a station on the corner of Gervais and Gadsden Streets, linked Columbia to Charleston. One decade later, two more lines linked the capital to Greenville and Charlotte. The Greenville line used the station at Gervais, while the Charlotte line, with its station at Blanding and Barnwell Streets, followed Laurens Street south until it merged with the South Carolina Railroad just beyond the town limits.
Following the Civil War, the railroad system was left in poor condition. Engines and cars were worn out, and miles of track and trestle had been destroyed. Rebuilding the railroads proved costly, and several corporations went bankrupt. Finally between 1873 and 1880, new railroad regulations permitted companies to reorganize and refinance. This reorganization produced marked improvements in rails, bridges, station accommodations, and the speed and frequency of trains. By 1880, one could travel from Charleston to Columbia in three hours and forty minutes. Two years later 1,600 miles of railroad track criss-crossed the state and transported 961,313 passengers and carried 1,323,364 tons of freight. This growth continued so that, by 1910, trains made it possible for The State newspaper, printed in Columbia, to be in most South Carolina towns before breakfast.
Charleston Businessman’s Trips Across South Carolina in 1860

Samuel Edward Burges kept a diary of his trips across South Carolina. It is an excellent travel log documenting the variety of transportation systems available to the public in the period just before the Civil War. He entered in his diary the distance traveled, mode of transportation, names of railroad lines, creeks, and rivers, and final destination. He also entered his financial success with collections for the day. Samuel Edward Burges had no idea 150 years later that his diary would provide a useful tool for students to visualize traveling across South Carolina in the 1860's. Thomas W. Chadwick edited Burges' diary in 1947, which was printed in the South Carolina Historical and Genealogical Magazine, a Quarterly publication of the South Carolina Historical Society, Charleston, SC. The following excerpts are taken from this account.

The Diary of Samuel Edward Burges, 1860-1862
Edited by Thomas W. Chadwick

[ ] Indicates editorial notes inserted by SC MAPS authors
( ) Indicates editorial notes inserted by Chadwick

(Samuel Edward Burges, the author of the following diary, was born in Charleston on August 20, 1832, a son of James Smith Burges, a printer and bookseller whose imprint appears on a number of Charleston publications of the second quarter of the nineteenth century, and his wife, Margaret Eliza Seyle. Young Burges attended a private school, but at the age of nineteen, when he began the writing of the earliest extant volume of his diary, he was dividing his time between the duties of a traveling collector for certain Charleston newspapers and the management of a farm near the town of Cheraw, in Marlborough District. By 1859 his services as a collector appear to have been claimed entirely by the Charleston Mercury, which he continued to represent until its publication was abandoned in 1868.

It was Burges' practice to enter in the space provided in one of the standard pocket diaries of his time a few lines describing his activities during the day and recording, if he happened to be on the road, the mode of travel and the distance covered. To this he added, likewise in the allotted space, a record of his personal expenditures. The regularity with which these entries are made would seem to indicate that a diary was kept for every year, but only those of the years 1852, 1859, 1860, 1861, and a part of 1862 are now to be found.

During his trips, he crossed a number of creeks and rivers as well as several landform regions. Burges describes a variety of transportation modes available to South Carolinians in the mid 1800's.)

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
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<tbody>
<tr>
<td>Tuesday, February 7, 1860</td>
<td>Rained most of the day and fearing the weather would prevent the steamer leaving [Georgetown] in the morning I tried to get passage on the stage but all the seats were already engaged . . . At night went on board Steamer Charleston to leave in morning.</td>
</tr>
<tr>
<td>Wednesday, February 8, 1860</td>
<td>Rained and blew so hard last night that the steamer did not leave, so I went to stage agent and engaged passage, . . . I left on stage at 5 P.M. (3 miles south of Lane on NERR)</td>
</tr>
<tr>
<td>Thursday, February 9, 1860</td>
<td>We reached Gourdin's Turn Out a little before 2 A.M. Preferring railroad to stopping here I took the up train to Kingstree, where I spent an hour and took the down train about 4:30 A.M. Reached Charleston at 8 A.M. Stage 42 miles; NERR 78 miles.</td>
</tr>
</tbody>
</table>
Wednesday, August 29, 1860: Left [York in buggy] at 7:40 A.M. Took Pinckney road, pretty rough last 5 miles to Broad River which I crossed at Pinckney ferry. Then took Spartanburg road as far as Jonesville following Spartanburg and Union Railroad about 3 miles. Then took off to Glenn Springs [crossed Fair Forest Creek] where I arrived at 7:45 P.M. 43 miles.

Saturday, September 1, 1860: Left [Glenn Springs] about 7:40 A.M. Took a rough road a piece. Crossed North and South Tyger and Ennodee Rivers. Got into Spartanburg and Greenville road. Reached Greenville about 6:45 P.M. Put up at Goodlett House, where I found several friends. 41 miles.

Wednesday, September 5, 1860: Stirred up at 3 A.M. Took Greenville and Columbia Railroad at 4 A.M. Breakfasted at Belton, then took the branch to Anderson, then the Blue Ridge Railroad to Pendleton where I arrived about 8 A.M. Put up at Blue Ridge House [managed] by J.W. Cobb and went about my collections. Greenville and Columbia Railroad 36 miles, Blue Ridge Railroad 14 miles.

Thursday, September 6, 1860: Left at 1 P.M. on Blue Ridge Railroad to Anderson. Put up at Benson House [managed] by C.C. Langston. 14 miles.

Friday, September 7, 1860: Finished my business and left on Greenville and Columbia Railroad Branch. At a creek the bridge being down, had to foot it across to another train, which whirled us down to Belton, when after an hour's delay, took main trunk to Williamston. Greenville and Columbia Railroad 18 miles.

Monday, November 5, 1860: Left Charleston at 11 last night on NERR. got off at Kingstree. Put up at Wards new house over the branch. Retired to bed a while. Court opened, Judge Whitner. Sale day very good attendance. Collected pretty well. Grand jury found true bills against Cain Allen for Negro stealing, General Coffee Cheeler for killing his Negro boy, Henry Franks for killing Simson Coughleton. Left on NERR about 5 P.M. Got off at Florence. Put up at Gambles. NERR 102 miles.

Tuesday, November 6, 1860: Left on W&MRR after 2 A.M. Got off at Sumter. Put up at Sumter Hotel now kept by Clark. Court in session, Judge Glover. Not many in attendance, so finding I could do very little, left on W&MRR about 1:10 P.M. to Kingsville where I took the SCRR to Columbia. Put up at Hunts. Legislature was convened in extra session yesterday and today. Voted for Electors to vote for J.C. Breckenridge for President and Jas. Lane for Vice Pr. At night a party out serenading. Called out several gentlemen. Hon. W.W. Boyce, Gen. W.E. Martin and others. Kept it up till 12 o'clock. W&MRR miles, SCRR 25 miles.

Wednesday, November 7, 1860: Attended session of legislature. In consequence of news arrived that Lincoln is election [sic], several bills for call of convention were introduced and notice given of bills to arm the state. All made special orders for tomorrow. At night serenading. Hon. Edmund Rufin spoke, cast his vote in Va. and came in to share our fate. W.S. Mullins, F.W. Fickling, Senior and others spoke, all for immediate separate secession.

Thursday, November 8, 1860: Attended legislative sessions. Bills were made special orders, were referred to Com. on Federal Relations. More serenading at
night and speaking by W. D. Porter, I. W. Hayne, O. M. Dantzler and others until after 11.

**Friday, November 9, 1860:** Rained all morning until about 1 P.M. Attended session of Legislature until about 1 P.M. when I returned to Hotel dined and then to SCRR. Some 20 minutes behind time starting which threw us out of schedule and in last time meeting up train as we reached Kingsville. Too late for W&MRR train. For want of something better practiced with my Colt revolver. SCRR 25 miles.

**Saturday, November 10, 1860:** Blew pretty hard during night and turned cool. Got up about 3 A.M. Left about 4 on W&MRR. Got off at Sumter. Put up at Clark’s. Collected what bills I had about town. W&MRR.

**Sunday, November 11, 1860:** Walked, read and wrote. Weather pleasant.

**Monday, November 12, 1860:** Started in buggy with Webb Clark. In good time reaching Manning, put up at Stukes. Found crowd disappointed as the Judge (Glover) is too sick to attend court. Collected tolerable. A meeting was held on the Secession question. Several speeches. Buggy 21 miles.


**Wednesday, November 14, 1860:** Walked to fair grounds. Fine exhibition and a very large attendance. Estimated at 10,000. Walked to Hunts to dinner. Again visited Fair in afternoon. At night crowd serenaded Col. O.W., who said if he was a member of the convention, tomorrow he would vote for secession. A drunken fellow asked if he was for separate state action. He replied he was making the argument but that he could not make brains for him to understand. Col. Kiett and others addressed the crowd. A large torch light procession paraded previous to the speaking. A drunken fellow tried for half an hour to make himself heard amid the most uproarious shouts.

**Thursday, November 15, 1860:** Walked to Fair grounds, remaining until 3 P.M. At night several gentlemen were to speak, but the crowd brought out some drunken men which killed it off.

**Friday, November 16, 1860:** Walked to Fair grounds. Premiums distributed. I got one for Miss A.E.B. for a collar and one for Mrs. M.S.S.I. for knitted shawl. Got a late dinner at Hunts. At night some more drunken fellows tried to speak.

**Saturday, November 17, 1860:** Left on SCRR in heavy rain at 5 A.M. Breakfasted in Kingsville. About this time the rain cleared off. T.A.G.C. told E.P.C. he would have to take him back to the Asylum. A gent nearby asked if he knew a certain gent there. E.P.C. denied having been there and told T.A.G.C. to stop it. E.P.C. bought a 10ct paper from newsboy and gave him a common umbrella saying he had no change. We made newsboy believe he was crazy, and after dunning until he was tired he finally grabbed the paper, threw down the umbrella and eloped. A woman weighing 600 was our fellow passenger from Columbia to Branchville, where E.P.C. handed her out our train and to the train.
for Augusta. We had quite a jolly time to Charleston where we arrived about 1 P.M. SCRR 130.

**Friday, December 21, 1860:** Went over to Woodlands (near Cheraw) in buggy and brought over some seedling Peach trees which set out, also Catawba grapevines. Walked to Col. P’s. After tea we heard firing in Cheraw. Concluded they had the news of the secession of So Ca, so we loaded up 13 barrels and gave a salute, then fired 2 more to make the 15.

**Saturday, December 22, 1860:** Walked to my place where I fired a salute of 15 guns. Cole fired some. Worked until dinner, then went in buggy with Cole to Cheraw. After some business left on C&DRR at 3:30 P.M. Got off at Florence and put up at the Hotel. Buggy 5 miles, C&DRR 40 miles.

**Sunday, December 23, 1860:** The W&MRR train considerable behind time which detained us until after 3 A.M. when left on NERR. Reached Charleston safely about 9 A.M. NERR 102 miles.

**Saturday, January 5, 1861:** Left at 2 P.M. on NERR. Passed train with company from Marion. At Gourdin took stage for Georgetown. NERR.

**Sunday, January 6, 1861:** Staging very rough, roads bad. Reached Georgetown about 2 P.M. Put up at Donill house. Went to roost for a few hours. Knocked about. Met a few acquaintances. Stage [illegible] miles.

**Monday, January 7, 1861:** Sale day. Not much sold. Collected some accounts. Did better than expected. In evening Mr. [illegible], collector for the port was arrested. A letter having been found in which he informed the President of what was going on. His deputy [illegible] both in a tight fix. At night visited Hall to see the Rifle Co. drill. A la zouave.

**Tuesday, January 8, 1861:** Stirred around. Collected all in town that was collectable. At night the Rifle Co. Drilled in the bayonet. Was a la zouave. About 10 P.M. came aboard St. Ch(arleston) to go to Charleston.

**Wednesday, January 9, 1861:** Storm started about 5 A.M. Detained a short time by fog. Detained again at Charleston bar. Got off at Ch(arleston) about 3:30 P.M. Found city in state of excitement from the Star of the West having appeared with 250 troops to reinforce Fort Sumter, but she was driven off by some shots from Fts. Morris and Moultrie. St. Chn. 85 miles.

**Saturday, March 2, 1861:** Left (Charleston) on SCRR at 2:30 P.M. Got off at Graham, T.O. (Branchville) went to friend Cooper. SCRR 81 miles.

**Sunday, March 3, 1861:** Amused ourselves looking over the plantation and talking on matters and things in general. Left on SCRR about 7:30 P.M. Got out at Augusta. Put up at Augusta Hotel. SCRR 56 miles.

**Monday, March 4, 1861:** Left on Edgefield stage a little after 8 A.M. through Hamburg, for about 9 miles over an infernal plank road. When we left it some rain. Over the hills to Edgefield. Put up at Ryan’s. Court in session, Judge Whitner. State 24 miles.
Tuesday, March 5, 1861: Wind blew hard all day. Turned cold. Pretty fair collection. Left on stage about 6 P.M. to Augusta. Chilled and jolted nearly to death. Put up at Augusta Hotel. Stage 24 miles

Wednesday, March 6, 1861: Attended to some collections in town and at Hamburg which looks used up and nearly deserted.

Thursday, March 7, 1861: Left at 8 A.M. on SCRR. Got off at Aiken about 9. Stopped with friend Raulet and attended to collections about town. Left at 8:30 P.M. for Charleston. SCRR 17 miles.

Friday, March 8, 1861: Reached Charleston about 4:15 A.M. Walked home. SCRR 120 miles.
The American Civil War and South Carolina

The American Civil War destroyed South Carolina's plantation dominated world. South Carolina had been the first state to secede from the Union to form, with ten other southern states, the Confederate States of America. Charleston suffered the longest siege of the war and was eventually occupied by the Union Army. An invasion by General Sherman resulted in the destruction of Columbia. On Sherman's march through South Carolina, his 60,079 officers and enlisted men burned houses, hotels, public buildings, churches, and fields leaving columns of smoke and burned out chimneys. The Civil War proved to be an economic, political, and social turning point in South Carolina history.

Legacy of the Civil War

In 1865, South Carolina ranked third in per capita income in the nation, but by 1929 had dropped to last. While the institution of slavery was destroyed, the struggle over the place the freedmen (ex-slaves) would play in South Carolina society had just begun. Reconstruction was another tumultuous era in the state's history. It ended with the overthrow of the state's Republican dominated Reconstruction government in 1877.

Benjamin Tillman and a New Era for South Carolina

A new era of South Carolina history started with the victory of Benjamin Tillman's Farmer's Association in the election of 1890. This association promised more political power to poor whites. In 1895, the newly adopted state constitution disenfranchised black citizens by placing so-called Jim Crow restrictions into the laws of the state. These new laws established official segregation under the banner of "separate but equal," although facilities such as schools and restaurants, and even municipal services, were seldom of equal quality. During this period, railroad construction dramatically increased and textile mills spread throughout the Piedmont and Midlands. In the 1930's, the New Deal placed an emphasis on land conservation and diversification of agriculture. Manufacturing continued to grow and became an increasingly important part of the state's economy. Today South Carolina has a diversified industrial and agricultural base which includes a thriving tourist industry. South Carolina seeks to preserve the best of its past while it prepares to face the 21st century.

The Civil Rights Movement in South Carolina

South Carolina played several important roles during the Civil Rights Movement of the 1950's and 1960's. Penn Center, located on St. Helena near Beaufort, served as a frequent meeting site for many famous black leaders. Dr. Martin Luther King Jr. and his staff used the Penn Center facility as a haven where they could plan strategies for the nonviolent Civil Rights movement. The social pressure produced by this movement resulted in the passage of the Civil Rights Act of 1964 which ordered restaurants, hotels, and other businesses to serve all people without regard to race, color, religion, or national origin. This was followed by the Civil Rights Act of 1968 ending discrimination in the sale or rental of housing. These new laws received a mixed response from South Carolinians. Some felt the civil rights laws were an unnecessary federal intrusion into issues which should be handled by the states. Others argued that the laws did not go far enough in addressing the evils of racism. But passage of these laws nevertheless
started the process of integrating black South Carolinians into many social and governmental institutions which had formerly kept them out.

For example, in the 1960's and 1970's, federal civil rights laws brought significant changes to South Carolina's public education system. It was here that the famous Clarendon County desegregation case originated in 1949. Along with four similar cases, it was consolidated into the historic Brown v. Board of Education of Topeka school desegregation decision in 1954 which outlawed segregation everywhere in the country. Thurgood Marshall, serving as chief legal council for the National Association for the Advancement of Colored People, argued the case before the United States Supreme Court. The court held that "in the field of public education the doctrine of 'separate but equal' has no place. Separate educational facilities are inherently unequal." In 1969, the court ordered public school districts to desegregate. Initially, South Carolina opposed federally mandated desegregation and the state did experience incidents of violent opposition. Eventually, however, white businessmen, civic, and political leaders worked with leaders in the black community to bring about relatively peaceful desegregation statewide. The landmark enrollment of Harvey Gantt as the first black student at Clemson College in 1963 was the culmination of this process and was typical of the way desegregation was handled throughout the state. As a result of Thurgood Marshall's leadership and understanding of constitutional law, as demonstrated in the 1954 court case, President Lyndon Baines Johnson appointed Marshall the first black associate justice of the United States Supreme Court.

**Figure 1-14: Population Density Map (1990)**

![Population Density Map](image)

*Population density key:
  - 23 - 37 = light gray
  - 37 - 58 = medium light gray
  - 58 - 105 = medium gray
  - 105 - 155 = dark gray
  - 155 - 405 = black

Population per square mile of land area - 1990

U.S. Bureau of the Census Data, April 1, 1990
Soils and Land Use

When a soil scientist looks at a soil, he or she is not just considering the near surface, but a series of layers called *horizons* that can extend six feet or more below the surface. The presence or absence of these horizons and their physical and chemical characteristics are used to classify soils in terms of land use capability, for both agricultural and urban uses. Different environmental conditions can produce very different soils, even from the same original material. The factors most responsible for these differences are:

1. **Parent Material** - original material which was there before soil formation began (can be mud deposited by a river, sand deposited by the ocean, rock that weathers and breaks down, etc.)
2. **Organisms** (mostly vegetation, microorganisms)
3. **Climate** (on both large and small scales).
4. **Slope**, or landscape position.
5. **Time**.

The list above is referred to by soil scientists as *The Five Factors of Soil Formation*, and was first postulated in 1941 by soil scientist extraordinaire Hans Jenny. About 15,000 different soils have been identified in the United States, approximately 300 of which exist in South Carolina. Altering one or more of these factors will result in a different soil profile with different properties, which can make the soils behave quite differently. These factors are not always independent of each other. Landscape position can affect soil organisms and local climate. Both climate and parent material can affect organisms, etc. Jenny’s model of soil formation is still a good way of understanding the variation of soils found across a landscape.

Water Pollution

Water pollution is one of the most pressing ongoing natural resource issues facing South Carolina. The state’s high growth rate, coupled with increasing pressures on rural lands for food and fiber, have elevated these issues to the forefront of priorities set forth by natural resource managers.

Water pollution can be categorized as either "point source" or "non-point source," depending on its origin. The easiest way to explain non-point source pollution is to first describe point source pollution. If a river is being contaminated by waste discharged from a sewage treatment plant, factory or oil refinery, and the contamination can be traced back to a discrete source, such as a discharge pipe or drainage way, this is called point source pollution (because the source of the pollution can be traced back to a single point). On the other hand, when contaminants have no single source, such as exhaust from automobile engines, or water pollution from the over-use of lawn chemicals, it is referred to as non-point source pollution. Point source pollution is generally easier to fix than non-point source. If only one easily identifiable culprit is responsible for contaminating a waterway, steps can usually be taken quickly to reduce or eliminate the problem.
Non-point source pollution is somewhat more difficult to deal with because there are usually many sources, each responsible for relatively small amounts of contamination. For example, the lawn care industry has for many years recommended very high rates of nitrogen fertilizer to homeowners. Much of that fertilizer is not taken up by the grass, but instead leaches through the soil into the groundwater and into streams and rivers. If only a few people did this, the pollution would be dilute enough so that it would not be much of a problem. Since many people do this it is a problem.

In order to do something about non-point source pollution, many individuals must unite to change their practices or habits. To achieve a reduction in air pollution from automobile exhaust, both the auto industry and the oil industry had to alter their products. (Even more difficult is the task of getting individuals to alter their driving habits.) Common causes of non-point source pollution include:

<table>
<thead>
<tr>
<th>Non-Point Source Pollutant</th>
<th>What is Affected</th>
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<tbody>
<tr>
<td>Gasoline, oils, antifreeze from cars</td>
<td>water, land</td>
</tr>
<tr>
<td>car exhaust</td>
<td>air, water</td>
</tr>
<tr>
<td>septic system effluent</td>
<td>water</td>
</tr>
<tr>
<td>agricultural chemicals</td>
<td>water, air</td>
</tr>
<tr>
<td>eroding soil, sediment</td>
<td>water</td>
</tr>
<tr>
<td>natural gas leaks</td>
<td>air</td>
</tr>
<tr>
<td>refrigerator/air conditioner leaks</td>
<td>air</td>
</tr>
<tr>
<td>lawn chemicals</td>
<td>water</td>
</tr>
<tr>
<td>storage tank deterioration</td>
<td>water, land</td>
</tr>
</tbody>
</table>

By observing land use patterns we can predict the type of non-point source contaminants that might be found in a waterway. When a significant portion of land is used to grow row crops (corn, soybeans, tobacco, etc.) eroded soil, sediments, and agricultural chemicals may become a possible problem. Forest clearcuts also lay soil bare to erosion and create sedimentation problems. In more populated areas, runoff from roads and parking lots can introduce chemicals used by and for automobiles. Residential areas with significant amounts of land dedicated to lawns and gardens, and especially the presence of golf courses, can indicate the possible existence of excess fertilizers, herbicides and insecticides in local waterways.

Certain landscape conditions can help reduce the problem of non-point source pollution. The presence of undisturbed vegetated land immediately adjacent to waterways creates a buffer zone that can remove these contaminants from both surface runoff and groundwater. Eroded sediment is also trapped through physical filtration. In addition, when vegetation slows the flow of surface runoff water, the water loses its capacity to hold and carry sediment. The live plants in these buffer zones can also take up excess fertilizers, pesticides and other chemicals through their roots. (Trees have been found to do this even better than grass.) Wetland ecosystems have a unique ability to remove certain non-point source pollutants, especially hydrocarbons, due to the active chemical nature of the organic matter that is usually present.
Habitat Alteration

Habitat alteration is the other major ongoing natural resource issue facing South Carolina. Most plant and animal species have evolved as part of ecosystems with little human influence. These species have adapted to a particular niche within the ecosystem, whether it be a mountain cove, a salt marsh, a pine forest, or a Carolina Bay. People, over the past 300 years, have greatly changed much of the natural landscape - parts being altered through management or conversion of use. Some habitats were eliminated altogether. Natural ecosystems have been cleared for farming or put into pine trees, rivers have been dammed, and urbanization has consumed large portions of natural habitat.

Habitat alteration can be defined as the result of both vegetative community change, and the effects of stresses such as pollution and natural disasters. Some plants and animals are very adaptable to habitat change, where others, especially those with a limited range or niche, are very susceptible to changes in their environment. Listed below are several wildlife species whose long term survival is threatened due to habitat alteration.

**Peregrine Falcon** *Falco peregrinus*

Adult peregrines are 15 to 17 inches in length, with a wing span of about 40 inches. They are grouped into 19 races or subspecies world wide. The arctic peregrine, which breeds in Greenland and other remote northern locations, migrates along the South Carolina coast in the fall, and its breeding numbers appear stable and perhaps are even increasing without human intervention. Peregrines choose high places with sheer cliffs and prominent ledges as nesting sites. Peregrine falcons completely disappeared east of the Mississippi by the mid 1960's. Reintroduction efforts in the east began in 1974. As of 1993, there are an estimated 97 pairs nesting in the entire eastern half of the country, mostly in the Northeast. South Carolina has one pair that first produced young in 1990, and successfully fledged young each year through 1994.

One of the fastest animals in the world, the peregrine falcon is thought to be capable of diving at speeds ranging from 165 to 200 miles per hour, striking smaller prey like bluejays, towhees, woodpeckers, waterfowl and shorebirds. Females usually lay three to four eggs in late March or early April, and the young are fledged by late May to early June. DDT and related pesticides have contributed to the decline of adults as it has many other top level predatory birds, as a result of their feeding on contaminated prey. The principal effect has been damage to the reproductive system. Peregrines have full protection under the federal and state endangered species act.

**Black Bear** *Ursus americanus*

Most of South Carolina's bears are found in either the mountainous northwestern corner of the state, or in and around Horry County's 12,000 acre Lewis Ocean Bay Wildlife Management Area. Bears are also occasionally sighted within remote swamps of the Midlands and Coastal Plain. Black bears are omnivores, feeding on insects, tender green vegetation, fleshy berries, and acorns, depending on availability. They eat very little animal matter, although they sometimes scavenge on carrion.

These animals do not become sexually mature until their third year of life. Breeding peaks in late June and July. Cubs are born in late January or February with a
gestation period of 7 months. Litters usually consists of 2 or 3 hairless cubs weighing between 6 and 10 ounces. The presence of the black bear adds a wilderness character to our swamps and mountains. Bear habitats are threatened because these animals need an expansive range. Large, undeveloped, un-urbanized land tracts are becoming more rare in a rapidly growing state.

Gopher Tortoise *Gopherus polyphemus*

The gopher tortoise, or gopher, is a fairly large, land-dwelling turtle. Adults may reach 15 inches in length and weigh more than 10 pounds. They inhabit the Coastal Plain of the southeastern United States from southern South Carolina to western Louisiana to southern Florida. In South Carolina, only Jasper, Aiken, and Hampton counties are known to have gopher tortoises. Available habitat in these areas comprises about 3,000 acres.

Gopher tortoises are associated with the dry sand ridges and Sandhills of the southeastern Coastal Plain. These habitats include longleaf pine/scrub oak, live oak/red oak hammocks, and sand pine/scrub oak/wiregrass flatwoods communities. In South Carolina, longleaf pine, turkey oak, wiregrass, and a variety of other herbaceous plants make up the gopher tortoise’s habitat. Scattered openings in the canopy are important for its sunning activities, nesting, and production of its food. Most of its burrows are in these openings. These habitats depend on another element—fire. Fire management programs are needed to increase the number of ground plants, which are used for food, and to ensure that pines remain the dominant tree species. Fire is an important management tool for these forests.

Some populations of gopher tortoises have been reduced significantly. South Carolina probably has less than 2,000 individuals, so any population decreases are cause for concern. Unfortunately, some declines in habitat quality have occurred through the conversion of cut-over land to pastures and intensive site preparation for pine replanting. Gopher tortoise numbers in our state seem to be decreasing. Changes in man’s use of gopher habitat and fire suppression programs are the major factors responsible for this decrease.

Red Cockaded Woodpecker *Picoides borealis*

This small black and white bird is about seven inches long, and was originally found in open, mature pinewoods in the south from Virginia through Texas and Oklahoma. Most red-cockaded now live in North Carolina, South Carolina, and Florida. The species is nonmigratory, and spends most of its life within a few hundred acres around its nesting site. Most of the birds in South Carolina occur in the Francis Marion National Forest, Sandhills National Wildlife Refuge, and various other state-owned lands. Red-cockaded also occur on privately owned quail plantations within the Coastal Plain. There are remnant populations on smaller wooded lots. A rough estimate in 1979 placed the total population between 3,000 and 10,000. Probably 2,000 to 3,000 birds live in South Carolina, according to wildlife biologists. Based on trends in habitat destruction, a gradual decrease in the population is expected. The Endangered Wildlife Program’s recent survey results reflect a loss of red-cockaded in 10 of 28 counties previously occupied. However, populations on state and federal lands are becoming stable.
The red-cockaded woodpecker has highly specialized habitat requirements, which account for its endangered status at both the federal level and the state level in all states where it occurs, including South Carolina. Its cavity trees are found only in mature pine forests containing trees greater than about 60 years of age, which are fairly open and free of hardwood understory. Such sites were maintained historically by wildfires and by fires set by Native Americans. At one time, these pine forests covered millions of acres in the southern Coastal Plain. The species has probably always been uncommon in the Piedmont and more mountainous regions of the south because of the absence of these well developed pine forests.

The red cockaded woodpecker is unique because it is the only woodpecker that excavates a cavity in a living tree. Their diet consists of spiders, wood roaches, centipedes and other arthropods. Adults also occasionally feed on wax myrtle, blueberry, poison ivy, corn ear worms and sweet bay berries. The red-cockaded spends much of its waking time excavating a cavity - it may take up to a year or more to do so. Most old pines selected for excavation have fungal heartwood rot, called red heart disease, which probably allows for easier excavation. The red-cockaded also pecks holes around the cavity in the sapwood. The holes are called resin wells. This causes large quantities of sap to coat much of the tree, giving it a candle-like appearance. The sap is thought to aid in deterring predators such as raccoons and rat snakes, which are adept at climbing trees.

Modern forestry practices seldom allow pine stands to reach the age necessary for woodpecker use. Other threats include demographic isolation, clearcutting, and developing of entire colony areas. Even when protected from logging, certain wildlife management practices are still required. Red-cockadeds need open, park-like stand free of hardwood understory. This habitat is best achieved through the use of controlled fires which kill the hardwoods but not the pines. The Francis Marion National Forest in Berkeley and Charleston counties had one of the densest concentrations found anywhere. About 500 colonies of red cockadeds lived there before Hurricane Hugo destroyed many of the mature trees suitable for nesting. Lack of cavity trees has been a limiting factor in survival of this species. Through the installation of artificial cavities, biologists throughout the state have been able to augment populations on state and federal lands.

Bald Eagle *Haliaeetus leucocephalus*

The bald or American eagle is one of 59 species of eagles in the world. It is the only representative of the group of eagles known as fish or sea eagles found in the New World and is the largest bird of prey found in the state. South Carolina eagles have wingspans of 6 to 7 feet, and weigh 7 to 10 pounds. Eagles from more northern nesting populations which winter in South Carolina are noticeably larger. The eyes, bill, and feet are yellow. It may be identified by its broad, long wings and large, heavy bill. The bird has heavy, powerful wing beats in flight and holds its extended wings flat when soaring. Bald eagles can attain speeds in excess of 60 mph.
The bald eagle can be seen in every state of the union except Hawaii. South Carolina supports over 100 nesting pairs of eagles and reaches a peak number of just over 300 eagles in mid-January. This number represents resident adults and immature young as well as a small number of migrants from northern breeding areas. Most nests in South Carolina are located along the major river drainages of the lower Coastal Plain, and are usually adjacent to large areas of impounded marshes intentionally managed to attract waterfowl by providing suitable shallow-water feeding habitat. This has allowed the establishment of nesting territories in sites further inland than the historical range. Eagles usually lay eggs in late December and early January in South Carolina, and as a result, the best opportunity to see eagles in South Carolina is by boat during January along river bottomland. They can also be seen adjacent to the dams on inland reservoirs, particularly below hydroelectric power plants.

The bald eagle is a fish eagle and true to its name - the majority of its diet consists of fish. While fishing, they snatch a variety of fish species from the top six inches of water. Coots gallinules, and injured ducks supplement the diet during much of the winter, and they occasionally take rabbits or other small mammals. The bald eagle is also a scavenger, regularly feeding on dead fish and sometimes animals killed along the highway. Like most predators, the bald eagle is opportunistic and utilizes whatever is most attainable as prey. Food availability is most important during the period of nesting and raising young. Nesting during the winter months enhances feeding because water birds are abundant and reduced aquatic vegetation makes fish easier to capture.

In South Carolina, eagles usually construct their nests in large live pine trees. The canopy of the nest tree is typically higher than the surrounding forests and within one mile of open water. Nests are typically six feet across the top, six to eight feet from top to bottom, and an average of 100 feet from the ground. Nests are often used year after year with more materials added each season. In one extraordinary case, a nest weighed nearly 4,000 pounds. The adults continue to feed the young eagles for four to six weeks after the young have fledged from the nest. This enables the inexperienced fledglings to strengthen their muscles and sharpen their flying and hunting skills until they can sustain themselves independently. The young adults move north in spring and summer. Eagles banded in South Carolina have been reported as far away as Canada. Adults are at nesting territories from September through June. Juveniles and adults from other breeding populations are customarily in the state throughout the year.

Pesticides, indiscriminate shooting, and habitat alterations have been the primary factors reducing the bald eagle population from colonial times to the present, as man and eagle competed for some of the same habitat. Historically, in excess of 100 pairs of eagles nested in South Carolina. During the late 1960's, our state's breeding population was reduced to about a dozen pairs. The wholesale use of persistent pesticides, such as DDT, contributed to this precipitous decline in the eagle population by causing almost total reproductive failure. Regulating the use of persistent pesticides has led to recent increases in reproductive success in eagles. Education and heightened public awareness have resulted in reduced shooting mortality. Habitat protection for the eagle also helped stabilize the eagle population during the 1970's, and substantial increases have been monitored by the South Carolina Department of Natural Resources. Bald eagles are protected under the Eagle Protection Act, the Migratory Bird Treaty Act and the Endangered Species Act.
Loggerhead Turtle *Caretta caretta*

The loggerhead is one of only seven recognized species of marine turtles still in existence today. Adult female loggerheads can weigh as much as 300 pounds, and males may grow even larger. In coastal waters, the loggerhead feeds mainly on whelks (large marine snails), crabs, fishes and benthic organisms (organisms living on the bottom of the sea), such as sponges and algae. The loggerhead’s name refers to the size of its head, which is larger in proportion to its body than that of other marine turtles. One of this species’ major nesting concentrations is in the southeastern United States, from North Carolina to Florida. In South Carolina, the primary nesting beaches are between North Inlet and Prices Inlet, but other beaches in the southern part of the state also have moderate nesting densities. These are mainly undeveloped beaches between Kiawah Island and Hilton Head Island.

Adult females come ashore at night to nest from mid-May to mid-August. They may lay several clutches of eggs a season at approximately two week intervals. Turtle tagging studies have shown that females return to nest at a preferred beach on a two year or three year cycle. The female crawls ashore after dark to lay her eggs in the best site, usually a well drained dune with clean sand and scattered vegetation. After depositing the eggs in the nest cavity, the female then replaces the sand over the eggs and disguises the location by throwing sand over the spot with her front flippers. Most hatchlings leave the nest as a group within three minutes of each other, to begin their crawl to the ocean, an important part of their survival.

After hatchlings enter the ocean, human contact with them is lost. It is not known how many years it takes for a hatchling to reach adult size, but some researchers estimate it could be as long as 20 to 25 years. Evidence from tag returns, epifauna (organisms that are attached or grow on the shell), and now from mitochondrial DNA show the adult loggerheads in South Carolina and Georgia are the same stock and they are genetically different from Florida loggerheads. This had important implications for management. If we lose our loggerheads, we will not have recruitment from Florida, even though ten times as many nesting females are there.

The loggerhead was added to both the U.S. and South Carolina List of Endangered and Threatened Species in 1978. It is in the threatened category on both lists. Since the listing, state wildlife biologists have conducted research to learn more about our loggerheads. They have initiated active management to mitigate those factors which negatively impact the turtles and are conducting statewide monitoring of the nesting population to determine if these efforts are successful.

Turtles are primarily impacted by changes in habitat. For example, some coastal beaches were being lined with seawalls or rock revetments to protect property. This was destroying large segments of loggerhead nesting habitat. Since passage of the Beachfront Management Act, hard erosion control structures are no longer permitted and beach renourishment is used instead. This provides dry sand beaches that are beneficial to coastal residents, tourists, and loggerheads. Another danger to loggerheads was the high loss of nests on beaches due to natural erosion, predators such as raccoons and ghost crabs, and some human poachers. Now, thanks to the efforts of many volunteers, nests are moved to safer locations and are screened to keep out predators; poaching is also much reduced over past years.

Developed beaches pose yet another problem for hatchlings. Light from beach facilities will disorient them and cause hatchlings to wander away from the ocean until
they die from the sun’s heat, or get crushed on roadways. A final contributor to turtle mortality is the drowning of large numbers of subadults and adults in commercial shrimp trawl nets. South Carolina was the first state to require Turtle Excluder Devices in shrimp trawls. South Carolina was also instrumental in prohibiting the use of hopper dredges when sea turtles are present. Due to high mortality rates caused by hopper dredges, dredging of ship channels is now done during winter when sea turtles are absent.

Summary

South Carolina has five distinct landform regions: Blue Ridge, Piedmont, Sandhills, Coastal Plain, and Coastal Zone. Each of these regions has unique landscape features, drainage patterns, soils, vegetation, rocks and land use. The diversity of each of the landforms has greatly influenced the development of trade, industry, agriculture, and transportation across South Carolina. Indeed, the history of South Carolina is woven into the distinctions and relationships among these landform regions. All of these distinct features are economically valuable to the state and all must be used wisely to provide for a secure economic future for South Carolina.

The diversity of the state landforms may be generalized into a rather flat topography we refer to as the Low Country and rolling hills called the Up Country. Historically, this distinction has been marked by differences in the way people have made their living. The Low Country was characterized by large port cities like Charleston (a major trade and shipping center), an aristocratic society with large plantations, and an extensive slave population. In contrast, the Up Country or Upstate was settled by frontiersmen and small farmers of mostly Scotch-Irish background, who had fewer slaves. There was less dependence on large-scale agriculture, and the people were more receptive to a manufacturing-based economy. Recently, tourism has become one of the few economic activities shared by both areas.
PLACES TO VISIT

Man-made lakes both large and small are located over most of South Carolina. Plan to visit the one nearest your school. Identify the sources of water, type of dam, and means of flood control. How is this lake used?

Many farms, factories, and businesses located near your school depend directly on land resources. Plan a visit to one of these places to determine which resources are used and how disposal of waste products is accomplished.

Ask a geologist in your area, perhaps at a nearby college or university, to lead a field trip explaining the geology of your area.

Visit a farm which practices forest and wildlife management or uses soil and water conservation practices. To make arrangements for a visit to a farm or forest contact your local Soil and Water Conservation District Office. The phone number is in your local telephone directory.

REFERENCES AND RESOURCES


STUDY AREA 1 : STATEWIDE OVERVIEW

Activity 1-1: State Landform Regions

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<tr>
<th>Materials</th>
<th>1:500,000 or 1:1,000,000</th>
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</thead>
<tbody>
<tr>
<td>STATE BASE MAP #1, SHADED RELIEF</td>
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<tr>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<tr>
<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<td>Landform Regions of South Carolina</td>
<td>Figure 1-1</td>
</tr>
<tr>
<td>Index Map of Study Sites</td>
<td>Section 1 Title Page</td>
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<td>The Geologic Time Scale and South Carolina</td>
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<td>Geologic Map of South Carolina</td>
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<td>Geologic Cross-Section of South Carolina</td>
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<td>Average Annual Temperature</td>
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<td>Average Annual Precipitation</td>
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<td>Transparent Grid Overlays</td>
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<td>Wipe-off Pens</td>
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</tbody>
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PERFORMANCE TASKS
(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts =

1. Investigate the five landform regions.
   Outline and name South Carolina's five landform regions on the STATE BASE MAP
   #1, SHADED RELIEF, with a wipe-off pen. Use Figure 1-1, "Landform Regions of
   South Carolina," as a guide. Note that the landform regions form a pattern of broad
   parallel bands. What is the direction of these bands? Note also that these regions
   are parallel to the present coastline. Consider whether you think this is just a
   coincidence. Suggest several reasons why these parallel bands should exist?
   Which region is most mountainous? Which is flattest? Which region is most
   irregular in shape? Which region can be described as having small rolling hills?
   Which region contains most of the swamps in South Carolina? In which landform
   region is your school located?

2. Locate the 18 SC MAPS study sites.
   With a wipe-off pen, mark the approximate location of each study site with a small
   box on the STATE BASE MAP #2, WITH HIGHWAYS. Be as accurate as you can. Use
   the index map at the beginning of the section as a reference. Determine the
   approximate latitude and longitude of each study site by using the degree ticks in the
   margin of the state base map.

3. Make a chart listing age, geologic era, and rock type.
   Use the GEOLOGIC AND MINERAL RESOURCE MAP and the geologic data
   presented in the Background Information (Figures 1-5, 1-6, and 1-7) as a resource
   to make a chart listing basic characteristics for each of the five landform regions.
   Identify the age, geological era, and major rock type in each region. Why are the
   rocks in the Blue Ridge and Piedmont mostly metamorphic? Why are the Coastal
   Plain rocks mostly sedimentary? Why are there so many igneous intrusions,
   plutons, in the Piedmont? Also determine the age, geologic era, and classification of
   the rocks underlying the area where your school is located.
On another chart, describe the geologic evolution of the five landform regions and note their differences in regard to surface and sub-surface characteristics such as weathering, tectonics, and erosional processes. Also note, in detail, differences in drainage, topography, elevation, soil types, and land usage.

4. **Estimate percentage of state in each landform region.**

There are several methods by which the area of a geographic region can be calculated. Two of these methods are listed below. You may try some other methods as well. Divide into groups so that each method is tried by at least one group. First, with a wipe-off pen, mark the landform regions on the **STATE BASE MAP #1, SHADED RELIEF.** Then use your assigned procedure to fill in the table below with your numerical area data, then calculate the percentage of the state contained in each landform region. On a separate piece of paper, draw a pie chart (circle graph) depicting the relative percentage of land contained in each of the five landform regions. When all groups have finished, compare your answers with other groups and discuss which method is simplest to carry out, which is quickest, and which gives the most precise answers. Which method would you suggest to estimate the area of your school property?

**Group I  Estimation using transparent grid overlay**

Use the transparent grid overlay to estimate the area of each landform region in square miles. Refer to the scale bar on the map to calculate the number of square miles in one square of the overlay. On the basis of this estimation, calculate the percentage of land in each region. Compare your estimate to the actual area of the state. (Note that the total area of South Carolina is 80,583 square kilometers or 31,113 square miles).

**Group II  Calculate using areas of geometric shapes**

Using the coastline as the base for South Carolina’s triangular shape, find the approximate area of South Carolina using the formula (area = 1/2 base x height) for the area of a triangle. Compare your findings with the actual area of South Carolina. Why are these numbers so different? Now find the approximate area of each landform region by approximating other geometric shapes and using mathematical formulas to calculate the area of each.
5. Determine types of state boundary lines. 
Use the STATE BASE MAP #1, SHADED RELIEF, to determine which South Carolina state boundaries follow natural geographic features and which do not. Identify each type of boundary. Explain why natural geographic features usually make excellent boundary lines. Which natural features do not serve as good boundary lines? Why are other types of boundary lines sometimes used? Identify the type(s) of boundary line(s) used for your county.

6. Compare size of your county to entire state. 
With the STATE BASE MAP #1, SHADED RELIEF, in front of you, use a string to measure the perimeter of South Carolina. Use the scale bar on the map to convert this measurement to miles. Next, measure the perimeter of your county in the same way and convert this to miles. Just by observation, is your county a comparatively large, small, or medium sized county? Where is your county seat? How far are you from the capital of South Carolina, Columbia? Charleston? Greenville? Which region do you live in? Is measuring the perimeter a good way to compare the area of various counties? Explain your answer.

7. Calculate slope from mountains to the sea. 
Find Sassafras Mountain on the STATE BASE MAP #1, SHADED RELIEF, along South Carolina's northern border. What is the elevation, in feet, of this mountain? What is the elevation difference in feet between this mountain and the sea? Using the scale of miles on the base map, measure the distance "as the crow flies" between the mountain and the sea (parallel to the Savannah River). Use these values to calculate the average slope of the land from the mountains to the sea using units of feet per mile. Is your answer best characterized as a steep slope or a gentle slope? Explain your reasoning.

8. Estimate travel time to cross South Carolina. 
Starting at the North Carolina state line and traveling southward at 50 mph on Interstate 26, how long should it take to cross each landform region. What is the total time required to cross the entire state? What region, if any, did you miss? Use the scale bar on the STATE BASE MAP #2, WITH HIGHWAYS, to make your calculations. You may wish to use a string as a measuring devise.

During the Cretaceous Period of geologic time, the shoreline went through the midlands of South Carolina in what is now called the Sandhills region of the state. Use the STATE BASE MAP #1, SHADED RELIEF, to mark with a wipe-off pen the upper boundary of the Sandhills region of South Carolina. Determine the average
distance between the shoreline today and the shoreline of 100 million years ago. Use at least five measurements to arrive at your average distance. How many counties would have been completely under water at that time? Was your county one of these? Using your answers to Performance Task #4, estimate the percentage of the state which was under water during the Cretaceous Period.

10. **Determine coordinates of each study site.**

   Use the STATE BASE MAP #2, WITH HIGHWAYS, and the Index Map to Study Sites found on the Title Page of Section 1, to mark the location of each of the eighteen study sites with a wipe-off pen. Set the transparent grid overlay with the city of Columbia (Capitol building) as the origin and determine the coordinates (ordered pairs) of each of the study sites. Use a standard cartesian coordinate system. Record your answer and compare your results with the other teams.

11. **Calculate straight line distance between study site pairs.**

   Use the ordered pair data from Performance Task #10 and the formula below to calculate the straight line distance between the study site pairs listed in the table that follows. Next, use a ruler to measure the straight line distance ("as the crow flies") in map inches between the listed study site pairs on the STATE BASE MAP #2, WITH HIGHWAYS. Multiply your result by the scale factor (8 miles per map inch) to determine the actual straight line distance. Finally, mark the shortest road route between the two study sites on the map with a wipe off pen. Use the scale bar to measure total route mileage.

   \[ d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \]

   \[ d = \text{distance between study sites} \]

   \[ (x_1,y_1,) = \text{ordered pair for study site 1} \]

   \[ (x_2,y_2,) = \text{ordered pair for study site 2} \]

   Enter your data into the table. Compare the straight line distance to the actual shortest road distance. How do you account for these differences? Did it make a difference if the study site pairs were separated by one or more landform regions? Why did you think these particular study site pairs were selected to be printed back-to-back (on the map and lithograph products for SC MAPS)?

<table>
<thead>
<tr>
<th>STUDY SITES</th>
<th>Straight Line Map Distance (inches)</th>
<th>Actual Straight Line Distance (miles)</th>
<th>Estimated Road Distance (Use scale bar)</th>
<th>Calculated Distance (from ordered pair formula)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forty-Acre Rock - Myrtle Beach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Columbia – Silverstreet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graniteville - Winyah Bay</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Table Rock - ACE Basin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Congaree Swamp – North Inlet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woods Bay Charleston</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
12. **Relate average rainfall and temperature data to elevation differences.**

Use a wipe-off pen to trace and label the contour lines from Figure 1-3 "Average Annual Precipitation" onto the **STATE BASE MAP #1, SHADED RELIEF**. Also trace and label the contour lines from Figure 1-4 "Average Annual Temperature" onto the same map, using a different color wipe-off pen. Which of the following correlations best describes the relationship between the contour line values which represent these two climate variables?

- **positive correlation** = higher temperatures tend to occur around the same places as higher rainfall amounts and lower temperatures tend to occur around the same places as lower rainfall

- **negative correlation** = higher temperatures tend to occur around the same places as lower rainfall amounts and lower temperatures tend to occur around the same place as higher rainfall

- **no correlation** = there is no noticeable correlation between these two variables and higher temperatures occur around the same places as many different values for rainfall amounts

Which landform region has the highest average rainfall amount? Which region has the lowest? Which region has the highest average annual temperature? Which region has the lowest? Which landform region has the highest elevation? Which region has the lowest elevation? Combine your temperature and rainfall data with elevation data to hypothesize about the following relationships. How does a change in elevation affect the value of the average annual temperature? How does a change in elevation affect the value of the average annual rainfall? Locate Berkeley County and Cherokee County on the base map and use your hypothesis to predict answers to the following questions.

- Which will probably be hotter on average, Berkeley County or Cherokee County?
- Which will probably be wetter on average, Berkeley County or Cherokee County?

Propose a scientific explanation for why your hypothesis seems to be correct.

**ENRICHMENT**

1. **Compare SC landform regions with rest of USA.**

Locate a physiographic (landform) map of the United States. Compare landform regions in South Carolina with those of the entire United States. Which other southern states have the same regions that are found in South Carolina?

2. **Research, predict population changes.**

Research the changes in population of the five landform areas at 50 year intervals and project for the years 2000 and 2050.

3. **Research boundary line dispute between SC and GA.**

Research the dispute over an island in the Savannah River located close to where that river empties into the Atlantic Ocean. The island is also close to the city of Savannah, Georgia, and for years was claimed by both Georgia and South Carolina. Find out when the dispute first occurred, when it was resolved, and what legal issues were discussed in court. Which state finally got to claim the island in question?
Activity 1-2: State Drainage Patterns

**Materials**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>STATE BASE MAP #1, SHADED RELIEF 1:500,000</td>
</tr>
<tr>
<td>6</td>
<td>STATE BASE MAP #2, WITH HIGHWAYS 1:500,000</td>
</tr>
<tr>
<td>6</td>
<td>LAND USE/LAND COVER MAP 1:500,000</td>
</tr>
<tr>
<td>1</td>
<td>Map of South Carolina Canals Figure 1-11</td>
</tr>
<tr>
<td>1</td>
<td>Population Density Map (1990) Figure 1-14</td>
</tr>
<tr>
<td>1</td>
<td>State Map of Major Drainage Basins Figure 1-2</td>
</tr>
<tr>
<td>6</td>
<td>Transparent Grid Overlays</td>
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<tr>
<td>6</td>
<td>Wipe-off Pens</td>
</tr>
</tbody>
</table>

**PERFORMANCE TASKS**

(Icon Key) Overview = 🌊; Science = ⚪; Math = ☑; History = ☛; Language Arts = 📖

1. **Trace three major river drainage basins. 🌊**
   Use the STATE BASE MAP #1, SHADED RELIEF, Figure 1-2, "State Map of Major Drainage Basins," and a wipe-off pen to trace one of the following major river systems in South Carolina. Then use the wide-tip wipe-off pen to outline the entire drainage basin (watershed) of your selected river system. Name all counties drained by your river system. Identify any significant landmarks such as lakes, dams, and cities. Where are the headwaters formed? In which general direction does your river flow? Through which landform regions does your river flow? Name the specific bay, inlet, estuary, etc. where your river enters the ocean.

   **Group I** Savannah River System
   **Group II** Santee River System
   **Group III** Pee Dee River System

   After the tracings have been completed, compare and discuss the maps as a class, and answer the following questions. Which single drainage system is the largest in South Carolina? Which river has the most dams? Which empties into the largest bay? Which river forms a delta at its mouth? Which river system drains the area with the greatest population? Is your school in the watershed area of any of these rivers? Compare your conclusions to those from Performance Task #2.

2. **Trace three coastal river drainage basins. 🌊**
   Parts of the state are drained by Coastal Plain rivers. Some examples are the Ashley-Cooper river system, the Coosawatchie River, and ACE Basin river system (this acronym is derived from the first letters of Ashepoo, Combahee, and Edisto rivers). Use the STATE BASE MAP #1, SHADED RELIEF, Figure 1-2, "State Map of Major Drainage Basins," and a wipe-off pen, to trace one of these Coastal Plain river systems. Then use the wide-tip wipe-off pen to outline the entire drainage basin (watershed) of your selected river system. Name all counties drained by your river system. Identify any significant landmarks such as lakes, dams, and cities. Where are the headwaters formed? In which general direction does your river flow? Through which landform regions does your river flow? Name the specific bay, inlet, estuary, etc. where your river enters the ocean.

   **Group I** Ashley-Cooper River System
   **Group II** Coosawatchie River System
   **Group III** ACE Basin River System
After the tracings have been completed, compare and discuss the maps as a class, and answer the following questions. What is the general direction of flow for all of these rivers? Do any of these rivers drain a large populated area? Of these three river systems, which system drains the greatest amount of land? Is your school in the watershed area of any of these rivers? How can you account for sharp bends in these rivers? Compare your conclusions to those from Performance Task #1.

3. **Assess threats to habitat in different drainage basins.**

   Trace the major state drainage basin boundary lines onto the LAND USE/LAND COVER MAP. (These regions may be transferred from the STATE BASE MAP #1, SHADED RELIEF, as drawn in Performance Task #1-2.) Divide the class into four groups so that each group covers one of the major river drainage basins. Have each group determine the major types of land uses found in their particular watershed. How many are present? (Use the more general categories of Forest, Wetlands, Agricultural/Grassland, Urban/Built-up Land, and Beaches/Estuaries.) What types of plant and animal life will you likely find associated with each different land use? How have people altered the natural environment to accomplish these land uses? What sort of land management is occurring? List, in the chart below, some of the more obvious environmental concerns and dangers to habitat connected with these land uses or management styles within your watershed basin. Share your results with the rest of the class.

<table>
<thead>
<tr>
<th>HABITAT DATA FOR ______________________ WATERSHED</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND MANAGEMENT</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Forest</td>
</tr>
<tr>
<td>Wetlands</td>
</tr>
<tr>
<td>Agricultural/Grassland</td>
</tr>
<tr>
<td>Urban/built-up Land</td>
</tr>
<tr>
<td>Beaches/estuaries</td>
</tr>
</tbody>
</table>

4. **Write a story about salamander's river journey.**

   Using the STATE BASE MAP #1, SHADED RELIEF, locate Sassafras Mountain (in Pickens County), the highest elevation in the state, and the Saluda River, which flows away from the mountain towards the southeast. Pretend you are a small salamander who was living in a soda bottle carelessly dropped into the river alongside Sassafras Mountain by a thoughtless hiker. During a heavy rainstorm, the bottle is pulled into the river's current and heads downstream toward the ocean. Using a wipe-off pen, trace your path to the ocean on the shaded relief map. From a "salamander's eye" point of view, write a story about your trip from the mountains to the sea. Be sure to mention any obstacles you encounter. Be sure to use plenty of descriptive terms (adjectives) to tell others about what you see along the way. Share your story with other groups.
5. **Write a story about opossum’s after school journey.**

Use the STATE BASE MAP #1, SHADED RELIEF, to locate the stream or river closest to your school. Pretend you are an opossum being chased by a fox. To escape, you hop onto a log floating downstream. Describe your journey in detail, and locate on the map any obstacles you may encounter along the way as well as your final destination. How would you return home?

6. **Determine the percentage area of the state in each drainage basin.**

With a STATE BASE MAP #2, WITH HIGHWAYS, outline the four major drainage systems as shown in Figure 1-2 "State Map of Major Drainage Basins." Use the transparent grid overlay as a guide to determine what percentage of the state is contained in each of the drainage systems. First use the scale bar to determine how many square feet are contained in one square of the overlay. (Use 80,583 square kilometers or 31,113 square miles as the area of the state.) Use the chart below to record your answers. Also calculate gradients (slopes) of the major drainage basins by dividing total drop in elevation by distance to the ocean. Compare and explain your results based on landform differences as shown on the base map.

<table>
<thead>
<tr>
<th>Drainage Basin or Watershed Area</th>
<th>Area (miles² / km²)</th>
<th>% of State</th>
<th>Drop in elevation</th>
<th>Distance to Ocean</th>
<th>Slope (gradient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savannah</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pee Dee</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Coastal</td>
<td></td>
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</tbody>
</table>

7. **Investigate reasons for building canals.**

Use a wipe-off pen and Figure 1-11 "Map of South Carolina Canals" to mark the location of these canals on the STATE BASE MAP #1, SHADED RELIEF. South Carolina’s four main river drainage systems are the Savannah, Santee, Pee Dee, and the Coastal. Match up these river systems with the location of the canals. Which river system had the most canals? What landform features dictated the need for canals? Why did South Carolinians pursue using water transportation and building canals in the early 1800's? In which landform region are most of these canals located? What was inefficient about using rivers as the main avenue for transportation? Why were these canals never very successful? What obstacles did the canal builders encounter? Of these nine canals, which one is closest to your school? Two of these canals are now part of the South Carolina State Park system (Landsford Canal and Santee Canal). One other is now a city park (Columbia Canal). Why would an old canal make a good location for a park?
8. **Trace pathway of an industrial pollutant.**

   If a chemical pollutant were introduced into the Pacolet River in Spartanburg County, which South Carolina cities and towns would be concerned about it affecting their water supply? Trace the pathway of the pollutant on the STATE BASE MAP #2, WITH HIGHWAYS. Which high density population areas would be most affected? Use Figure 1-14 "Population Density Map (1990)", or the LAND USE/LAND COVER MAP as a resource. How far away from the source do you think the effect would be noticed? Explain your answer. What would be the impact of this pollution on tourism and recreational facilities?

**ENRICHMENT**

1. **Research Scenic River Act.**

   South Carolina has a Scenic River Act identifying picturesque rivers. Research this act to see how a river can be added to this list.

2. **Compare Up Country and Low Country rivers.**

   Write a paper comparing the rivers and tributaries in the Blue Ridge mountains and Piedmont with those of the Sandhills and Coastal Plain regions. Include in this paper a comparison of the sediment load, velocity, total discharge, salinity, and acidity of the water. What is meant by the phrase "water is constantly rearranging the landscape?"
Activity 1-3: Landforms Influence History & Culture

**Materials**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>STATE BASE MAP #1, SHADED RELIEF</td>
<td>1:500,000</td>
</tr>
<tr>
<td>6</td>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
<td>1:500,000</td>
</tr>
<tr>
<td>6</td>
<td>LAND USE/LAND COVER MAP</td>
<td>1:500,000</td>
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<tr>
<td>6</td>
<td>GENERAL SOIL MAP</td>
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<tr>
<td>1</td>
<td>Revolutionary War Campaigns in S. Carolina</td>
<td>Figure 1-10</td>
</tr>
<tr>
<td>1</td>
<td>Population Density Map (1990)</td>
<td>Figure 1-14</td>
</tr>
<tr>
<td>1</td>
<td>Barbecue Regions of South Carolina</td>
<td>Figure 1-9</td>
</tr>
<tr>
<td>6</td>
<td>Transparent Grid Overlays</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Wipe-off Pens</td>
<td></td>
</tr>
</tbody>
</table>

**PERFORMANCE TASKS**

(Icon Key) Overview = ; Science = ☐; Math = ☐; History = ☐; Language Arts = ☐

1. **Trace President George Washington's South Carolina visit, 1791. **

**Group I: Part I - President George Washington's Coastal Tour**

Using George Washington's diary, on pages 1-20 through 1-24, and a wipe-off pen, trace his Coastal Tour of South Carolina on the STATE BASE MAP #2, WITH HIGHWAYS. What were his objectives for making this southern tour? Describe Washington's party as they entered South Carolina. Why did Washington want to make compensation for his lodging and meals? Why did he dine and lodge with planters? What type of agricultural products did he find? How did the planters market their produce at that time? Why was Washington concerned about the feeling of these early settlers for the support of a federal government? How did he describe coastal South Carolina? Describe his entrance to Georgetown. Compare the events surrounding his entrance into Georgetown with later events in Charleston. Describe in detail the gala events held for President George Washington on his coastal tour.

**Group II: Part II - President George Washington's Sandhills Tour**

Using George Washington's diary, on pages 1-24 through 1-28, and a wipe-off pen, trace his Sandhills Tour on the STATE BASE MAP #2, WITH HIGHWAYS. Describe Washington's reentrance into South Carolina from Georgia. Who met him in Augusta? What were the specific goals for his southern tour? Why was he concerned about the excise tax? After talking with the people along his trip, what was his conclusion about the opposition to the excise tax? Describe Washington's trip from Granby to the State House. Explain what was meant by each of the toasts given at the State House dinner. Is it the same state house building that we are using today? Explain. What did Washington think about the location of the State Capitol? Why was Washington so interested in Revolutionary War battle sites? Where on his Sandhills tour did he find extensive damage as a result of the Revolutionary War? Explain. What were the grievances of the Catawbas? How did Washington handle these grievances? Why were the Catawba grievances not settled until recently? Use George Washington's words to describe the Sandhills landscape.
2. **Analyze President George Washington's writing style.**

As you read Washington's diary, on pages 1-20 through 1-28, make a comparison between his writing style and that of modern journalists. Identify differences in sentence structure. List changes in spelling, punctuation, and common abbreviations. Compare his journal entry format with that of today. How has this type of literature changed over the last 200 years? Rewrite one or more days of his journal entries in your own words.

3. **Outline Washington's southern tour using modern day highways.**

After tracing Washington's 1791 route (Performance Task #1 on page 1-58), use a different color wipe-off pen to outline his trip on modern day highways. Which primary highways or interstates would he follow today? Identify obstacles such as swamps, bays, sounds, and rivers that he had to overcome on his journey. Contrast the way he crossed these obstacles in 1791 versus the way they would be crossed on a modern day visit. Through which counties did Washington travel? Did he travel through your county? If so, is there a marker identifying his visit?

4. **Examine Washington's entries about agriculture and land cover.**

Washington in his dairy, on pages 1-20 through 1-28, described two methods of cultivating rice. How did these two methods differ? Why did he think one was better than the other? Which method was used most often by South Carolina planters? How did Washington describe the soil? Where did he find the best soil? How did he describe the population density on his coastal tour? In 1791, where were most of the people living? Where is the population density the greatest in South Carolina today? Is it in the same area he traveled on his southern tour? He described the land in his diary by saying, "the sameness seems to run through all the rest of the Country." What did he mean by this statement? How did he describe the landscape on his coastal tour? On his Sandhills tour?

5. **Determine Washington's daily rate of travel.**

Measure with a string the distance Washington traveled, using the tracing of his tour route (Performance Task #1 on page 1-58) on the STATE BASE MAP #2, WITH HIGHWAYS. Take different measurements for his coastal and Sandhills trips. For each part of his tour, calculate the average number of miles he traveled each day. Did he travel at the same rate (average miles/day) for each trip? How can you account for these differences? Compare his rate of travel per day with a modern business trip. (You must stay within the speed limit.) What was his normal daily schedule while traveling?

6. **List influential people Washington mentioned in his diary.**

Use George Washington's diary, on pages 1-20 through 1-28, to identify the influential people he met on his southern tour. Make connections between these people and their contribution to the early development of South Carolina. Use the STATE BASE MAP #2, WITH HIGHWAYS, to identify counties and towns named for these early colonists. Use a Columbia map to identify streets named for many of these early South Carolina citizens.
7. **Write a descriptive skit about George Washington’s tour.**

Make up your own scenario or use one of the following suggested ideas to write a descriptive skit or short play based on some part of Washington's tour (pages 1-20 through 1-28) in which he had a conversation with:

- local officials about the Duties on Distilled Spirits Act he had just signed into law
- one of the planters while enjoying a fine dinner
- community members who came to meet him
- his white charger (his favorite horse)

8. **Plan a modern day tour of your county.**

If the President of the United States or some group of famous world leaders were to visit your county today, where would you take them? What would they be interested in seeing in your county, town, or school? Plan a tour and identify the places that you would like for them to visit? Who would you like for them to meet? Why? Outline on a local map the route you plan to follow. Explain the significance of each stop.

9. **Trace Charleston Businessman’s trip.**

Use "The Diary of Samuel Edward Burges, 1860-1862" on pages 1-32 through 1-36 and a wipe-off pen, to trace his travels on the [STATE BASE MAP #2](#) WITH [HIGHWAYS](#). List all the modes of transportation Samuel E. Burges used to get around South Carolina. Why was he going to the county seats? Would he have had an easier time traveling to all the county seats later on in 1883? Why? Why did he use so many different railroads in his travels? Why did he have to use the stage and/or steamboat to reach some of his destinations? What momentous historical event does he specifically mention on January 9, 1861? What is the significance of this event for South Carolina? Keep a day-by-day diary of your own activities for one week. Share your journal with other students and compare your descriptions of similar events. Save your diary for several years and then re-read it. It may surprise you.

10. **Compare travel differences 1700's - 1900's.**

Describe the different modes of transportation that George Washington and Samuel E. Burges used as they traveled through South Carolina (refer to pages 1-20 through 1-28 and pages 1-32 through 1-36 as needed). Following the same routes, which travel options could you use today? Compare George Washington's rate of travel across South Carolina, from Performance Task #5, with that of the Charleston Businessman. How fast could you make a similar trip today? Compare the purpose of these two trips, the obstacles each man encountered, and the number of people in their parties as they traveled across South Carolina during these two very different periods of early South Carolina history. What would be the difference in travel arrangements if our current President visited South Carolina? Consider method of travel, obstacles encountered, security arrangements, attendance at local events, and the total length of time spent in the state. How would the President's description of our landscape differ from that of George Washington?
11. Speculate how town names reflect local landforms. ☑

Choose any six of the following towns or cities listed below. Locate them on the STATE BASE MAP #2, WITH HIGHWAYS. Each city name is followed by the name of the county in which it is located. Identify the landform region in which each city is located. Suggest a reason as to how each city got its name. What local landform, if any, is referred to? Can you identify other places in South Carolina that have a name related to a local landform?

Branchville, Orangeburg Little Rock, Dillon Pineville, Berkeley
Britton's Neck, Marion Mt. Pleasant, Charleston Red Bank, Lexington
Four Holes, Orangeburg Mountain Rest, Oconee Ridgeland, Jasper
Graniteville, Aiken Myrtle Beach, Horry Rock Hill, York
Great Falls, Chester Piedmont, Anderson Ware Shoals, Greenwood


A census is an official count of the population. Such a census of existing Native American Nations in the Carolina Colony was completed in the so-called Indian Census of 1715. Below is an excerpt of the statistical information compiled on eight Siouan Nations. What Nation was the largest, based on the table given below? Which Nation had the largest average village population? What was the average number of inhabitants in a typical Catapaw village? What percentage of this total were woman and children? Why do you think that the census collectors divided the count into two groups, men and women/children? How did Native Americans influence the history of South Carolina?

<table>
<thead>
<tr>
<th>NAME OF NATION</th>
<th>MILES &amp; DIRECTION FROM CHARLES TOWNE</th>
<th>VILLAGES</th>
<th>MEN</th>
<th>WOMEN &amp; CHILDREN</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catapaw</td>
<td>200 northwest</td>
<td>7</td>
<td>570</td>
<td>900</td>
<td>1470</td>
</tr>
<tr>
<td>Sarow</td>
<td>170 north</td>
<td>1</td>
<td>140</td>
<td>370</td>
<td>510</td>
</tr>
<tr>
<td>Waccomussu</td>
<td>100 northeast</td>
<td>4</td>
<td>210</td>
<td>400</td>
<td>610</td>
</tr>
<tr>
<td>Cape Fear</td>
<td>200 northeast</td>
<td>5</td>
<td>76</td>
<td>130</td>
<td>206</td>
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<tr>
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<td>2</td>
<td>43</td>
<td>60</td>
<td>125</td>
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<tr>
<td>Congaree</td>
<td>120 north</td>
<td>1</td>
<td>22</td>
<td>70</td>
<td>106</td>
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<tr>
<td>Weneaw</td>
<td>80 northeast</td>
<td>1</td>
<td>36</td>
<td></td>
<td>57</td>
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<tr>
<td>Seawee</td>
<td>60 northeast</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. **Locate Native American national territories.**

Using wipe-off pens, the STATE BASE MAP #1, SHADED RELIEF, and the census information given in Performance Task #12, (miles and compass direction from Charles Towne), locate and label the specific territories in which the eight Siouan Nations once lived. Using wipe-off pens, circle any place names today that bear the name of any of these eight Siouan Nations. Note that the Nations are listed using the eighteenth century spelling as recorded in the Indian Census of 1715.

14. **Compare Native American census data to modern population density.**

Compare the locations of major Native American communities in 1715, as determined in Performance Task #13, to the locations of modern cities and other heavily populated areas. Refer to Figure 1-14 "Population Density Map (1990)" for the location of urbanized areas shown on the LAND USE/LAND COVER MAP. Which locations were highly populated both then and now? What landform features in those areas favored continued higher population density? Which locations were highly populated then but not now? What factors might have caused the decline in relative population density? Which locations were not highly populated then, but are now? What factors might have caused the upward trend in population density in these areas?

15. **Analyze effects of landforms on Revolutionary War campaigns.**

Each class group should work with a single battle from Figure 1-10 "Revolutionary War Campaigns in South Carolina." Locate and mark your assigned battle site with a wipe-off pen on the STATE BASE MAP #2, WITH HIGHWAYS, at your table and also on the map located at the front of the classroom. Each group should trace the assigned campaign routes on its base map with a wipe-off pen, answer the following questions for both the British forces and the American forces, and be prepared to report its answers to the rest of the class in the proper time-line sequence. Who commanded the forces at the Battle? From where did each army march to get to the battle? How far did they each have to march? Approximately how long did it take each army to travel that distance? What landform obstacles did they have to overcome to reach the battle site? Were there any landform features at the battle site which influenced the outcome of the battle? Explain your answer.

- **Group I** Battle of Camden, August 16, 1780
- **Group II** Battle of Kings Mountain, October 7, 1780
- **Group III** Battle of Cowpens, January 17, 1781
- **Group IV** Battle of Hobkirk's Hill, April 25, 1781
- **Group V** Battle of Orangeburg, May 11, 1781
- **Group VI** Battle of Ninety Six, May 22, 1781
- **Group VII** Battle of Eutaw Springs, September 8, 1781

16. **Explain geographic distribution of barbecue regions of South Carolina.**

Use Figure 1-9 "Barbecue Regions of South Carolina" to trace the approximate boundaries of each barbecue region onto the STATE BASE MAP #2, WITH HIGHWAYS, with a wipe-off pen. Do the barbecue regions line up more closely with the landform regions or with the major river system watersheds? Explain your answer. Develop a hypothesis about why that particular relationship might exist in South Carolina. Write down a list of reasons why you think your hypothesis is correct. Do you expect the boundaries of the barbecue regions to change in the
future, or would you expect those borders to be constant through time? Explain your answer.

17. **Analyze spelling of word "barbecue."**
How many different ways have you seen the word "barbecue" spelled? List each spelling along with your hypothesis as to why the advertisement used that spelling. Discuss your list with the rest of the class and speculate about why different spellings might exist. How can people recognize the word "barbecue" on signs even when it is purposely misspelled? Why would restaurant owners want to deliberately misspell the word? What meat is traditionally used to make South Carolina barbecue? Do you expect this to change? Why or why not? Explain your answer. Refer to Figure 1-9, "Barbecue Regions of South Carolina."

**ENRICHMENT**

1. **Research origins of selected city names.**
Write to the Chambers of Commerce of several of the cities listed below. Ask how the town got its name. Compare these official explanations to your own given in Performance Task #11.

| Branchville | Little Rock | Pineville |
| Britton's Neck | Mt. Pleasant | Red Bank |
| Four Holes | Mountain Rest | Ridgeland |
| Graniteville | Myrtle Beach | Rock Hill |
| Great Falls | Piedmont | Ware Shoals |

2. **Research South Carolina place names.**
Have you ever poked fun at a name of a town, city, or river in South Carolina? The people in this state have given all sorts of names, taken from a variety of sources, to identify places they call home. In Nancy Coleman's *S.C. Wildlife* article "Nine Times to Pocotaligo," (Nov.-Dec., 1979), she relates the sources used for naming a variety of places in South Carolina. Dr. Claude H. Neuffer, Professor Emeritus of English at the University of South Carolina, has studied the origins of names and later wrote a book on the subject, *Names in South Carolina.* The study of the origins of names is called onomastics. Use these sources to research the names given to places, rivers, landforms, etc. in your county. Circle the appropriate names on the STATE BASE MAP #2, WITH HIGHWAYS, and list each name separately along with its source. Make up a story relating all of these place names.

3. **Research people Washington met on Southern Tour.**
Select any two famous people Washington met on his Southern Tour in 1791 and explain their contribution to the early growth and development of South Carolina. Were any places in the state named for them?

4. **Choose a Native American Nation to research.**
Over forty different Native American Nations lived in South Carolina in 1670. Pick one Nation and list at least two cultural characteristics of that Nation. You should utilize a wide range of reference materials.
Activity 1-4: Landforms and Land Use

### Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE BASE MAP #1, SHADED RELIEF</td>
<td>1 : 500,000</td>
</tr>
<tr>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
<td>1 : 500,000</td>
</tr>
<tr>
<td>LAND USE/LAND COVER MAP</td>
<td>1 : 500,000</td>
</tr>
<tr>
<td>GENERAL SOIL MAP</td>
<td>1 : 594,000</td>
</tr>
<tr>
<td>Map of Antebellum Railroads -1860</td>
<td>Figure 1-14</td>
</tr>
<tr>
<td>Wipe-off Pens</td>
<td></td>
</tr>
</tbody>
</table>

### PERFORMANCE TASKS

(Icon Key) Overview = ➔; Science = ☞; Math = ☞; History = ☞; Language Arts = ☞

1. **Determine city size and reason for location. ➔**
   
   Use the printed size of the letters in city names, *e.g.* (ANDERSON, Honea Path, Starr) on the STATE BASE MAP #2, WITH HIGHWAYS, as a guide to determine the relative size of the cities. Also note the city limit boundaries of the largest cities as shown on the map. Name the city with the largest population in each of the five landform regions. Why is each city located where it is? Give a unique characteristic of each city.

2. **Compare land use/land cover map with soils map. ☞**
   
   Compare the patterns on the LAND USE/LAND COVER MAP with the GENERAL SOIL MAP. What are the major divisions on the soils map? What are the major divisions on the land use/land cover map? How does each land use category relate to the major soil groups? Do these land uses follow geological and landform region patterns? Explain.

3. **Explain how water is used by various businesses. ➔ ☞**
   
   Large industries, plants, businesses, and agriculture in this state depend on our river systems and reservoirs for water in a variety of ways. Divide into groups and locate each industrial or other use listed below, as closely as possible, on the STATE BASE MAP #2, WITH HIGHWAYS. Identify the source of the water that is used. Explain how the water is used and whether or not it is returned to the river or reservoir. Speculate about what happens to the water afterwards and whether it is returned clean or polluted. Share your results with other groups and note similarities and differences.

   - **Group I** Hydro-electric plant near Columbia on the Saluda River.
   - **Group II** Coal fired generating plant in Conway on the Waccamaw River.
   - **Group III** Paper mill in Georgetown on the Sampit River.
   - **Group IV** Soybean farm in Orangeburg County on the Edisto River.
   - **Group V** Nuclear processing plant in Aiken on the Savannah River.
   - **Group VI** Rock quarrying in Graniteville.

4. **Explain obstacles to transportation in 1800's. ☞**
   
   What was the major method of transporting goods in the 1700's? Using Washington's diary for reference, what were the major cities in South Carolina at that time? What was the major method of transporting goods in the 1800's? Using Burges' diary, what were the major cities in S.C. at that time? Use the STATE BASE MAP #1, SHADED RELIEF, to decide which pair of cities listed below would have been the most difficult to travel between. Explain why. Your answer should be
based on the transportation available in 1800. Which pair would have been easiest to travel between? Explain why. What method of transportation would have been the best choice for each pair at that time? What method would be best today?

- Beaufort and Georgetown
- Greenville and Cheraw
- Columbia and Greenville
- Columbia and Charleston

5. **Locate reservoirs and list uses.**

Working in student teams with the STATE BASE MAP #2, WITH HIGHWAYS, locate and name five large man-made reservoirs in South Carolina. List all of the recreational and industrial uses of these reservoirs you can think of. Identify the positive and negative impacts of creating these reservoirs. Compare your list of impacts with lists of the other groups.

6. **Explain impact of railroads on economy.**

South Carolina's first locomotive, the *Best Friend of Charleston*, began running in 1833 from Charleston to Hamburg, which is located on the Savannah River near North Augusta. Trace with a wipe off pen the Charleston-Hamburg railroad track on the STATE BASE MAP #1, SHADED RELIEF. The South Carolina Canal and Railroad Company, chartered in 1827, was designed to improve the economy of Charleston by bringing goods to market. When finished, it was the longest railroad track, 136 miles, in the United States. Why did the geography of South Carolina hinder the development of Charleston as a major port city after the Revolutionary War? Identify at least ten major towns located on early railroad routes. Were many of these towns considered to be railroad towns? What is meant by saying a town is a "railroad town"? Are any of these towns still railroad towns today? Did the *Best Friend of Charleston* help Charleston's economy? Explain. Study the ridges and valleys on the shaded relief map. How did the early railroad engineers use South Carolina's landscape to their advantage in designing the location of railroad tracks? Note: The South Carolina State Museum has on display a replica of *The Best Friend of Charleston*.

7. **Compare railroad travel costs 1842 - 1883.**

Compare the number of railroad routes listed in Figure 1-12 "Map of Antebellum Railroads - 1860", to the number of railroad routes shown on the STATE BASE MAP #1, SHADED RELIEF. Most of the modern railroads were constructed in the late 1800's and the early 1900's. In 1842 the cost of passenger travel in South Carolina was 6.5 cents a mile. In 1883 it only cost 3.42 cents a mile. Why do you think the cost had gone down so much? What do you expect would have happened to freight shipping costs? Was it usually cheaper to ship goods by water or on the railroads? Explain your answers. What are the most popular methods of passenger travel and cargo shipping today? Why?

8. **Relate early railroad lines to locations of county seats.**

Using Figure 1-12 "Map of Antebellum Railroads - 1860" as a reference, trace with a wipe-off pen the major railroad lines of 1860 on the STATE BASE MAP #1, SHADED RELIEF. Create your own symbols for each of the railroads. These railroad lines were built with private funding and designed to transport goods and produce to the market. Complete the chart which follows indicating major cities along the route and full names of railroad companies. How many of the towns along the early routes are present day county seats? List all the counties today that carry
the same name as their county seats, e.g., Allendale County, Edgefield County, and Chesterfield County. How many of the present day county seats are located on active or formerly active railroad lines? Why did towns away from the railroad lines tend to remain small? Which railroad line is closest to your home town? Which one is closest to your school?

<table>
<thead>
<tr>
<th>RELATIONSHIP OF RAILROAD LINES TO COUNTY SEATS</th>
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<tr>
<td>RAILROAD SYSTEM</td>
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<tr>
<td>C&amp;SCRR</td>
</tr>
<tr>
<td>C&amp;SRR</td>
</tr>
</tbody>
</table>

9. **Investigate nicknames for cities.**

   Nicknames are often given to cities. For example, one is called the "Port City," others are identified as the "Textile City," "Gamecock City," or "Capitol City." Which South Carolina cities do you think have these particular nicknames? Suggest nicknames for several other major cities in South Carolina. Give a unique characteristic of each city. Does the city nearest your school have a nickname? If so, what is it? How did it get that nickname? If it does not have a nickname, choose an appropriate one and explain your choice to the class.

10. **Trace flight path of Cessna.**

   You are joining a group of students flying across South Carolina in a Cessna. Your pilot is flying by dead reckoning (using only a compass and altimeter) across the state at a steady velocity of 120 miles per hour with no winds. Time of departure is 8 A.M. at the Charleston Airport located in North Charleston. It is a clear day with blue skies. Visibility is 100 miles. As the plane takes off your pilot turns northeastward heading up the coast following the shoreline to Myrtle Beach. You have before you the STATE BASE MAP #1, SHADED RELIEF, and a wipe-off pen to trace your flight path. Once you reach Myrtle Beach, look for the Seaboard Coast Line railroad track, which almost runs into the ocean. As you leave Myrtle Beach, turn at the railroad track on a heading of 300°. You will fly over the Intracoastal Waterway. After you have gone 60 miles, look for a major city that is due west of the Pee Dee River and north of Jeffries Creek. What city is this? How long have you been flying? Record your time.
Continue from Florence heading due west until you come to the Wateree River. Turn north following the Wateree River. Name the rivers you have crossed so far. While following the Wateree River identify the four major dams you pass over. Identify the city that is located 7 miles due south of Wylie Dam. Go west from Wylie Dam until you fly over the railroad track located on the crest of the drainage divide between the Wateree and Broad rivers. Which town are you now near? Follow this track southward. Oh, by-the-way, you will be following the railroad track all the way to the Capitol City, Columbia. Why was this railroad track built along the crest of the land between these two river watersheds?

Passing Columbia, follow a heading of 190° from the confluence of the two major rivers which meet at this city until you see a railroad track. Follow the Seaboard Coast Line railway all the way to the Savannah River. Count the number of towns you fly over along the way. Why are there so many towns along this railway? Describe the landform features followed by the track. Head northwestward up the Savannah River until you see a small urban area that is known for its abundance of golf courses. What city is this? Turn northeasterward, and follow another railroad track. Follow this track until you come to a junction. Turn and follow the north fork of the track. Continue to follow this track until you come to a familiar metropolitan area. Where are you now? Why was the track laid along this type of terrain?

Passing over this large metropolitan area, head due west (a heading of 270°) until you reach the headwaters of Clark Hill Reservoir. What latitude line are you flying along? Why are there so few towns along this path? When you come to the Savannah River, you will see a dam, spillway, and reservoir (lake). Name these landscape features. What is the elevation of the spillway? Head north up the lake (take the right fork) until you see a small town housing a major land grant university. Name this place.

Be sure to increase your altitude to 4000 feet MSL. Why is this necessary? Continue to follow the same string of rivers and lakes until you come to the Jocassee Dam. Name the bodies of water that you have just flown over since leaving the Savannah River. Describe the landscape. Turn eastward on a heading of 100° and land at the Greenville-Spartanburg Airport.

How are airports marked on the STATE BASE MAP #1, SHADED RELIEF? How many total miles have you traveled since you left Charleston? List the counties that you flew over. How many landform regions have you crossed? Name and describe each region. List the major rivers that you have flown over. How long did it take you to make this entire flight? What time of day did you arrive at the Greenville-Spartanburg Airport?

And finally, the most important question - why did you take such a bizarre trip across South Carolina? Each person on your team should come up with a possible explanation. Share your reason with the other members of your team. Select one team member to tell the class your group’s best reason or rationale for this incredible journey across South Carolina.
ENRICHMENT

1. **Research land use management programs. ✽**
   Select and research one of the state land use management programs from the list below.
   - Forestry Management and Wildlife
   - Agricultural Soil and Water Conservation
   - Water Conservation and Management

2. **Monitor stream pollution near your school. 🌱**
   Find a way to monitor the dissolved oxygen, acidity, and/or heavy metal contaminants over several months in the stream, river, or lake nearest your school. To facilitate this activity, water testing kits can be purchased at feed and seed stores or through scientific supply companies. Research how toxic or hazardous waste materials pollute our river systems. What happens when too much sewage is allowed to enter a stream? What effect do phosphates and nitrates have on the growth of algae? Why is dissolved oxygen an important component to monitor? What is eutrophication?

3. **Construct timeline of transportation. ➔ 📕**
   Make a timeline of transportation across South Carolina using opening dates of the railroad companies, and other important events related to railroads or other transportation. Use as a reference *The History of South Carolina in the Building of a Nation*, by Archie Vernon Huff, Jr.

4. **Research information about the railroad closest to your school. ✽ 🦉**
   Where is the closest railroad to your school? How often does it run? Is it mainly a freight or passenger line? What type of freight is carried on this line? Where are the passengers headed?

5. **Locate and research railroad tunnels. ✽ 🌸**
   Locate Rabun Gap in Georgia and Stumphouse Tunnel near Walhalla S.C. Consult a map of the Southeastern States to trace the possible routes from Cincinnati that would have connected it to the ports in the Carolinas and Georgia. Which mountain range would they have to tunnel under? Research Stumphouse Tunnel and find out how far below the top of the mountain the tunnel was located, why vertical shafts were needed, how many feet a month the workers tunneled, and how close the men came to finishing.
SECTION 2
BLUE RIDGE REGION

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<th>5B</th>
<th>Santee Cooper Project (Engineering &amp; Canals)</th>
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</thead>
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<td>6A</td>
<td>Congaree Swamp (Pristine Forest)</td>
</tr>
<tr>
<td>3A</td>
<td>Forty Acre Rock (Granite Outcropping)</td>
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<td>Lake Marion (Limestone Outcropping)</td>
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<td>3B</td>
<td>Silverstreet (Agriculture)</td>
<td>8A</td>
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<td>3C</td>
<td>Kings Mountain (Historical Battleground)</td>
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<td>4B</td>
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<td>Sugarloaf Mountain (Wildlife Refuge)</td>
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  (ICONS)  Overv =  →  Sci =  ⊗  Math =  ⊘  Hist =  ⊕  Lang Arts =  ⊖
  - Newspaper Article - "Teen Found at Table Rock; Family Relieved"
  - Rationale
    - Brief Site Description
      p. 2A-2 . . . . . . - Introduction
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      p. 2A-3 . . . . . .  1. locate the study site → ⊗
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- Performance Tasks
p. 2A-8 1. analyze the newspaper article
p. 2A-8 2. correlate land use to topography
p. 2A-8 3. analyze land use changes through time
p. 2A-9 4. select best route for trail
p. 2A-9 5. explain location of Greenville’s water supply
p. 2A-9 6. write story about Pumpkintown history
p. 2A-9 7. create a Venn diagram contrasting mountain land use
p. 2A-9 8. identify ways people have altered natural landscape
p. 2A-10 9. calculate average field size
p. 2A-10 10. compare shapes and patterns of road intersections

- Enrichment
p. 2A-11 1. interview a Realtor
p. 2A-11 2. interview a forester
p. 2A-11 3. interview a former CCC member

- STUDY SITE 2B : LAKE JOCASSEE (ENERGY PRODUCTION)
  (ICONS) Overv =  Sci =  Math =  Hist =  Lang Arts =
  - Newspaper Article - "Trout Stream Affected by Bad Creek Development"
  - Rationale
  - Brief Site Description
p. 2B-2  - Introduction
p. 2B-2  - story - “The Legend of Issaqueena”
p. 2B-4  - story - "Wildflower Folklore"
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  - Performance Tasks
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p. 2B-10 2. locate features and place names
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p. 2B-11 5. analyze land use changes through time
p. 2B-12 6. analyze vegetation using the ‘Doctrine of Signatures’
p. 2B-12 . . . . . . . . 7. write short story about travel down stream
p. 2B-12 . . . . . . . . 8. locate forest land
p. 2B-12 . . . . . . . . 9. determine the dimensions of a lake
p. 2B-12 . . . . . . . . 10. sketch a topographic profile along the state boundary line
p. 2B-13 . . . . . . . . 11. analyze geographic distribution of trout streams
p. 2B-13 . . . . . . . . 12. compare vegetation and bear habitat on north vs. south facing slopes
p. 2B-13 . . . . . . . . 13. compare modern and pioneer life
p. 2B-14 . . . . . . . . 14. locate areas of active sedimentation
p. 2B-14 . . . . . . . . 15. analyze stream drainage patterns
p. 2B-14 . . . . . . . . 16. prepare a land use management plan
p. 2B-15 . . . . . . . . 17. write a short story about how natural features were named

- Enrichment
p. 2B-15 . . . . . . . . 1. research land use restrictions
p. 2B-15 . . . . . . . . 2. relate life history of trout to sedimentation problems in streams
p. 2B-15 . . . . . . . . 3. research folklore associated with common plants
p. 2B-15 . . . . . . . . 4. research potential for gold mining in Lake Jocassee Region

- Activity 2B-2: Power Production and Engineering
  - Materials
  - Performance Tasks
p. 2B-16 . . . . . . . . 1. identify possible second pumped storage facility site
p. 2B-16 . . . . . . . . 2. trace path taken by the nuclear reactor vessel in route to Lake Keowee
p. 2B-16 . . . . . . . . 3. calculate the volume of water in a reservoir
p. 2B-17 . . . . . . . . 4. locate a fire tower/wildlife observation center in wilderness
p. 2B-17 . . . . . . . . 5. evaluate power generation options for wilderness cabin
p. 2B-17 . . . . . . . . 6. plan new housing subdivision on lake
p. 2B-17 . . . . . . . . 7. evaluate stream profile for hydroelectric potential
p. 2B-18 . . . . . . . . 8. speculate about future uses of facilities used for energy production
p. 2B-18 . . . . . . . . 9. identify areas threatened by point source and non-point source pollution
p. 2B-18 . . . . . . . . 10. locate power line corridors
p. 2B-18 . . . . . . . . 11. determine whether power lines are visible from center of lake
p. 2B-19 . . . . . . . . 12. compare ease of identification of features on map and photo
p. 2B-19 . . . . . . . . 13. analyze vegetation types by examining infrared color signatures
p. 2B-19 . . . . . . . . 14. calculate change in lake levels when pumped storage water is released
p. 2B-19 . . . . . . . . 15. explain why contour lines do not line up with lake shoreline

- Enrichment
p. 2B-20 . . . . . . . . 1. determine how much power people generate in one day
p. 2B-20 . . . . . . . . 2. research advantages and disadvantages of coal-fired energy facilities
p. 2B-20 . . . . . . . . 3. research the Duke Power Management Plan for the Bad Creek Project
p. 2B-20 . . . . . . . . 4. research public opinion of nuclear power plants through time
SECTION 2
BLUE RIDGE REGION

POWER THINKING ACTIVITY - "Mayday! Mayday! Mayday!"

You are an aircraft controller in the Greenville-Spartanburg Airport control
tower, and you receive the following radio call. "MAYDAY! MAYDAY! MAYDAY! This is SC 320 (South Carolina Air National Guard Plane 320); I have just experienced engine failure and am losing altitude....just crossed over the North Carolina-South Carolina boundary line; my position is 35° 06' latitude and 82° 40' longitude and headed south....to my left barely passed over waterfalls, cliff, and mountain ridge oriented West Southwest to East Northeast...flying down a small creek valley...losing altitude....now 2,000 MSL (mean sea level)....now flying due South...see large lake, turning East. still losing altitude, now 1800 MSL, following river....looking for place to land."

Trace the path taken by the pilot on the Table Rock Topographic Map with a wipe-off pen. Locate the North Carolina-South Carolina boundary line. Name the waterfalls, cliff, and mountain ridge seen by the pilot. Identify the large lake mentioned by the pilot. Compare land terrain and features on the TABLE ROCK TOPOGRAPHIC MAP with the TABLE ROCK LITHOGRAPH. Locate and determine the latitude and longitude coordinate points for the most promising area in which to conduct the search. How does the terrain affect the probability of a safe landing?

PERFORMANCE OBJECTIVES

1. Contrast landform features and rock types of the Blue Ridge with other regions of the state.
2. Illustrate Blue Ridge Region landscape features by using graphs to make topographic profiles and map information to calculate slopes.
3. Analyze and retell legends and ballads taken from Native American and early pioneer folklore.
4. Correlate mountain topography with historical land use.
5. Recognize the importance of mountain coves as a unique habitat for rare plant species.
6. Describe processes used for generating electricity in mountainous regions and explain why Blue Ridge topography is favorable for these processes.
7. Evaluate multiple uses of the Blue Ridge landscape and make recommendations for a balance of tourism, recreation, logging, commercial exploitation, and preservation of wilderness areas.
8. Compare mountain landscape features on infrared aerial lithographs with symbols and patterns on topographic maps.
9. Differentiate among types of vegetative cover on land and degree of sediment load of bodies of water on infrared lithographs.
10. Calculate areas of geometric regions on maps and lithographs using scale conversion factors.
BACKGROUND INFORMATION

Description of Landforms, Drainage Patterns, and Geological Processes

Characteristic Landforms of the Blue Ridge

The Blue Ridge Mountain Region is located in the northwestern corner of South Carolina and covers approximately two percent of the area of the state. South Carolina State Hwy. 11, also known as the Cherokee Foothills Scenic Highway, serves as a fairly accurate and easily recognizable eastern boundary for this region, which occupies the northern portions of Oconee, Pickens, and Greenville counties but also extends north and west well beyond the borders of the state. This region is the only truly mountainous region in South Carolina. Although other regions are hilly in places, none show the drastic elevation changes and high relief (difference in elevation between high hills and adjacent low valleys) that characterize the Blue Ridge. Several mountain peaks rise to more than 3,000 feet above sea level, and many mountains have very steep slopes and high cliffs. Local topographic relief can range from a few hundred feet to more than a thousand feet from valley floor to ridge crest. The best scenic lookouts are often located at the tops of cliffs because most other areas, including the mountain tops, are covered with trees and other vegetation.

Mountain streams or creeks are usually small and rocky with clear, cold water and many rapids and waterfalls. They generally flow in narrow valleys which have developed a rectangular drainage pattern due to the underlying geologic structure. Occasionally these streams will disappear below piles of rock debris fallen from the adjacent mountainside, and reappear as springs at the downslope side. Landslides and other mass movement of rock and soil are common occurrences in the mountains. The amount of water flowing in these creeks varies greatly, depending on the amount of precipitation which has fallen recently in the local area. Occasionally small floodplain areas, called hollows or coves, occur along flatter sections of streams. Such areas contain rich bottomland soil for farming and provide a unique habitat for wildlife. No natural lakes occur in this region although beavers occasionally dam up small streams to form ponds and engineers have constructed several reservoirs in the area.

Geographic Features of Special Interest

The highest point in South Carolina, Sassafras Mountain, lies along the North Carolina - South Carolina state boundary line in Pickens County, and is 3,554 feet above sea level. A paved road leads to the top. Caesar's Head Mountain can also be reached by road. Several other high mountains, such as Table Rock Mountain, Pinnacle Mountain, and Whetstone Mountain, are accessible by hiking trail. Stumphouse Tunnel, a partially completed Civil War era railroad tunnel, is accessible from Hwy. 28 north of Walhalla. Several state and county parks in the area offer hiking, swimming, fishing, boating, and scenic views.
Whitewater rafting is a popular activity along the Chattooga River, and many spectacular waterfalls in the area attract both hikers and photographers. The most famous waterfalls in the Blue Ridge are Raven Cliff Falls, near Caesar's Head; Isaqueena Falls, near Stumphouse Tunnel; and Whitewater Falls, north of Lake Jocassee. Upper Whitewater Falls is located just over the state line in North Carolina, but the Lower Falls are in South Carolina. Collectively, Whitewater Falls is the second highest waterfall in the eastern United States. The 7,500 acre Lake Jocassee and the Bad Creek Reservoir are artificial lakes built by Duke Power Company for hydroelectric power generation. Table Rock Reservoir and Poinsett Reservoir were built primarily as water supplies for the nearby city of Greenville. A few of the most popular trout rivers are the Chattooga, the Whitewater, the Eastatoe, and the Saluda. Lake Jocassee likewise is home to a large native trout population, and is also a popular water recreational area for fishing, boating, swimming, and scuba diving.

Blue Ridge Rock Types

Blue Ridge rocks are composed of various types of igneous and metamorphic rock, especially granite-gneiss and amphibolite, which is a very dark banded gneiss with high concentrations of the mineral amphibole. Many of the mountains of the Blue Ridge Region started out deep underground as large igneous intrusions of granite called batholiths. During several episodes of tectonic activity, due to continental collisions, these batholiths were uplifted and metamorphosed. During this metamorphism, minerals were totally recrystallized by high temperatures and pressures to create a texture very different from that found in the original rock.

As erosion removed the overlying rock and soil, the granite-gneiss rose closer to the surface and began to expand and crack because of the lower confining pressures near the surface of the earth. Eventually, the resistant granite-gneiss rose so high that all surrounding rock was eroded away and the mountains as we know them today took form. Because of the cracking and expansion, sections of the rock often slide off the steep slope to crash to the ground at the base of the exposed cliffs. It is this frequent sliding of rock, along with the dense crystalline nature of the rock, which prevents trees and other vegetation from populating the exposed rock slopes of Table Rock Mountain as well as several other similar mountains in the Blue Ridge and upper Piedmont regions.

Blue Ridge -- Piedmont Boundary

The boundary between the Piedmont and Blue Ridge landform regions is marked by a sharp escarpment characterized by sudden changes in elevation and slope. The higher elevation Blue Ridge shows considerable relief, as indicated by huge cliffs, large waterfalls, and deeply eroded valleys. The contrast with the relatively flat Piedmont has long baffled geologists because the rock types of the two regions are fairly similar. Some have tried to relate this difference to a major vertical fault, but no direct evidence of uplift has ever been found. Another theory proposes that more than 70 million years ago the Atlantic Ocean extended westward to this area, causing extensive shoreline erosion, which affected the Piedmont but not the Blue Ridge. Again, no direct evidence of such an event has ever been found.
A final attempt to explain the sharp transition in landscape features utilizes the difference in stream power between streams flowing to the north from the Blue Ridge and streams flowing to the south. Streams flowing northward from the Eastern Continental Divide have a much lower gradient (slope) and therefore erode the landscape much more slowly. The lower gradient is a result of the fact that these northward flowing rivers have to travel over 1,500 miles to reach sea level in the Gulf of Mexico. The southward flowing streams, by contrast, only have to travel about 300 miles to the Atlantic Ocean and therefore drop in elevation more rapidly producing higher gradients and higher energies which erode the landscape more quickly. Such stream behavior could allow the Blue Ridge escarpment to be maintained through time even while the location of the divide itself migrated slowly northwestward.

Fracturing, Folding, and Uplift of the Blue Ridge

In addition to being altered by metamorphism, the rock in the Blue Ridge Region has been severely fractured and folded by tectonic activity. The fractures in particular create zones of weakness and provide preferred pathways for stream erosion and chemical weathering. Sudden bends in the generally rectangular drainage pattern, as seen on maps and photographs, mark the intersections of such fracture lines. The cliffs of Table Rock itself are roughly parallel to existing fracture lines. Folds in the rock are not noticeable on maps or aerial photographs, but are easily seen while walking along the many trails within the park.

In general, the higher elevated section of Table Rock Mountain is mostly granite-gneiss and is very resistant to erosion. The lower elevations are generally underlain by the less resistant amphibolite. The relative positioning of these two main rock types, resistant and non-resistant, determines the occurrence of waterfalls, rapids, and water slides within the area. Vegetation grows more readily on the easily decomposed amphibolite areas.
Native American Folklore

The Cherokee Nation developed many legends and stories to explain how the world came to be the way it is and how each animal and plant had its own special place in the natural order of things. Legends were usually told or sung by the elders of the community to the children to help teach the history and values of their people. Before written language became widespread, such oral storytelling was the only way to pass along the beliefs and traditions of the community to future generations. The "Legend of Little Deer" is one example of a legend designed to teach young hunters to respect the land and its animal inhabitants and to hunt only when necessary.

Legend of Little Deer
Adapted from Richard Mancini, Indians of the Southeast

Long ago the Cherokee people lived peacefully with all the animals. They hunted only when they needed food or skins for clothing. Later, the hunters learned to make bows and arrows, and hunting was much easier. They hunted all the time, even when they did not need food or clothes. The deer held a council to find a way to make the people stop killing so many of their family. Little Deer was the leader. He spoke wisely and told the other deer that the people must hunt only to live and not kill for sport. They must respect the deer and hunt only when they are in need. Little Deer told the Cherokee people that they must prepare themselves for the hunt. They must ask permission before killing one of the deer family. After they kill a deer, they must respect its spirit and ask to be pardoned--if they do not, then they will be crippled. To this very day when a Cherokee hunter kills a deer, he must go to the deer and ask for pardon. If he does not, then Little Deer returns to punish him. For this reason, the Cherokee respect and thank the deer and all other animals they hunt.

Traditional Scottish Ballads of the Blue Ridge

The Blue Ridge Mountain region contains a large number of people who are of Scotch-Irish descent. The Scots and the Irish both have long histories of strong oral tradition shown in their collection of narrative songs and ballads. Any event of general interest such as a joke, a love affair, or a murder, might find its way into a ballad. The form of such ballads is usually expressed in strongly rhymed, four-syllable measures of verse, not prose. Many of these old ballads were brought to America from Europe by early settlers. In most cases, the old dialects and wordings were kept, even though the people spoke modern English in their day-to-day lives. The sharing of such narrative songs was a way to remember and maintain the old culture in a new land with new ways.
Bonny Barbara Allan
--Anonymous--

It was in and about the Martinmas time, When the green leaves were afalling,
That Sir John Graeme, in the West Country, Fell in love with Barbara Allan.

He sent his men down through the town, To the place where she was dwelling;
"O haste and come to my master dear, Gin ye be Barbara Allan."

O hooly, hooly rose she up, To the place where he was lying,
And when she drew the curtain by: "Young man, I think you’re dying."

"O it’s I’m sick, and very, very sick, And ’tis a’ for Barbara Allan."
"O the better for me ye’s never be, Tho your heart’s blood were aspilling."

"O dinna ye mind, young man,” said she, “When ye was in the tavern adrinking,
That ye made the health gae round and round, And slighted Barbara Allan?"

He turned his face unto the wall, And death was with him dealing:
“Adieu, adieu, my dear friends all, And be kind to Barbara Allan."

And slowly, slowly raise she up, And slowly, slowly left him,
And sighing said she could not stay, Since death of life had reft him.

She had not gane a mile but twa, When she heard the dead-bell ringing,
And every jow that dead-bell geid, It cried, “Woe to Barbara Allan!”

"O mother, mother, make my bed! O make it saft and narrow!
Since my love died for me today, I’ll die for him tomorrow."

Ellicott’s Rock

Within Sumter National Forest, along the banks of the Chattooga River, is a special marker known as Ellicott's Rock. The marker identifies the spot where three states, South Carolina, North Carolina, and Georgia, meet. Chiseled on the rock is a three line notation. The inscription reads "Lat 35°/ AD 1813/ NC & SC." The marker was named for Andrew Ellicott who was a geographer and astronomer originally commissioned by the state of Georgia to determine its boundary with North Carolina. In his journal, Ellicott noted that he stayed at the house of Captain John Lynch, who resided in what today is Oconee County. According to Robert Mills in his Statistics this was the same Lynch who, as a patriot leader during the Revolutionary War, had a reputation for dealing harshly with Tories and was responsible for the origination of the phrase "Lynch law."

What many people do not realize is that there is a second, not so famous, Ellicott's Rock located on the North Carolina - South Carolina boundary line near Sassafras Mountain in Pickens County. The surveyor established these two rock markers as the endpoints of a straight line which today forms the northern boundary of both Oconee and Pickens counties in South Carolina. Most straight line boundaries of other states or counties have been determined by surveyors in much the same way.
Mountains as Recreational Areas

The Blue Ridge Region has developed into a picturesque tourist attraction primarily because of the dramatic slopes and high relief of the area. This effect is mostly due to the different resistance of the major rock layers and the widespread erosion of powerful streams, especially during storm events. These elevation differences are sufficient to produce spectacular scenery and also create unique microclimates and microenvironments found nowhere else in South Carolina. Not far from Table Rock State Park are attractions such as Whitewater Falls, whitewater rafting expeditions on the Chattooga River, the Walhalla Fish Hatchery, Caesar's Head Mountain, and several Heritage Preserves such as the Ashmore Tract and Watson Bog.

Although a small area, the Blue Ridge Region, as a result of its inspiring scenery, natural resources, largely undeveloped land, and relatively mild summer climate, attracts great numbers of tourists, both from other parts of the state and from elsewhere in the nation. The high, rocky, forested mountains and ridges give a character to the area unlike any found elsewhere in the state, and numerous hiking trails allow visitors to experience this area in a thorough and personal way. For those with time and stamina enough for the trip, a hike along the Foothills Trail, which extends approximately 90 miles from Caesars Head State Park in Greenville County to Oconee State Park in Oconee County (passing through much of the Blue Ridge Region in South Carolina) is a wonderful way to appreciate the character of this area.

Shorter hikes on this trail or walks on any of the numerous other trails in this region, such as the Bartram Trail (named after the 18th Century explorer-botanist William Bartram, who traveled throughout the Southeast) also allow glimpses of this beautiful, rugged terrain. For those who desire a view to reward their efforts, a day hike up Pinnacle or Table Rock Mountain in Table Rock State Park will provide opportunities to gaze at a distant horizon. From these vantage points, the Piedmont can be seen spreading out below like a green blanket, clearly showing the mostly level surface.

Tourist Attractions

The Blue Ridge Region has developed into a picturesque tourist attraction. In addition to hiking, opportunities for recreation abound in the Blue Ridge, an area rich with possibilities. Mountain bikers and horseback riders wend their way through the forested mountains. Motorists find varied and rewarding drives on the numerous and well-maintained roads of the region, with each new season changing the drives—winter views, spring flowers, summer greenery, and fall colors, perhaps the most powerful attraction. Those drivers who seek challenge and adventure trek through public lands on numerous four-wheel drive roads designated for this purpose. The exposed rock faces provide adventurists with locations for hang-gliding and rock climbing. Numerous waterfalls attract viewers and photographers to their rocky cascades. Trout in the streams and cold mountain reservoirs bring anglers to the region. Trophy bucks hide from agile hunters. Mountain crafts and collectibles await buyers in many roadside shops. Homestyle meals are served in friendly restaurants tucked into the hills. Festivals such as Walhalla's Oktoberfest and Westminster's Apple Festival celebrate the history and commerce of their communities.
The list of attractions continues. Numerous summer camps introduce young people to the joys of the area, and the many communities of vacation homes testify that these joys are not forgotten as people grow older. State parks and private campgrounds provide visitors with quiet and scenic places to spend a night or more. The peaceful environment and slower pace of the region have attracted people for generations, as the names Travelers Rest and Mountain Rest, two towns in the region, show. Legend has it that Travelers Rest got its name because it was a convenient and pleasant stopping-off point for those traveling north from Greenville into the mountains. Farther to the west, in the lower part of Table Rock cove, was the junction point of the State Road, which ran from Charleston into North Carolina, and the Keowee Trail (or Cherokee Path) to Virginia. This junction point, called Pumpkintown because of the large and plentiful pumpkins that the early settlers grew, was popular because even in the days of the colonists the Table Rock area was a recreational haven. In 1840, Table Rock Hotel was built. It was a two-story building constructed from lumber sawed on a Pumpkintown farm. On a flat area between Table Rock and Stool Mountain a saddle rack was built to serve the travelers who came by horse. Table Rock as a resort site experienced periods of plenty followed by years of lean. During the 1930's, under Franklin D. Roosevelt's administration, the area surrounding Table Rock was purchased by the state of South Carolina for a park. The Civilian Conservation Corps (CCC), organized as part of President Roosevelt's New Deal, provided work for young men during the depression. The CCC workers landscaped the area and built a fresh water lake on the grounds.
Climate Influences Land Use

The Blue Ridge Region has a humid temperate climate with a 200 day growing season. The region receives some of the highest rainfall amounts in the state with average annual precipitation ranging from 60 to 76 inches. In great part, this high precipitation rate is due to elevation, because as moist air masses from the ocean pass northward over the mountains, the air rises and cools, moisture condenses, and clouds form producing rain or occasionally a winter snow. The higher elevations also feature cooler summer temperatures and lower humidities which make the area attractive to vacationers. It is not unusual for summertime mountain top temperatures to be at least ten degrees cooler than adjacent lower elevation Piedmont temperatures.

Trout Streams

Trout can be found in streams throughout the Blue Ridge Region, from clear, steep mountain creeks to large, slow-moving streams in the valley bottoms. Local anglers, and many who are not local, are drawn here over and over again to walk the banks or wade these waters in hopes of catching some of these reclusive and delicious fish. Sometimes an angler may spend the entire day alone or with only a friend or two, endlessly casting small, beautiful, hand-tied flies into the shady nooks and rocky pools of a seldom-visited stream. Sometimes a path is beaten all along the water's edge, and people are lined up almost as thick as shoppers waiting to check out at the grocery store. But in either case, and in all of the cases in between, anglers enjoy that surprising combination--like sweet and sour--of relaxation and excitement that comes with fishing. And the trout keep bringing the anglers back.

There are three kinds of trout which inhabit the waters of the Blue Ridge: the Brook trout, the Rainbow, and the Brown. Of these three, only the Brook trout, or Brookie, is a native species. Before the sport anglers of today, before European settlers, before Native Americans, long before anglers of any sort--other than bear, osprey, and the like--Brookies made the Blue Ridge their home. Technically, Brookies are not a trout at all, but are a type of char, an arctic fish. Although the glaciers of the last Ice Age stopped well north of South Carolina, the climate was cooler then; it is surmised that Brookies moved south in the ocean and up the rivers of this state. When the Ice Age ended and the climate warmed, the Brookies retreated to the cool, shaded mountain headwaters of these river systems, a move to be duplicated in the Nineteenth Century by wealthy South Carolinians who also hoped to leave the summer heat behind as they climbed the escarpment into the Blue Ridge Mountains.

However, by the 20th century increasing numbers of anglers were chasing decreasing numbers of trout. Brookies, also called speckled trout, were disappearing from many streams. Once plentiful enough to be a dependable trail food for early travelers and briefly a staple of settlers and the occupants of upstate forts, the Brookie declined throughout the 19th century because of over-fishing and habitat degradation. Land cleared for agriculture and in timbering operations eroded, sending heavy loads of silt into streams. Also, once the shade-providing trees along the banks were cut, water temperatures in many streams rose too high for Brookies. To fill the vacancy, trout more tolerant of the changed conditions were introduced.
Fish Hatcheries and Stream Stocking

There are numerous tales of zealous anglers (and thoughtful businessmen) bringing trout from elsewhere to stock the depleted streams of the Blue Ridge Region. One recounts that members of the Nicholson family, who ran a lodge on the Whitewater River, went into Tennessee to bring fertilized trout eggs back from the Erwin fish hatchery near Johnson City. These Rainbow trout, raised in rearing ponds constructed on small tributaries of the Whitewater River, were released for the eager anglers. Other accounts are harder to believe, such as the tale of a plane loaded with Brown trout destined to be stocked elsewhere which is supposed to have crashed into the Chattooga River, introducing in unplanned and dramatic fashion a new species.

Stocking continues today, with a government fish hatchery on the Chattooga, although some disparage the practice, calling it “Put and Take Fishing,” since many of the newly stocked fish are caught almost immediately by anglers alerted to the stocking. But a balance has been reached among the trout. Brown and Rainbow may co-exist, but Browns, which can tolerate warmer and less clear water, generally live lower in the stream system. While Rainbows and Brookies both need clear, cool water, Rainbows are the more aggressive species and usually out-compete the native Brook trout. Therefore, Brookies only do well when separated from Rainbows, often upstream from a fall which the stocked Rainbows cannot pass. However, all three species are susceptible to fishing pressure and continued development that alters their streams. Care must be taken to ensure a happy ending to the story of trout in the Blue Ridge.

Soils and Farming

Soils in the Blue Ridge Region vary from thin to moderately thick. The thinnest soils often occur on steep sideslopes and exposed ridgetops along which rock outcroppings and regolith (loose rock fragments) are also common. Thicker soils occur on more level areas such as lower elevation hilltops and valley bottoms. Mountain soils are primarily composed of an altered rock material called saprolite, which has weathered in place for long periods of time. The characteristics of the soil are determined almost exclusively by the characteristics of the minerals present in the original rock. Surface soils are clayey to loamy in nature and may be especially well drained on slopes.

In a few cases, such as along river bottoms, transported soils can form from the sediment brought in by rivers, called alluvium, or from material falling from the adjacent slopes, called colluvium. The agricultural use of mountain soils is generally limited by the steepness of the slope. Suitability for row crops is classified as poor to fair. Only about 13,900 acres, 2.8 percent of the region, is categorized as potential prime farmland. Close to 90 percent of the land is forested. Farming areas that do occur are generally limited, occurring mainly in bottomlands and adjacent slopes associated with the narrow valleys, in mountain coves, or along flat ridgetops. The comparatively small family farms produce mainly corn, hay, and truck crops.

Unique Habitats and Changes Through Time

Blue Ridge Mountain forests are predominately hardwood, consisting mainly of oaks and hickories. They are surprisingly similar to more northern forests found in New England. Some species, such as hemlock, white pine, beech and sweet birch, became
established here during the Ice Ages when the region experienced much colder temperatures. There are also some locations in the region which contain a mix of hardwoods and pines, as well as some isolated stands of shortleaf and Virginia pine. Shrubs, such as the flame azalea, wild azalea, mountain laurel and rhododendron, constitute the typical understory - the last two particularly near streams. Other trees like alder, tulip poplar, cottonwood, and sycamore are also commonly found near streams throughout the region.

The Blue Ridge's diverse forest types and **topography** support one of the state's richest and most abundant assortment of plant and animal communities, including some rare old-growth hemlock-hardwood forests. Within the Blue Ridge Region are located many small but important pockets of land with various unique environmental characteristics. Examples are the Coon Branch Natural Area along the Whitewater River, Eastatoe Gap along the Eastatoe River, and the Ashmore and Wildcat tracts within the Mountain Bridge Wilderness area. These locations harbor many species of rare and unusual plants and likewise provide specialized habitat for animals. Mountain coves which face south are often protected from storms and enjoy a much milder and more humid climate than the surrounding regions. Bogs and water slides also create unique habitat conditions where rare plants flourish. An example of such a plant is the insect-eating mountain sweet pitcher plant, which is found only in the Carolina mountains. These special areas are fragile and can be destroyed easily by development activities.

The South Carolina Heritage Trust, with the assistance of the South Carolina Nature Conservancy, has purchased several of these sites to protect and preserve them for years to come. For example, 40,000 acres of mountain wilderness habitat is now protected as part of the Mountain Bridge Wilderness, an undertaking started in the 1970's by public and private interests with the vision of preserving a significant portion of the magnificent Blue Ridge escarpment. This wilderness area includes sheer rock faces, mountain coves, whitewater rivers and streams, old growth hardwood forests, waterfalls, and steep gorges. Each of these significant landscapes supports a diversity of plants and animals, including mammals, birds, reptiles, amphibians, insects, and aquatic life. Also, this region supports the largest black bear population within the state.

**Constructing Reservoirs**

Small, man-made lakes, called reservoirs, have been constructed for many centuries as storage areas of water for irrigation or drinking. Since the early 1900’s, even larger reservoirs have been constructed to help produce electric power. Lake Jocassee and Lake Keowee are two examples of this latter type of reservoir. Duke Power Company constructed these lakes to generate hydroelectric power and to be used for cooling when nuclear energy is generated.

When considering the construction of a reservoir, much planning is required. A topographic map is needed to determine what land will be underwater and what areas will become waterfront real estate. Reservoir constructors like Duke Power Company must buy all the land that will be flooded. Waste storage facilities must be cleaned out or sealed to prevent leakage, cemeteries must be removed, and trees and other tall objects must be removed so that they do not become future underwater obstacles. Large reservoirs provide many positive benefits for the surrounding communities. In addition to creating electrical power, the lakes provide water management capability and flood control. Boating, swimming, camping, and fishing are all recreation benefits that everyone has an opportunity to enjoy.
Hydroelectric Power Plants

The development of hydroelectric power plants was achieved by constructing large dams on major free-flowing rivers which experienced a rapid drop in elevation as they flowed through the local region. Such dams were designed to maximize water storage capabilities and change in elevation, above and below the dam, based on the natural topography of the area. The energy in the falling water provides the power to generate electricity.

Another way to use water to generate electricity during times of great demand is through pumped-storage facilities. There are two such facilities in this area, one located between the Bad Creek Reservoir and Lake Jocassee and another between Lake Jocassee and Lake Keowee. These pumped-storage facilities pump water uphill when energy costs are low, or during off-peak hours. At the upper reservoir of Bad Creek, this pumping raises water level as much as 160 feet. When electrical power is in higher demand, the water is released through an 850 feet vertical underground tunnel and four turbines to the lower reservoir of Jocassee. This can create about 1,000 megawatts of power per hour which can supply 700,000 average households with all the electricity they need.

Multiple Use of the Blue Ridge Landscape: Concepts and Conflicts

Much of the Blue Ridge Region remains relatively untouched by modern civilization. Until recently, only Cherokee villages and log cabins of early settlers were found in this region. The greatest threats to this region today are over-development and over-commercialization. For example, power projects have drastically changed the landscape by forming lakes from dammed rivers and streams. These newly formed lakes continue to attract recreational developments and retirement communities that steadily encroach upon wilderness areas, while pumping millions of dollars into the local economy. Although logging has been commercially important to the economy of upper South Carolina for some time, most of the area is still heavily forested. Tourism proponents and logging interests occasionally clash over issues such as clearcutting and the need for extensive systems of logging roads. The values which have made the tourist industry so successful are themselves endangered by that success and will continue to be affected by the activities of people.

The environmental implications of building reservoirs must also be considered before more are planned and constructed. Serious loss of habitat for many native species, like the Oconee Bell wildflower and the Clemson Salamander, could result. Both species are dependent on shaded areas near streams but are still successful in areas surrounding the lakes. Some argue that new aquatic habitats will be created as lakes and wetland areas are formed. A change in the thermal layering of established reservoirs by nuclear stations is a concern, as well as fish kills from reversing turbine direction in pumped-storage facilities. Increased development and expanding human populations surrounding a reservoir may also create the potential for significant pollution increases which could have damaging effects on the aquatic environment.

Currently, several federally maintained campgrounds are located in the Sumter National Forest in Oconee County. This is also the home of the Chattooga River, a National Wild and Scenic River and one of the foremost whitewater rivers in the nation.
In addition to the tens of thousands of canoers and kayakers who challenge themselves with the rapids of the Chattooga each year, and who enjoy the remote river gorge, approximately 40,000 people a year descend the river with commercial outfitters. These commercial rafters are treated to an experience of rugged beauty which, according to the supporters of the activity, heightens their appreciation for natural places in general and for the Blue Ridge Region in particular. Opponents of large-scale rafting maintain that 40,000 people a year is too many for the Chattooga. They claim that such visitation degrades the resource which attracted the people in the first place, a condition which, if true, is detrimental both environmentally to the river ecosystem and economically to the Blue Ridge Region, which benefits from tourism dollars.

This worry—that our use of attractive resources may degrade them to the point that they are no longer attractive—is a concern throughout the Blue Ridge Region. How many hikers can a trail carry without being damaged? How many anglers before a stream is fished out? How many vacation homes can be built before vistas are degraded and traffic increased? And how can the quality of life and the traditions of the local population be safeguarded as tourism continues to grow? Sound management plans must be developed for the Blue Ridge Region. In addition to protecting the natural resources of the area, it is necessary to balance the wants and needs of many users. A single region, even one as rich and diverse as the Blue Ridge, cannot be all things to all people.
Summary

West of the industrial corridor of I-85, which is located in the upper Piedmont of South Carolina, rises the Blue Ridge Region. South Carolina State Hwy. 11, also known as the Cherokee Foothills Scenic Highway, serves as a fairly accurate and easily recognizable eastern boundary for this region, which extends north and west well beyond the borders of South Carolina. The Blue Ridge Region in South Carolina is composed of parts of three upstate counties: Greenville, Pickens, and Oconee. Whereas elevations in the lower parts of these counties range from 500 to 700 feet, in the Blue Ridge Region one is generally above 1500 feet, and often higher. The highest point in South Carolina is Sassafras Mountain, located in Pickens County, with an elevation of 3,554 feet.

This high, rugged corner of South Carolina has long been a land apart. The Cherokee Nation held this region until the 1800's, well after the Revolutionary War. Their lifestyle of small farms, hunting and fishing, and the trade with the people of the lower state was largely continued by the predominately Scotch-Irish settlers who came into the Blue Ridge Region after the Cherokees were gone. Indeed, this lifestyle is echoed even today by the current residents of this part of the state, although the ease of modern transportation and the job opportunities in the Upper Piedmont have turned many of the residents of the Blue Ridge into commuting workers.

Although many residents of the Blue Ridge Region leave that area daily to work in the Piedmont, many residents of the Piedmont (and beyond) visit the Blue Ridge for scenery and recreation. Tourism is an important industry, but so are timber and power production. To balance uses, which possibly have adverse effects on each other, is a difficult task, but it is the task before us.
PLACES TO VISIT

Table Rock State Park. Highway 11, Pickens, SC. For information call 864-878-9813 or 864-878-6641.


The South Carolina Botanical Garden. Perimeter Rd. Clemson, South Carolina. For information call 864-656-3404.

Caesar’s Head State Park. Highway 28, south of Highlands, NC. For information call 864-836-6115 or 864-836-7438.

Ellicott Rock Wilderness/Burrels Ford. SC 28 to SC 107 to Forest Service Road 708 W. For information call 864-638-9568.

Tugaloo Education Center. 351 Teec Drive in Westminster, SC. For information call 864-647-4930.

Wildwater Ltd. Off Hwy. 76 on Academy Road. For information call 864-647-9587.

Chatooga Adventures Unlimited. 14546B Long Creek Hwy., Mount Rest, SC. For information call 864-647-0365.

Chatooga Whitewater Shop. 14239 Long Creek Hwy., Long Creek, SC. For information call 864-647-9083.

Jones Gap State Park. 25 miles northwest of Greenville off US 276 and 11 miles northwest of Marietta, at 303 Jones Gap Road, Marietta, SC. For information call 864-836-3647.

Oconee Station/Oconee State Park. Walhalla, SC. For information call 864-638-2792/5353.


REFERENCES AND RESOURCES


South Carolina Department of Archives and History. Public Programs Document Packets: The Civilian Conservation Corps in South Carolina, 1933-1945, Packet No. 4.


STUDY AREA 2: BLUE RIDGE OVERVIEW

Activity 2-1: Overview

Materials

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<td>6</td>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<td>6</td>
<td>Wipe-off Pens</td>
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PERFORMANCE TASKS
(Icon Key) Overview = ➔; Science = ☰; Math = ☰; History = ☰; Language Arts = ☰

1. **Compare Blue Ridge terrain with rest of state. ➔**
   
   Use the STATE BASE MAP #1, SHADED RELIEF, to identify the Blue Ridge Landform Region. Mark the Blue Ridge-Piedmont boundary line with a wipe-off pen. Contrast the mountainous terrain with the flatter landforms in the rest of the state. Which rivers are formed in the Blue Ridge Region of South Carolina? Identify the major lakes and dams in this region. Locate the approximate position of Table Rock State Park and Sassafras Mountain.

2. **Locate state boundaries and Ellicott's Rock. ➔**
   
   How are the state boundaries between South Carolina and North Carolina identified on the STATE BASE MAP #2, WITH HIGHWAYS? Between South Carolina and Georgia? Locate the 35° North latitude line and the point where Georgia, South Carolina and North Carolina meet. This is the location of the famous Ellicott's Rock. Is the latitude of that point exactly 35°? What is the longitude value for Ellicott's Rock? What is the name of the river that marks the boundary between South Carolina and Georgia in this area? Now find the location of the other Ellicott's Rock, near Sassafras Mountain at the eastern end of the straight state boundary with North Carolina. Name the county in which each Ellicott's Rock is located. Describe the terrain of the area. Why is a straight line boundary suitable for this region?

3. **Create ballad commemorating Ellicott's Rock. ☰**
   
   Use the story of Ellicott's Rock as the basis for creating a ballad commemorating Ellicott's adventures. Try putting your verses to a familiar tune, and then sing or recite your ballad to the rest of the class.

4. **Re-write "Bonny Barbara Allan" into standard English. ☰**
   
   Read through the ballad "Bonny Barbara Allan" on page 2-6 and select your two favorite stanzas. Re-write these into standard English, as it is taught in your school, and practice telling them aloud to your classmates. How does the use of antiquated words or a dialect affect how others understand your story? Find at least two examples of words or phrases in the ballad, which would lead you to think of Scotland instead of the Blue Ridge Region of South Carolina. Explain your choice. Are those words nouns, verbs, adjectives, or adverbs?
5. **Relate story of modern deer hunt to Native American legend.**
   The story "Legend of Little Deer" on page 2-5 was told by the elders of the community to the young before they went on their first hunt. Think of other examples of legends (stories) used to teach people different lessons. What are they? Write a story that a modern deer hunter might tell, or give your own hunting experience story. Use the **TABLE ROCK TOPOGRAPHIC MAP** to determine where you would hunt for deer. Explain your choice of location.

6. **Make up Native American legend based on real place names.**
   Pretend you are living in the Blue Ridge Mountains in the year 1700. Make up a legend or story using real Native American place names from the **STATE BASE MAP #1, SHADED RELIEF**, which are based on local landforms. Assume that any Native American sounding names found on the map were actually in use at the time (although this may not be true in all cases). Use newspaper articles or library references if needed to get more names. Once your story is complete, form a circle and share your legends much the way the Native Americans would have done.

7. **Explain the cultural isolation of the Blue Ridge.**
   Why has there always been such a strong, isolated single culture in the Blue Ridge Region? Why have people of other cultures not mixed or blended in easily? Refer to the terrain of the area as shown on the **TABLE ROCK LITHOGRAPH** to explain your answer.

**ENRICHMENT**

1. **Plan a publicity campaign to preserve mountain coves.**
   Plan a multi-media publicity campaign to alert other students to the unique mountain cove environments and the Heritage Trust areas. Outline all the reasons for preserving and protecting these unique areas.

2. **Research mammal habitat in mountainous areas.**
   White-tailed deer, black bears, silver and red foxes, and gray squirrels are some of the inhabitants of South Carolina's mountain forests. Select one of these mammals to research. Find out about the animals' habitat, food, range, natural enemies, and reproduction characteristics. What is needed for each of these animals to survive in the face of continuing development?

3. **Compare Native American and modern hunting practices.**
   Chapter 2 of Forrest Carter's *The Education of Little Tree* (University of New Mexico Press, 1986) is titled "The Way." This chapter deals with the same lesson some Native Americans have taught their young--never kill more than you truly need. What restrictions do we have today for hunters? How has environmental awareness affected the way we protect our world and its creatures? Plan an activity you and your classmates can do which will teach others to respect life. Make up your own legend that could be used in teaching this lesson to others. Tell it as though it is from long, long ago.
Greenville News
July 29, 1991
Teen Found at Table Rock; Family Relieved

by Jason Folkmanis

The mood shifted quickly at Table Rock State Park's Cabin 11. What had earlier been a scene of desperation had become a joyful gathering, as the family and friends of Bradley Wayne Nivens celebrated the news that the 14-year-old Mauldin youth was alive and in good condition.

"My arms are going to go around him, and I'm going to say 'I love you,'" said his mother Clydie Nivens when asked what she would do when she first saw her son. "I'm not mad at him. I just thank God he's been found."

"I just want to hug him and tell him I love him," echoed Nivens' brother Billy who was with the boy before he set off up the mountain. "It's something I usually don't do with my brother but it's something I really want to do right now. No matter how much he stinks I'm going to hug him." Nivens' family said they believed the fact that the teenager is a good athlete played a crucial role in his ability to survive. "He's in good physical condition" says Clydie Nivens. "He's a get-up-and-goer."

Though most of Nivens' family and friends believed he was all right they also admitted to having some doubts. "I wanted to feel confident," said Wanda Donley, Nivens' sister, "but I was real bad worried."

Candace Donley, a niece of Bradley Nivens, expressed relief that he had been found but also suggested that some discipline for the wayward youth might be in order. "The first thing that went through my mind," she said when she heard the news, "is that we ought to whip his butt."

RATIONAL

The Table Rock Mountain region is an excellent example of Blue Ridge topography, land use, and wildlife habitat. At 3,124 feet above sea level, the mountain itself is one of the highest in South Carolina. Its sheer cliffs and bare rock exposures create spectacular scenic views characteristic of this mountainous region. Waterfalls abound on steep mountain slopes, and numerous hiking trails lead not only to the summit of Table Rock Mountain, but also to a variety of unique habitats and forest ecosystems at lower elevations. Table Rock Mountain is the major attraction in Table Rock State Park, one of South Carolina's oldest and best known parks, which has recently become a major tourist attraction for the whole southeastern region of the United States. The park area also reveals a diverse human history, both Native American and colonial, as well as a rich heritage of folk tales and traditions. The recent influx of tourists has replaced logging as the major economic resource and created a demand for even more development, which has in turn created much controversy over how best to manage the land for so many different and sometimes contradictory purposes.
Brief Site Description

Introduction

The towering mass of rock known as Table Rock Mountain sits high above the surrounding valleys and is almost completely surrounded by exposed white cliffs. These cliffs represent surfaces of hard, resistant granite-gneiss which have been gradually uplifted over long spans of geologic time while weaker rock has been removed and carried away by stream erosion. Because of its location at the eastern edge of the Blue Ridge landform region, Table Rock Mountain is easily visible for miles around in the neighboring Piedmont and has become well known as a famous South Carolina landmark. Table Rock State Park is one of South Carolina's busiest parks and is a favorite tourist destination because of its spectacular scenery and easy accessibility. How was Table Rock named? Many legends have been told about this unique geological feature. Reece, in his history of Pumpkintown, relates one such tale.

Table Rock Legend

Traditional

In the days of extreme witchcraft, the witches had planned a convention and needed a place to meet. They chose the flat top of our mountain. The morning session had ended and it was time for lunch, but they had no table on which to spread their lunch. They bewitched the wind and commanded it to blow the rock clean. The wind blew--and it blew and blew until there was nothing left on the rock. So, they spread their lunch on it. But, there were no chairs and they knew their mighty Wizard, The Old Man of the Mountain, must be provided a place to sit. So the witches made ready the little hill into a stool for their ruler. He sat on this stool and ate from the table of rock. So, this welded the name Table Rock to the mountain and The Stool to the nearby hill, and the wind is still keeping the rock clean.

Table Rock State Park Constructed by CCC

In 1935, the area surrounding Table Rock (3,083 acres in total) was purchased by the state of South Carolina for a state park. Many of the early state parks were actually constructed by the Civilian Conservation Corps (CCC), organized by President Franklin D. Roosevelt's administration to address the problem of the nation's vast number unemployed young men between the ages of eighteen and twenty-five. Table Rock State Park was constructed by workers housed in CCC Camps SP-5 and SP-6. Utilizing natural materials and manual labor, CCC workers built Table Rock Lodge from hand-worked stone and hand-hewn chestnut logs. The spillway at the park's man-made 36-acre reservoir, called Pinnacle Lake, was constructed of slabs of granite laid in a stairstep pattern to imitate a mountain waterfall. The CCC also transplanted azaleas and mountain laurel and used them in landscaping the park.

By the time that the CCC was abolished by Congress in 1942, various CCC groups in South Carolina had constructed thousands of soil control dams, built 97 fire towers, planted 57 million trees to help turn the tide against deforestation, built and stocked two fish hatcheries, and constructed 18 state parks. Today the citizens of the state continue to enjoy and to benefit from this CCC legacy.
Activity 2A-1: Mountain Landforms

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<td>6  GENERAL SOIL MAP 1 : 594,000</td>
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<td>6  GEOLOGIC AND MINERAL RESOURCE MAP 1 : 1,000,000</td>
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<td>6  TABLE ROCK LITHOGRAPH 1 : 18,000</td>
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<tr>
<td>1  State Map of Major Drainage Basins</td>
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<td>6  Transparent Grid Overlays</td>
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<td>6  Wipe-off Pens</td>
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PERFORMANCE TASKS

(Icon Key) Overview = ➔; Science = ☄; Math = ☐; History = ☙; Language Arts = ☙

1. **Locate the study site. ➔ ☄**
   Locate the Table Rock Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Locate features and place names. ☄**
   Locate the following well-known landscape features on the TABLE ROCK TOPOGRAPHIC MAP: Table Rock Mt., Stool Mt., Caesar's Head Mt., Pinnacle Lake, Saluda River, Table Rock Reservoir, Raven Cliff Falls, Pumpkintown, and Oolenoy River. How many of these features can you find on the TABLE ROCK LITHOGRAPH? Explain how you were able to locate each feature. Using the topographic map, determine the elevation of the highest and lowest points shown on the map. Indicate their approximate latitude and longitude values. Use the scale bar on the map to determine how far Pumpkintown is from Table Rock.

3. **Locate edge of Blue Ridge Region. ☄**
   On the TABLE ROCK TOPOGRAPHIC MAP, both the Blue Ridge and Piedmont can be identified. Refer to the TABLE ROCK LITHOGRAPH for help in determining landform differences. Locate the approximate boundary between the two regions by looking carefully at contour lines. At what elevation does this transition occur?

4. **Compare stream course and cliff trends. ☄**
   Use a wipe-off pen to trace all stream courses north and west of Table Rock Mountain on the TABLE ROCK TOPOGRAPHIC MAP. Examine your tracing and describe the pattern of drainage in this area. What might cause such a pattern? Examine the cliff exposures on Table Rock and nearby mountains. Using a different color pen, trace along the cliff lines. How does the cliff pattern compare with the stream pattern? Would you have expected this result? Why? Examine the streams...
on the topographic map, relative to contour line patterns. Use contour line data to identify two areas where a waterfall is likely to be found. Why did you choose these areas? How can you tell which way the stream is flowing?

5. **Examine vegetation and lake patterns.**

Using the TABLE ROCK LITHOGRAPH, examine the vegetation patterns and different intensities of red on the infrared aerial photograph. What factor is most responsible for the differing colors along streams versus mountain tops? Recall that the infrared photograph was taken during the month of April. How would the vegetation pattern appear different in July? In December? Several lakes are visible on the lithograph. Notice that most of the lakes in the upper half of the lithograph are a slightly different color than the lakes in the lower half. What do you think causes this color difference? Why is there such a clear separation on the photo of the two groups of lakes? How is this difference related to the division between the Blue Ridge and Piedmont regions?

6. **Write legend about mountain names.**

Use the TABLE ROCK TOPOGRAPHIC MAP. Locate mountains other than Table Rock whose names refer to natural landform features. Select one of these mountains and write a legend about how it got its name. What is the scientific hypothesis which explains how that mountain came to be? How does your legend compare with the geological explanation?

7. **Locate south facing cove.**

Compare the TABLE ROCK LITHOGRAPH with the TABLE ROCK TOPOGRAPHIC MAP to locate a south-facing cove or hollow in the mountains. Why are such areas wetter, warmer, and more protected than surrounding areas?

8. **Compare drainage basins on opposite sides of reservoir.**

Examine Table Rock Reservoir on the TABLE ROCK TOPOGRAPHIC MAP. Count the number of stream tributaries entering the reservoir from the north. Count the number entering the reservoir from the south (ignore the Saluda River drainage which enters from the west). Use a wipe off pen to outline each of the stream drainage systems to the north and to the south of the reservoir. Which drainage basins cover more area, those to the north or those to the south? Use the transparent grid overlay to estimate the area of each basin. Use contour line information from the map to help explain any difference in your answers.

9. **Locate drainage divide between North and South Carolina.**

On the TABLE ROCK TOPOGRAPHIC MAP, locate the North Carolina-South Carolina boundary line. Trace the North Carolina rivers using a wipe-off pen. In which direction do the North Carolina rivers flow? Trace the South Carolina rivers with a wipe-off pen. In which direction do the South Carolina rivers flow? Use a broad-tip wipe-off pen to draw the actual drainage divide. Why is a drainage divide the sensible place to locate a state boundary line? Can you locate the North Carolina-South Carolina state line on the TABLE ROCK LITHOGRAPH? If so, how? If not, why not?
10. **Calculate slope of Table Rock Mountain.**

   Compare the different topography on the north and south sides of Table Rock Mountain. Use contour line information on the north and south sides of Table Rock Mountain. Use the scale bar on the map to determine your distance. Is your estimate of the slope an accurate representation of this topography? Use the following formula.

   \[
   \text{slope} = \frac{\text{rise}}{\text{run}} = \frac{\text{difference in elevation between two points}}{\text{distance between two points}}
   \]

   Note that the slope is the same whether you go from the Lake to Table Rock or from Table Rock to the Lake. Algebra students should note that the slope may be viewed as positive or negative, depending on the frame of reference.

   **Group I North Slope**

   Estimate the average slope of the ground from the top of Table Rock Mountain to the western shore of Table Rock Reservoir. Use the TABLE ROCK TOPOGRAPHIC MAP and the formula for slope.

   **Group II South Slope**

   Estimate the average slope of the ground from the top of Table Rock Mt. to the shore of Pinnacle Lake. Use the TABLE ROCK TOPOGRAPHIC MAP and the formula for slope.

11. **Construct mathematical models of Table Rock slopes.**

   Using the slopes determined in Performance Task #10, build a model of the triangle formed (rise vs. run) using rulers, toothpicks, straws, or Cuisenaire rods. Compare the two models and observe the mathematical relationships. Mathematically, what is the difference in the two slopes? How does your model compare with the actual ground slopes as indicated on the TABLE ROCK TOPOGRAPHIC MAP?

12. **Construct topographic profiles.**

   **Group I North Profile**

   Make a profile of the scenic view of Table Rock Skyline by looking northward along South Carolina State Hwy. 11. Locate the peak of Pinnacle Mountain on the TABLE ROCK TOPOGRAPHIC MAP. Draw a straight line starting at the peak of Pinnacle Mountain along the western edge of Table Rock Mountain. End at Table Rock Reservoir just to the right of the final letter "r" in the word "Reservoir." Determine the vertical axis scale by finding the difference between the highest and lowest elevations (the rise) along the drawn line. Mark intervals of 10 or 50 feet (based on your rise) on the graph paper. This is your vertical axis. Be sure your axis is at least one inch from the left edge of your graph paper.

   Fold the graph paper to form the horizontal axis. Place the horizontal axis along your line so that the origin is at Pinnacle Mountain. Starting at the origin, imagine you are walking a path along the line you have drawn. Each time you come to an index contour line, stop and plot the elevation corresponding to that point. Continue to walk, stopping and plotting each contour line until you reach the reservoir. Connect the points you have plotted. Label Pinnacle Mountain, Table Rock, and Table Rock Reservoir. This graph is your profile of Table Rock area. Driving northeast along South Carolina State Hwy. 11, the Cherokee Foothills Scenic Highway, and looking
northwest, you would see this skyline. Describe the scenery you would see driving along State Hwy. 11. How would the shape of the profiles you drew change if you made the horizontal and vertical scales equal?

**Group II  South Profile**

Make a profile of the skyline of the view seen by looking southward driving along South Carolina State Hwy. 11.

On the **TABLE ROCK TOPOGRAPHIC MAP**, draw a line starting at the letter "y" of the word "Oolenoy River" in the lower left hand corner of the map. End at the symbol labeled "New Town School" located in the lower middle part of the map. Determine the vertical axis scale by finding the difference between the highest and lowest elevations (the rise) along the drawn line. Mark intervals of 10 or 50 feet (based on your rise) on the graph paper. This is your vertical axis. Be sure your axis is at least one inch from the left edge of your graph paper.

Fold the graph paper to form the horizontal axis. Place the horizontal axis along your line so that the origin is at Oolenoy River. Starting at the origin, imagine you are walking a path along the line you have drawn. Each time you come to a contour line, stop and plot the elevation corresponding to that point. Continue to walk until you get to the New Town School, stopping and plotting each contour line until you reach the peak. Connect the points you have plotted and label Oolenoy River, Carrick Creek, and New Town School. Driving northeast along South Carolina State Hwy. 11, the Cherokee Foothills Scenic Highway, and looking southward, this is the skyline you would see. Describe the scenery you would see driving along State Hwy. 11. How would the shape of the profiles you drew change if you made the horizontal and vertical scales equal?

13. **Estimate maximum number of witches Table Rock could hold.**

Read the story "Legend of Table Rock." Assume that each witch needed 256 sq. ft. to spread her picnic on the top of the mountain. Estimate the number of witches who would be able to gather there at one time. Use the **TABLE ROCK LITHOGRAPH** and the transparent grid overlay to estimate the size of the flat top of Table Rock Mountain. Refer to the scale bar on the lithograph to make your conversion. Based on your understanding of the story, is your assumption of 256 square feet per witch a reasonable one? Explain why or why not.

14. **Plan a hiking trip to top of mountain.**

You and three friends want to take a hike up Pinnacle Mt. First, locate Pinnacle Mt. on the **TABLE ROCK TOPOGRAPHIC MAP**. With a wipe-off pen, trace the trail with a dashed line from the parking lot at Pinnacle Lake to the top of Pinnacle Mt. Compare the topographic map with the **TABLE ROCK LITHOGRAPH**. With the transparent grid overlay placed on the map, determine the coordinates of this mountain using the parking lot as your origin. Calculate the distance from the parking lot to this mountain. Write a complete agenda for your hiking trip. Plan to leave your car in the parking lot at Pinnacle Lake. If you hike at a rate of two miles per hour and start at Pinnacle Lake, how long will it take you to climb the mountain and return to your car? What provisions will you need? What gear will you need? Where will you stop to rest? Where along the trail will you expect to get some good scenic views? Refer to the lithograph to confirm your results. How can you use the lithograph to locate scenic overlooks? Write a letter to your three friends inviting them to join your group and telling them what each one needs to bring.
ENRICHMENT

1. **Research state symbols.**
   Plan an imaginary hike on one of the Table Rock trails. Research and identify the state bird, flower, tree, stone, fish, animal, wild game bird, fruit, shell, gemstone, reptile, and insect. Which of these state symbols could you probably see on your hike? In other words, does Table Rock State Park have the proper environment or habitat for any of the state adopted specimens?

2. **Calculate height of Table Rock using shadow.**
   Using the [TABLE ROCK LITHOGRAPH](#), calculate the total relief of Table Rock Mountain by measuring the length of the shadow cast by the mountain. Be sure to use the scale bar on the lithograph to determine the actual length of the shadow. The sun is approximately 5 degrees north of the celestial equator in April when this infrared aerial photograph was taken, and Table Rock Mountain lies at approximately 35 degrees north latitude. This means that the sun would appear to be 60 degrees above the horizon at midday. Elementary trigonometry gives the following relationship:

   \[
   \text{Local Relief} = \text{Tangent } 60\degree \times \text{Length of shadow (in feet)} \quad \text{Tan } 60\degree = 1.76
   \]
Activity 2A-2: Land Use and Development

Materials

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PERFORMANCE TASKS
(Icon Key) Overview = ☑; Science = ☐; Math = ☐; History = ☑; Language Arts = ☑

1. **Analyze the newspaper article.**
   Read the newspaper article on page 2A-1 "Teen Found at Table Rock, Family Relieved." Explain how the story relates to the Blue Ridge Landform Region. Identify a possible location on the TABLE ROCK TOPOGRAPHIC MAP (refer to the TABLE ROCK LITHOGRAPH if needed) where the story could have taken place. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same people as characters and the same location as your setting, write another newspaper article related to this incident, but date it either before or after the given story occurred. Choose an appropriate title and draw an appropriate picture to illustrate your main point.

2. **Correlate land use to topography.**
   Look carefully at the TABLE ROCK LITHOGRAPH. Identify farm fields, small towns or communities, logging roads, and developed and undeveloped land. What type of landform, slope, and topography is associated with each of these types of land use? See how well you can identify the same features on the TABLE ROCK TOPOGRAPHIC MAP. Look at the pattern of agricultural fields in the lower half of the infrared lithograph. Why are these fields located where they are? Refer to the LAND USE/LAND COVER MAP. How many of the Table Rock land use categories can be recognized on the state map?

3. **Analyze land use changes through time.**
   On the TABLE ROCK TOPOGRAPHIC MAP, notice the features shown in purple. These represent new developments or other changes which have occurred since 1946 when the land was surveyed for the original map. Identify major new features not on the original map. What section of the map area has experienced the most change? Why do you think these changes have occurred? How will these changes affect the environment and the scenic features of the Table Rock area? How many of these changes can you recognize on the TABLE ROCK LITHOGRAPH? In what year was the aerial photograph taken? Circle and explain any additional changes which occurred between the time the map was revised and the time the photograph was taken.
4. **Select best route for trail.**

Mountainous areas always pose transportation problems. Early Native American trail blazers looked for passes through the mountains which provided the lowest possible slope. Modern highways generally follow original Native American trails. Keeping in mind the landforms of this region, plot the best trail route on the TABLE ROCK TOPOGRAPHIC MAP from Table Rock Reservoir to the East Fork Road in North Carolina near the upper left hand corner of the topographic map. Identify natural features that are obstacles along your trail route and explain how you overcame them. Is your route a straight line? Why or why not? Compare your route with routes of others in your class. Which route is best? Why? Use the map scale to calculate the trail length. How long is the distance "as the crow flies." Would you rather climb a short steep trail than a long trail with a gradual slope? Explain.

5. **Explain location of Greenville's water supply.**

Locate Table Rock Reservoir and the city of Greenville on the STATE BASE MAP #2, WITH HIGHWAYS. With a wipe-off pen, trace the path of the Saluda River from the Table Rock Reservoir to the Anderson County line. How close does the Saluda come to the city of Greenville? The city of Greenville uses this reservoir on the Saluda River for its drinking water supply. Why do you suppose the city founders of Greenville built a dam on the Saluda River over 25 miles away from the city, when they could have built a reservoir on the Saluda River just a few miles west of the Greenville City limits?

6. **Write story about Pumpkintown history.**

Pumpkintown developed at a junction point of two well-traveled roads, one for travelers going east-west and one for others going north-south. Locate Pumpkintown on the STATE BASE MAP #2, WITH HIGHWAYS. What do you think was the destination of the travelers on these well traveled roads in the past? Is Pumpkintown located on a main highway now? How do you think Pumpkintown got its name? Write a short story about the adventures of a traveler in 1800 who passed through Pumpkintown on his way to Charleston. Include at least three references to pumpkins in your story and write a surprise ending!

7. **Create a Venn diagram contrasting mountain land use.**

Create a Venn diagram to compare and contrast the uses of the Table Rock area of today versus the way it was used in the time of the Cherokees. Focus on both land and water resources. Refer to the TABLE ROCK LITHOGRAPH and the Background Information on pages 1-12 and 2-12 for ideas.

8. **Identify ways people have altered natural landscape.**

Using the TABLE ROCK TOPOGRAPHIC MAP and the Background Information on page 2A-2, identify features which were constructed or altered by the Civilian Conservation Corps (CCC). How did they utilize the natural landscape and natural resources of the area? List pro's and con's to help you consider the long term effect of these changes to this natural area.
9. Calculate average field size.  
Use the TABLE ROCK LITHOGRAPH to locate farm fields along the Oolenoy River. (If necessary, refer to the TABLE ROCK TOPOGRAPHIC MAP to locate the Oolenoy River.) How can you recognize an agricultural field on the photo? On the map? Select at least 10 sample rectangular (or approximately rectangular) fields on the lithograph along the Oolenoy River and calculate their area in acres. South Carolina fields are usually measured in acres. Use two different mathematical procedures to do your calculations. Use your sample data to calculate the average (mean) field area and the median and range of these values. Compare data from Group I and Group II. Would you expect both groups to get exactly the same answers? Explain any discrepancies.

**Group I Calculation**
Use the scale bar to determine length and width of the rectangular fields in feet. Use the formula below to determine the area (square feet) of each field.

\[
\text{area} = \text{length} \times \text{width}
\]

Now convert the area (square feet) to acres by multiplying by the conversion factor 1 acre = 43,560 ft².

**Group II Estimation**
Use the transparent grid overlay to count the approximate number of squares which cover each rectangular field. Use the scale bar to determine the approximate area of a grid square in square feet. Next multiply the number of squares (including fractional squares) by the approximate area of a single square to determine the total area of each field in square feet. Then multiply the area in square feet by the conversion factor 1 acre = 43,560 ft² to get the area expressed in units of acres.

10. Compare shapes and patterns of road intersections.
In order to improve visibility, road intersections are usually designed to be as close as possible to a 90 degree angle. Measure either the acute or obtuse angle of 10 road intersections on the TABLE ROCK TOPOGRAPHIC MAP and record your results in the table below. Explain any significant variances you find. On the map, mark the intersections with a wipe-off pen and assign a number to each one. Note the location of contour lines near the intersections. Enter your data on the table below. Locate these same intersections on the TABLE ROCK LITHOGRAPH.

<table>
<thead>
<tr>
<th># OF INTERSECTION</th>
<th># DEGREES MAP</th>
<th>ACUTE OBTUSE</th>
<th># DEGREES PHOTO</th>
<th>ACUTE OBTUSE</th>
<th>REASON FOR NON-90 ANGLE</th>
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2A-10
ENRICHMENT

1. Interview a Realtor. 
   Talk with a local Realtor about where and why new developments are planned in the Table Rock region. Compare the rate of subdivision growth in the Table Rock area to growth rates in your own county.

2. Interview a forester. 
   Talk with a timber company representative. Find out what trees are being harvested in the Table Rock region and why. List the pros and cons of different timber management practices. Also find out about the South Carolina "Best Management Practices" booklet published by the South Carolina Forestry Commission.

3. Interview a former CCC member. 
   Interview a former participant of the Civilian Conservation Corps (CCC). How old would such a person have to be now to have participated in the original government program? Plan for your interview by making a list of questions concerning daily life and living conditions on the camp sites and types of projects supported by the CCC. Write up the interview and submit the article to your school newspaper. Research the state park closest to your school. How was it developed? Was it developed by the CCC? What are the special recreational features for which this park is noted?
The News
Dec. 17, 1989

Trout Stream affected by Bad Creek Development

by Ron Barnett

While Duke Power Co. officials say protecting the environment has been a major concern in development of the Bad Creek pumped-storage hydrostation since its beginning, they also say they were aware that the project could seriously damage--at least temporarily--one of the state's few pristine trout streams.

But their expectations that the stream would recover from the excess load of silt and sand that has washed into it appear to be holding true.

When construction on the project began in 1984, Bad Creek and West Bad Creek had to be diverted into nearby Howard Creek to avoid water filling in behind the dams. Though the muddy water was first channeled through settling pools, the silt and sand pumped into Howard Creek was still overbearing.

Environmentalist Dennis Chastain says that Howard Creek is looking better now than when he saw it four years ago, but he isn't convinced that the creek will return to its natural state any time soon.

According to Randy Geddings, district fisheries biologist for the South Carolina Wildlife and Marine Resources Department, sediments washing in from the diverted streams killed the aquatic insects that trout depend upon for food and smothered the gravel trout use as spawning grounds.

Duke Plans to flush the creek with clear water in 1992 or '93 if the sediments haven't sufficiently washed away by then. The state will re-stock the stream, if necessary, in 1993 or '94.

David Meecham, Duke's environmental coordinator for the Bad Creek project, said that in recent weeks a few brown trout have begun to migrate back into the stream.

<table>
<thead>
<tr>
<th>RATIONALE</th>
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The Lake Jocassee Region Study Area is a prime wilderness location characterized by rugged mountain topography, scenic waterfalls, pristine trout streams, and unique habitats, which are home to more than fifty rare plant and animal species. Because of the undeveloped nature of this region, both the federal and state government, along with private groups such as the Nature Conservancy, have established a series of parks, preserves, and wild-and-scenic river corridors to help preserve this wilderness area for the study and enjoyment of future generations. Lake Jocassee is one part of a series of dams and reservoirs constructed, operated, and maintained by Duke Power Company, to provide electricity for the citizens residing in upstate South Carolina. The rugged topography is ideal for power generation by standard hydroelectric plants as well as pumped storage technology. Lake Keowee also provides cooling water for the Oconee Nuclear Station. The environmental demands created by power generation often conflict with goals of wilderness preservation. Duke Power Company, through their land management subsidiary, Crescent Resources, Inc., has established a winning partnership with state resource agencies and private organizations to provide the power needs of upstate South Carolina with minimal disruption to the environmental resources.


**Introduction**

The Lake Jocassee area is a complex mixture of unspoiled wilderness, carefully managed wildlife habitat, and a series of dams, reservoirs, and utility corridors used in generating electrical power for a large portion of upstate South Carolina. Until the mid 1800’s, this area was populated mostly by Native Americans of the Cherokee Nation. For years prior to that time, the only European Americans to visit the area were either soldiers or traders. Today, tourists constitute the major population group, drawn not only by the many scenic waterfalls, whitewater streams, and hiking trails in the area, but also by the two major visitor centers run by the Duke Power Company whose exhibits highlight both the scenic wonders of the area and the many varieties of energy production used in South Carolina. The World of Energy, located at the Oconee Nuclear Station, has many hands-on exhibits that show how natural resources such as falling water, coal, and uranium are used to make electricity. The Bad Creek Visitors Center offers seasonal tours of the pumped storage facility, including the underground powerhouse. Several parks with picnic, camping, and boat launch areas are operated by county, state, and private agencies. The renowned Foothills Trail runs through a large portion of the Lake Jocassee Region with several footbridges over spectacular gorges north of Lake Jocassee.

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**The Legend of Issaqueena**

Traditional

At the time when the British had forts in the upstate and the Cherokees still held the westernmost part of South Carolina there lived near the Chattooga River a beautiful Native American Princess named Issaqueena. She was dark, modest, and lovely, and she had caught the eye of a handsome, young British soldier who occasionally had business with the locals. She returned his admiration, and soon they shared a deeply felt but secret love.

Relationships were strained between the British and the Cherokees, and Princess Issaqueena doubted whether her father, the chief, would ever give consent for her to wed the soldier. One night Issaqueena heard with horror that the Cherokees planned to hold a raid against her soldier’s fort at dawn. What must she do? If she warns the soldiers she has betrayed her father and her people. If she does not warn them then her own true love will soon lie dead. Taking no more time to think, she flees her village, running off into the darkness to her soldier’s fort. Running in the nighttime, she counts off her progress, naming every creek she crosses: Six Mile Creek, Twelve Mile Creek, Eighteen Mile Creek, Three and Twenty Creek, and finally Six and Twenty.

At last she reached the fort and warned the soldiers. They were ready in the morning; when the Cherokees arrived the fort was closed and guarded. Under clouds of anger and betrayal, the natives returned to their own village. At the village, Issaqueena’s father, noting that she had been gone the night before, asked her flatly if she had warned the soldiers in the fort.

Standing there before her chief and father, with tattered dress and battered feet from all her nighttime running, Issaqueena would not shame him by lying to him. “Yes, father,” she said, “for love I warned the soldiers.”
“Then you must flee,” her father said. “Flee now! Our warriors will be after you. Be gone, my daughter. Now! Be swift!”

Off Issaqueena ran toward the fort, but soon she knew the fleet-footed warriors would overtake her, weary from her grief and night of running. At the top of a waterfall near Stumphouse Mountain, at the very edge, Princess Issaqueena paused and looked out a moment eastward on the Piedmont down below and thought about her soldier there. She heard the native warriors close behind her, and then she flung herself out to fall among the silver water to the rocks below.

The creeks are still called by the names she gave them, and the waterfall near Stumphouse Mountain still is known as Issaqueena Falls.

Some people say that Princess Issaqueena grabbed a muscadine vine as she fell and swung herself back into a cave behind the falls. They say she waited there until the warriors gave up their fruitless search for her body on the rocks below. She then climbed out into the evening air and made her way quietly to her soldier’s fort where she and the young soldier married, and they lived happily ever after.

Part of the popularity of the Lake Jocassee area is the diversity of plant and animal species, which can be found there. The Duke Power Company has worked with various environmental agencies to ensure that the maximum amount of habitat is preserved during both the construction and operational phases of their many power projects. An example is the construction of an artificial cliff along the side of a mountain that was mined for rock for the Jocassee Hydroelectric Dam. Once the rock was removed, the remaining steep drop-off provided a perfect habitat for peregrine falcons. Other habitats are uniquely suited to a variety of plant species, some of them on the endangered list. The folklore of many of these plants, particularly wildflowers, is fascinating. Ralph Waldo Emerson once defined a weed as “a plant whose virtue has not yet been discovered.” Many of the plants found around Lake Jocassee did have presumed virtues, at least by those who originally named them. In such cases, plant names followed what is known as the “Doctrine of Signatures,” a theory proposed by a Swiss physician in 1657 that some plants have parts (called signatures) that resemble parts of the human body. The so-called signature of the plant enabled doctors to recognize which portions of the plant were useful for medicines and food. For example, the leaf of *Hepatica* looks very much like the human liver and was therefore thought to be a cure for liver ailments. A book entitled “Wild Flower Folklore” reveals how observers can obtain information on the plant to discover its physical characteristics, the reason for its name, the medicinal values, its value as a food source, the superstitions and lore associated with the plant, and the language of the plant. A sample analysis is given for the common dandelion.
COMMON NAME: dandelion
FAMILY: Compositae (Daisy)
Genus: Taraxacum
Species: officinale

DESCRIPTION: A bright yellow head of flowers sits atop a hollow stem, which arises from a rosette of basal leaves. The blossoms are about one to two inches across, and the stems grow from two to eighteen inches tall. The leaves are dark green and, in most cases, deeply toothed.

HABITAT: The dandelion is very common in yards and waste places all over North America.

BLOOMS: February through June

Almost everyone is familiar with the dandelion. Its common name is French, meaning "the tooth of the lion," because of the toothed margins of the leaves. The generic name, from Arabic and Persian, means bitter herb. The species name means that it was sold in the marketplace. Due to its widespread growth, the yellow-flowered dandelion is sometimes called "tramp with the golden head."

An important folk medicine, dandelion, rich in vitamins A and C, is used as a general antidote and also for specific ailments. An old mountain superstition says that if you drink a cup of dandelion tea every morning and evening you will never have rheumatism. A Dutch legend says that if you eat dandelion salad on Monday and Thursday you will always stay healthy. An herbal remedy written in 1821 says that the root of the dandelion is good for impetigo, the itch, and several other ailments including "induration of the liver."

A native of Europe, the plant is often cultivated for food. The leaves are gathered in early spring when they are sweetest and boiled and eaten like spinach or eaten raw in salad.

The dandelion is abundant for several reasons. Its bitter summer leaves are not grazed, and the root is buried deeply, resisting burrowing animals and fire. The silken parachutes are actually seeds, easily dispersed by wind.

Because the blowballs, or parachutes, are irresistible to children all over the world, there are several superstitions about them. Children commonly believe if they can blow off all the seeds in one breath, a wish will come true. Another superstition says the number of seeds left tells what time it is. Yet another says the number of seeds left on a blowball after a child's good hard puff tells how many children that child will have. Some say if you whisper words of love to your favorite person and blow the seeds gently towards him, the seeds will carry your words to your beloved.
The Bad Creek Pumped Storage Project

The Bad Creek project was started in 1981 but did not begin generating electricity until 1991. Although some environmental concerns were raised during construction, particularly regarding possible sediment pollution of trout streams, attempts were made to minimize damage and to restore full habitat quality to the affected areas. To construct the reservoir, engineers had to dam up two small streams (Bad Creek and West Bad Creek) with two separate dams and a dike. The main dam, made of earth and covered with rock, stands 360 feet high and measures a half-mile across. At full pond, the reservoir covers 313 acres, is 310 feet deep, and has a maximum drawdown capability of 160 feet, which can be achieved in 27 hours. Bad Creek’s water flows into Lake Jocassee through 30 foot diameter pipes in an underground tunnel. The water turns turbines located in a powerhouse 540 feet underground in solid rock, then exits through an underwater portal on the Whitewater River arm of Lake Jocassee. When the reservoir is to be refilled, the turbine generators act as electric motors to pump the water back uphill until the next time it is needed. Lake Jocassee itself is also used for pumped storage with Lake Keowee serving as the lower reservoir.

Figure 2B-1: Bad Creek Pumped Storage Project: Diagram and Map View
The Oconee Nuclear Station

The establishment of a nuclear power plant in northwestern South Carolina was a massive undertaking, which required years of planning. The arrival of the first nuclear reactor vessel at the Oconee site marked the end of one of modern history’s most complicated hauling jobs. The 325 ton container completed its long journey in February 1970, nearly two months after leaving the Babcock & Wilcox Plant at Mt. Vernon, Indiana, where it was constructed. Enroute to its final resting base, this huge mass traveled by barge and special rail car, and on the world’s largest truck. It traveled the Ohio and Mississippi Rivers, the Gulf of Mexico, the Florida Barge Canal, the Intracoastal Waterway, the Savannah River, and 145 miles of road and rail bed. The total distance covered was almost 2,000 miles. The power plant began generating electricity in 1973. Its three units are capable of producing up to 2.6 million kilowatts of electricity. By 1991, the Oconee Unit became the first nuclear power plant in the United States to produce 100 million megawatts of electricity.

Figure 2B-2: Oconee Nuclear and Keowee Hydroelectric Stations
Lake Keowee was constructed in the late 1960’s primarily to provide cooling water for the Oconee Nuclear Station. A nuclear power plant generates electricity by using nuclear fuel (usually uranium) to produce heat (from nuclear fission) that changes water into steam and turns turbines mechanically. Water from Lake Keowee never comes in direct contact with radioactive material, but rather supplies a secondary flow path, which circulates around the primary system to cool the steam back into water for re-heating. This water also removes heat from the reactor itself to prevent the unit from overheating. Colder water is brought in to the reactor building from the bottom of Lake Keowee. After absorbing heat from the three reactors at the Oconee Nuclear Station, the water is warmer and therefore less dense. It is therefore released at surface levels of the lake, which are usually warmer than bottom waters, to minimize any temperature differences in the lake water and any subsequent threat to aquatic organisms in the lake.

Transmission of Power

Producing electricity is only part of the job faced by utility companies. To be useful, power must be transferred to where people live and work. Almost all electricity travels at velocities close to the speed of light over high voltage (44,000 - 525,000 volts) transmission lines that connect the power plants to regional substations. Transformers at these substations reduce the voltage level to amounts that are safe to transmit along highway power lines (4,160 - 24,940 volts). Still another set of transformers must be used before the voltage level is safe for use in homes or businesses (120 - 240 volts). The major advantage of using higher voltages is that electricity can be transferred greater distances with less loss of power. The disadvantage is that high voltage lines must be placed high off the ground and away from trees and buildings. This requires the complete clearing of a corridor of land before a power line can be constructed across the area.

Whenever a new power line is needed, planning engineers look for the best corridor site to achieve reliable electrical service to an area at reasonable cost while addressing local environmental and aesthetic concerns. Siting and construction are particularly difficult in wilderness areas or other places with limited access for heavy machinery and other equipment. Usually planners will route power lines along highways or railroads to reduce environmental impact. Sometimes the power company will purchase the land, but in most cases it is more effective to simply purchase a “right-of-way” that allows the company to run its power lines across other people’s property. Normally neutral paint colors (grays and greens) are used on the metal towers, which helps them blend with the natural landscape. Planting trees adjacent to the cleared corridor helps to control erosion and also helps to hide the lines.
Figure 2B-3: Operating Costs of Various Appliances

Appliance: Heat Pump
Wattage: 5,000 watts
Hours of Operation: 12
Kilowatt-hours consumed: 60
Operating cost (kWh × 7.5¢) = 450¢

Appliance: Room Air Conditioner
Wattage: 900 watts
Hours of Operation: 12
Kilowatt-hours consumed: 10.8
Operating cost (kWh × 7.5¢) = 81¢

Appliance: Refrigerator/freezer
Wattage: 920 watts
Hours of Operation: 12
Kilowatt-hours consumed: 11.04
Operating cost (kWh × 7.5¢) = 82.8¢

Appliance: Radio
Wattage: 50 watts
Hours of Operation: 4
Kilowatt-hours consumed: 0.15
Operating cost (kWh × 7.5¢) = 1.1¢

Appliance: Computer
Wattage: 150 watts
Hours of Operation: 6
Kilowatt-hours consumed: 0.9
Operating cost (kWh × 7.5¢) = 6.75¢

Appliance: Color Television
Wattage: 145 watts
Hours of Operation: 6
Kilowatt-hours consumed: 0.87
Operating cost (kWh × 7.5¢) = 6.5¢

Appliance: Hair Dryer
Wattage: 1,000 watts
Hours of Operation: 0.5
Kilowatt-hours consumed: 0.5
Operating cost (kWh × 7.5¢) = 3.75¢

Appliance: Electric Dishwasher
Wattage: 1,200 watts
Hours of Operation: 0.5
Kilowatt-hours consumed: 0.6
Operating cost (kWh × 7.5¢) = 4.5¢

Appliance: Clothes Dryer
Wattage: 5,600 watts
Hours of Operation: 1
Kilowatt-hours consumed: 5.6
Operating cost (kWh × 7.5¢) = 42¢

Appliance: Vacuum Cleaner
Wattage: 650 watts
Hours of Operation: 1
Kilowatt-hours consumed: 0.65
Operating cost (kWh × 7.5¢) = 4.9¢

Appliance: Lights (Fluorescent)
Wattage: 34 watts per bulb
Hours of Operation: 12
Kilowatt-hours consumed: 41
Operating cost (kWh × 7.5¢) = 3.1¢

Appliance: Light (incandescent)
Wattage: 100 watts per bulb
Hours of Operation: 12
Kilowatt-hours consumed: 1.2
Operating cost (kWh × 7.5¢) = 9.0¢
I asked my grandmother if she remembers when her family first got electricity, and she said, “Yes. We got it after we moved into town.” Moving into town was a big event in my grandmother’s life, and she often dates things that happened when she was young as either before or after this move. Before it, she and her parents and many siblings lived in the country to the west of Pickens and farmed, plus whatever other work they could come by. She was about 10 or 12 when she moved into town, and she can still remember what she was doing when she found out that they were moving.

The day they moved she was washing clothes for a neighbor lady; one of her brothers walked over and told her, “Hurry up, Essie. We’re moving to the mill!” She finished the washing, and the neighbor paid her with a small paper sack of peanuts. By the time she got home her family was nearly packed.

“Moving to the mill” was a good way to put it, because the mill village or mill hill was like a small town of its own. You lived in mill houses, paying rent to the mill, and bought your groceries and clothes at the mill store. Some mills even paid you in their own money, good only at their own stores. You bought coal for heating and wood for cooking and oil for lamps from the mill. You could keep chickens and a small garden at your house, but you couldn’t keep pigs since the houses were too close together for that. The mill had a nearby pasture where everyone who wanted to could keep a cow. And of course you worked at the mill.

Soon the mill began providing one more thing: electricity. The mill houses were wired with one power cord hanging from the ceiling of one room. A bare light bulb hung in a socket at the end of the wire. And that was all: one wire, one bulb, and electric power for two hours each week on Wednesday afternoon when the mill closed down and didn’t need the power.

My grandmother says they used to sit around and talk about what electricity might be good for. They guessed some people at the time might have had electric irons, but they didn’t have one. My grandmother’s family still used flatirons heated on the woodstove. She says she can’t remember when they started getting electricity all of the time, but she does remember the first appliance they got when they had full-time electricity: a small refrigerator. She says it changed their life; milk would keep, meat could be bought ahead of time, and they could have cold water to drink—things only possible before when they could buy a piece of ice for their ice box. “We didn’t dream of air conditioning,” she said, “or even of a window fan. But we didn’t need them. After we got that refrigerator we could have cold water any time we wanted!”
Activity 2B-1: Watershed Management and the Environment

**Materials**

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**PERFORMANCE TASKS**

(Icon Key) Overview =  ; Science =  ; Math =  ; History =  ; Language Arts =  

1. **Locate the study site.**  
   Locate the Lake Jocassee Region Study Site on the **STATE BASE MAP #2, WITH HIGHWAYS**, on the **LAND USE/LAND COVER MAP**, on the **GEOLOGIC AND MINERAL RESOURCE MAP** and on the **GENERAL SOIL MAP** by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Locate features and place names.**  
   Locate the following landscape features on the **LAKE JOCASSEE REGION TOPOGRAPHIC MAP** and use the map information to answer the questions.
   - Lake Jocassee (large light purple area on right side of map). Outline the shoreline of this lake with a blue wipe-off pen. Why does this lake have such an irregular shoreline shape? Explain your answer.
   - Lake Keowee (smaller light purple area in lower right corner of map). Outline the shoreline with a green wipe-off pen. How is the shape of Lake Keowee similar to Lake Jocassee? How is the shape different? Explain your answer.
   - Lake Jocassee Dam (where Lake Jocassee flows out into Lake Keowee). Outline the location of the dam with a red wipe-off pen. Why do you think the dam was built at this particular location?
   - Bad Creek Reservoir (smaller light purple area in center of map, to left of Lake Jocassee). Outline the shoreline with a black wipe-off pen. The dam that holds back Bad Creek Reservoir is not shown on this map. Mark the location where you think the dam should be, and explain why you think it was placed there.
   - Four main rivers that flow into Lake Jocassee. Trace these river courses with a wipe-off pen. Whitewater River (also mark the location of the Lower Falls and Upper Falls); Thompson River; Horsepasture River (also mark the location of Windy Falls and Rainbow Falls); Toxaway River (also mark the location of Toxaway Falls). Why do you think there are so many large waterfalls on these rivers? Why do you think
the Federal Government has established a “wild and scenic river” designation for the Horsepasture River? 
- State Highway 11 (a new highway shown in light purple running SW - NE along the bottom portion of the map). Why do you think this highway was needed? What benefits did the new highway bring to this region? South Carolina has officially designated this highway as the “Cherokee Foothills Scenic Highway.” Explain the reasons behind this designation.
- Walhalla Fish Hatchery (far left center of map along the east Fork of the Chattooga River). Along which river is this facility located? Why do you think it is located there?

How many of these features can you find on the LAKE JOCASSEE REGION LITHOGRAPH? Explain how you were able to locate each feature. Using the topographic map, determine the elevation of the highest and lowest points shown on the map. Can you locate these points on the lithograph? If so, how did you locate them? Use the scale bar on the map to determine how far Jocassee Dam is from Lower Whitewater Falls (straight line distance - as the crow flies). How far is this distance by road (non-straight line distance - as the car drives)?

3. Analyze the newspaper article. 📜
Read the newspaper article on page 2B-1, “Trout Stream affected by Bad Creek Development.” Explain how the story relates to the Blue Ridge Landform Region. Identify a possible location on the LAKE JOCASSEE REGION TOPOGRAPHIC MAP (refer to the LAKE JOCASSEE REGION LITHOGRAPH if needed) where the story could have taken place. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same people as characters and the same location as your setting, write another newspaper article related to this incident, but date it either before or after the given story occurred. Choose an appropriate title and draw an appropriate picture to illustrate your point.

4. Correlate land use to topography. 🌱
Look carefully at the LAKE JOCASSEE REGION LITHOGRAPH. Identify farm fields, small towns or communities, logging roads, and developed and undeveloped land. What type of landform, slope, and topography is associated with each of these types of land use? See how well you can identify the same features on the LAKE JOCASSEE REGION TOPOGRAPHIC MAP. Look at the pattern of agricultural fields in the lower half of the infrared lithograph. Why are these fields located where they are? Refer to the LAND USE/LAND COVER MAP. How many of the Lake Jocassee land use categories can be recognized on the state map? Identify sources of non-point source pollution associated with each land use.

5. Analyze land use changes through time. 📈
On the LAKE JOCASSEE REGION TOPOGRAPHIC MAP, notice the features shown in purple. These represent new developments or other changes that have occurred since 1946 when the land was surveyed for the original map. Identify major new features not on the original map. What section of the map area has experienced the most change? Why do you think these changes have occurred? How will these changes affect the environment and the scenic features of the Lake Jocassee area? How many of these changes can you recognize on the LAKE JOCASSEE REGION LITHOGRAPH? In what year was the aerial photograph taken? Circle and explain...
any additional changes that occurred between the time the map was revised and the
time the photograph was taken.

6. **Analyze vegetation using the ‘Doctrine of Signatures.’**
   Pick any plant likely to be found in the Lake Jocassee region and construct a
   "Doctrine of Signatures" similar to what was done in the "Wildflower Folklore"
   example on page 2B-4. Include your own original stories about the plant. Identify a
   location on either the **LAKE JOCASSEE REGION TOPOGRAPHIC MAP** or the
   **LAKE JOCASSEE REGION LITHOGRAPH** at which you would expect to find this
   particular plant. Explain why this plant is found in this particular environment.

7. **Write short story about travel down stream.**
   Write an adventure story starring Rudy the Raindrop, who fell out of the sky on a
dreary summer afternoon and landed in Sapphire Lake (near the top border of the
**LAKE JOCASSEE REGION TOPOGRAPHIC MAP**). Tell the story of Rudy’s travels
as he winds his way down the Horsepasture River to Lake Jocassee. Describe the
creatures he meets along the way as well as the changing habitat along the river.
Use lots of adjectives to make his story exciting to read.

8. **Locate forest land.**
   Note the abundance of green color on the **LAKE JOCASSEE REGION
   TOPOGRAPHIC MAP**. What does this green color represent on most topographic
   maps? What color represents forests on the **LAKE JOCASSEE REGION
   LITHOGRAPH**? Why are these colors different? Compare the colors of lakes and
   streams on the topographic map and lithograph. How are they similar? How are
   they different? Why is purple used in place of blue for certain bodies of water?
   Identify forest clear-cut areas on the lithograph. Can you identify these areas on the
   topographic map? Explain your answer. Is clear-cutting usually done alongside
   large bodies of water? Why or why not? Discuss within your group the pros and
   cons of clear-cutting as a timber management practice.

9. **Determine the dimensions of a lake.**
   Determine a simple way to measure the length in miles of the shoreline of Lake
   Jocassee. Try out your method and record your answer. Use the Transparent Grid
   Overlay to estimate the area of Lake Jocassee in square miles. Calculate the ratio
   of this area to your measured perimeter of Lake Jocassee. In the same way,
determine values for the area and perimeter of Bad Creek Reservoir and calculate
the ratio of area to perimeter. Which ratio is larger? Use your analysis of the
topographic map and lithograph to create a hypothesis as to why the ratios would be
different. What percentage of the map area is occupied by Bad Creek Reservoir?
What percentage is occupied by Lake Jocassee? Does the size difference between
these lakes affect the value of your calculated ratio?

10. **Sketch a topographic profile along the state boundary line.**
    Draw a topographic profile, on a separate piece of graph paper, along the state
    boundary line between the Thompson River and the Horsepasture River. Plot
distance from the Thompson River along the X-axis of your graph and plot elevation
    (contour data) along the Y-axis of the graph. Before you label your Y-axis, identify
    the highest and lowest elevations along the profile line and use a contour interval of
    200 feet to set up your graph. Use only the marked index contour lines to record
elevation data points, then connect the points to construct your sketch. Analyze
your sketch and discuss why this part of South Carolina's boundary was originally surveyed as a straight line. Would this boundary line be a good place along which to construct a hiking trail? Explain your answer.

11. **Analyze geographic distribution of trout streams.**

   Biologists have determined that most streams in the Lake Jocassee Region will contain trout if the elevation of the stream is over 1,000 feet. Trace with a wipe-off pen the paths of all streams on the **LAKE JOCASSEE TOPOGRAPHIC MAP** that meet this criterion (elevation higher than 1,000 feet). These higher streams are usually colder water streams and therefore make the best trout streams. Based on information from the topographic map and lithograph, what factors other than temperature do you think might create problems for trout in this area?

12. **Compare vegetation and bear habitat on north vs. south facing slopes.**

   Locate several areas on the **LAKE JOCASSEE REGION LITHOGRAPH** that would qualify as south-facing mountain coves. Compare the vegetation coverage in these coves to that on more exposed open areas on steeper south-facing slopes. What characteristics of infrared aerial photographs enable you to identify such areas? Also, compare this coverage with vegetation patterns on north-facing slopes. List observable differences. Why do blackberries usually grow better on south-facing slopes? These slopes are prime black bear habitat. Wildlife experts estimate that over 200 bears live in the mountains of upstate South Carolina and that their population density here approaches one black bear for every square mile of wilderness habitat. Draw a square, with an area of one square mile, anywhere on the lithograph such that at least half of the square is within the boundaries of Sumter National Forest (refer to topographic map for exact location). Examine the lithograph and identify at least five danger zones within that square where humans and bears are most likely to come in close contact. Predict how long a black bear would stay in this spot. Explain your prediction.

13. **Compare modern and pioneer life.**

   Locate, on the **LAKE JOCASSEE REGION TOPOGRAPHIC MAP**, where Laurel Fork Creek flows into the northeast side of Lake Jocassee not far below the North Carolina state boundary line. In the early years of the 20th century, before Lake Jocassee was ever constructed, a small community with several houses, and even a school, existed in the broad, flat valley of Laurel Fork Creek. Mark on the map the exact location at which you suspect the community might have been located. The lives of students attending that community school were very different from what most students' experience in modern times. The community no longer exists today. Discuss with your classmates where all the people might have gone and why the community ceased to exist. Imagine you have found the diary of one of these students in the Laurel Fork Community who left the area when he or she was 14 years old. Write what you think might have been included as daily journal entries for the week just before leaving home.
14. **Locate areas of active sedimentation.**

What coloration on the \textit{LAKE JOCASSEE REGION LITHOGRAPH} indicates sediment-filled water? What characteristics of infrared aerial photography make this determination possible? Locate areas of active sedimentation in Bad Creek Reservoir, Lake Jocassee, and Lake Keowee. In each case, speculate about the cause of the sedimentation. Is land use a factor? Explain your answer. Refer to the \textit{LAKE JOCASSEE REGION TOPOGRAPHIC MAP} for additional data.

15. **Analyze stream drainage patterns.**

Trace the original stream drainage pattern (ignoring all modern lakes and reservoirs) for the entire Keowee River Drainage System (includes the Keowee, Whittewater, Thompson, Toxaway, and Horsepasture Rivers) on the \textit{LAKE JOCASSEE TOPOGRAPHIC MAP}. Take special notice of the numerous right angle bends in each of the stream channels. Divide into groups to analyze each of these river patterns individually. Each group should construct a special kind of graph, called a “rose diagram,” for their assigned river by dividing a piece of graph paper into equal quarters and labeling the vertical and horizontal axes with compass directions (North, East, South, and West). Be sure the North Axis points toward the top of the page.

- **Group 1** Keowee River
- **Group 2** Whitewater River
- **Group 3** Thompson River
- **Group 4** Horsepasture River (Transylvania Co.)
- **Group 5** Toxaway River in North Carolina
- **Group 6** Toxaway River in South Carolina

Re-trace your assigned river, with a different color wipe-off pen, so that the river channel shows up as a series of straight-line segments and angular bends. This new tracing will not exactly match the actual path of the river channel, but it should be a close approximation. Do not try to trace every little bend of your river, but try for a total of between ten and twenty line segments that mark a mostly linear portion of the river channel. Measure, with a ruler and protractor, the length of each line segment and its compass orientation (degrees away from north). Transfer that information to your rose diagram by drawing each segment in its proper length and angular orientation. Be sure that the midpoint of every line segment falls exactly on the origin point of your graph (where the vertical and horizontal axes intersect).

What conclusions about stream patterns in the Lake Jocassee Region can you derive from your rose diagram? Compare your graph to those of other groups. How are they similar? How are they different? Can you identify an underlying geologic cause for these results? How would this relate to the geologic history of the Blue Ridge Landform Region?

16. **Prepare a land use management plan.**

Mark off a square one mile by one mile anywhere on the \textit{LAKE JOCASSEE REGION LITHOGRAPH}. Exchange your map with another group. Analyze your designated area and prepare a complete 'land use management plan' that will address environmental impacts, economic benefits, and social factors. You may refer to the \textit{LAKE JOCASSEE REGION TOPOGRAPHIC MAP} for additional information. Prepare a short presentation to give to the class. The class will act out the role of a county government planning commission that will have to decide whether or not to approve each group's plan. Groups not receiving approval must modify their plan or prepare additional documentation for a second hearing.
17. **Write a short story about how natural features were named.**

Examine the **LAKE JOCASSEE REGION TOPOGRAPHIC MAP** looking for unusual names for rivers, mountains, lakes and other natural features. List ten place names that your group agrees are unusual. Write down some brief explanations for why these names might have been given. From your list, select the most unusual name and write a short story about how that feature got its name. Share your stories with the rest of the class. Point out your location on the topographic map. Use the Legend of Issaqueena as an example. In your story, refer to other place names on the map so that other readers can follow the action.

**ENRICHMENT**

1. **Research land use restrictions.**

Examine various state and local programs designed to protect scenic mountain areas. Are land use and building restrictions needed in your local community (such as zoning and building codes)?

2. **Relate life history of trout to sedimentation problems in streams.**

Research the life history of the rainbow trout or brown trout and explain how excessive sedimentation in streams affects these fish.

3. **Research folklore associated with common plants.**

Obtain a copy of *Wildflower Folklore* or a similar book and research the folklore associated with the following plants common in the Lake Jocassee region.

- Butterfly-weed
- Mayapple
- Rattlesnake Plantain
- Foam Flower
- Mullein
- Solomon's Seal
- Jack-in-the-Pulpit
- Oconee Bells (Shortia)
- Trillium
- Jewelweed
- Pokeweed
- Watercress
- Joe-Pye Weed
- Queen Anne's Lace
- Yarrow

4. **Research potential for gold mining in Lake Jocassee Region.**

Research the potential for gold mining on the Chauga River and nearby areas in Oconee County. An application to prospect for gold in this area was turned down by government authorities in 1997. Examine newspaper articles from local newspapers as well as the article in *South Carolina Wildlife* magazine (September-October 1996 issue) to discover why the application was rejected.
Activity 2B-2: Power Production and Engineering

### Materials

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<td>JOCASSEE HYDRO STATION LITHOGRAPH</td>
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### PERFORMANCE TASKS

(Icon Key) Overview = ➔; Science = ☀; Math = ☐; History = ☐; Language Arts = ☞

1. **Identify possible second pumped storage facility site.** ➔ ☀

   Assume Duke Power Company wants to build a second pumped storage power facility in the Lake Jocassee Region. Select a site that you think will provide the greatest opportunity for electrical output with the least amount of environmental impact. What information will you need to make these decisions? You must locate the site on the LAKE JOCASSEE REGION TOPOGRAPHIC MAP, identify the best spot for a dam, mark off the area to be covered by the reservoir, locate your generators, run power transmission lines, roads, etc. Make separate lists of engineering and environmental obstacles you may encounter. Explain which items on each list are most significant and propose a method for overcoming both types of problems. Compare your site selection with that of other groups. Are there similarities in the areas you selected? What are the differences?

2. **Trace path taken by the nuclear reactor vessel in route to Lake Keowee.** ➔ ☐

   The nuclear reactor vessel for the Oconee Nuclear Station traveled all the way from Indiana to Lake Keowee on a variety of different transport vehicles. Refer to the paragraph entitled “The Oconee Nuclear Station” on page 2B-6. Trace, on the STATE BASE MAP #2, WITH HIGHWAYS, the South Carolina portion of the route (from Savannah, GA, to Lake Keowee). What obstacles did each form of transportation have to overcome to move such a large and heavy object? How long do you think each portion of the journey took? Explain your answer.

3. **Calculate the volume of water in a reservoir.** ☐

   Calculate the volume of water in the Bad Creek Reservoir by approximating a geometric shape for the surface area and hypothesizing an average depth or determining a maximum depth. Three possible options are to assume a triangular solid, a hemisphere, and a cylinder.

   - Volume of triangular solid = \( \frac{1}{2} \times \text{area of triangle} \times \text{depth} \)
   - Volume of hemisphere = \( \frac{2}{3} \pi r^3 \)
   - Volume of cylinder = \( \pi r^2 \times \text{height} \)

   Calculate the amount of power produced by that water based on the potential energy. Determine the elevation change as the water falls from the Bad Creek Reservoir surface to Lake Jocassee surface.

   Potential Energy = \( mgh \) (mass \times gravity \times height)
4. Locate a fire tower/wildlife observation center in wilderness. 
As a forest ranger for Sumter National Forest, you must locate and build a mountain cabin to service a combination fire tower / wildlife observation center in a wilderness area. You must locate the center at least two miles from the nearest paved road; and you must be on high ground to get a good view from the fire tower. You must also be sure your location is in South Carolina. What other factors do you have to consider when selecting your site? Present your plans as a group to the rest of the class. Evaluate other groups' sites.

5. Evaluate power generation options for wilderness cabin. 
Having located your cabin (from task #4), you will have to provide power of some kind to run your computer, short-wave radio, and other necessary household appliances. Refer to Figure 2B-3 "Operating Costs of Various Appliances" to determine your total power requirements. List all of the electrical appliances you will need along with their power requirements. Consider all of the different ways you can produce electrical energy to run these appliances. Do a cost-benefit analysis for each method and decide what method of power generation you will use. Note the environmental impact of each method you consider. Compare results among groups.

6. Plan new housing subdivision on lake. 
Plan the best location for a new housing subdivision on Lake Keowee by gathering data from the LAKE JOCASSEE REGION TOPOGRAPHIC MAP and the LAKE JOCASSEE REGION LITHOGRAPH. Use the Transparent Grid Overlay or a series of other transparent sheets as a template to record information. Use three different colors of wipe-off pens to shade in the following areas:
- Red = all areas one mile or less away from a paved road
- Green = all areas one mile or less away from Lake Keowee
- Blue = all areas one mile or less away from a power line corridor

Look over all areas that meet all of the criteria and select the best location for the subdivision. Why are these three criteria important for selecting sites for new subdivisions?

7. Evaluate stream profile for hydroelectric potential. 
Using the LAKE JOCASSEE REGION TOPOGRAPHIC MAP as a guide, draw a stream profile graph along the line of the Thompson River from its confluence with Reed Branch (north of Long Spur Ridge and Misery Mountain) to its entry into Lake Jocassee. Treat the stream channel as a straight line (even though it's not) and transfer stream distance measurements to the horizontal axis of your graph. Use only the marked index contour lines to transfer elevation data to the vertical axis of your graph. Before you set up your vertical scale, determine the beginning and ending elevation values for your stream profile. When your elevation points have been transferred, connect the points with a smooth line and describe the resulting profile. Explain why such a profile is appropriate for producing hydroelectric power, and is especially favorable for pumped storage projects. What other topographic factors are important for locating hydroelectric power projects?
8. Speculate about future uses of facilities used for energy production.

In the future, nuclear fusion, solar, or some other abundant energy source might eventually replace the need for both nuclear fission power plants and pumped storage facilities. If the Bad Creek facility were no longer needed to produce energy, what would you do with the site? Refer to the LAKE JOCASSEE REGION TOPOGRAPHIC MAP and the LAKE JOCASSEE REGION LITHOGRAPH to justify and explain your plan. What would you do with the Oconee Nuclear Station power plant? Refer to the OCONEE AND KEOWEE STATIONS LITHOGRAPH inset to justify and explain your plan.

9. Identify areas threatened by point source and non-point source pollution.

Refer to the LAKE JOCASSEE REGION TOPOGRAPHIC MAP, the BAD CREEK HYDRO STATION LITHOGRAPH inset, and Figure 2B-1 "Bad Creek Pumped Storage Project.". Trace on the lithograph the path of underground pipes and water flow, the reservoir, the building complex, and the outflow into Howard Creek. Also, for Howard Creek, identify areas of sediment influx and trace the stream channel downstream. For the spoils area, hypothesize as to why it was located so close to the reservoir, why it was terraced, and why the material was not simply used up in making the dam. Locate possible sources of both point source and non-point source pollution associated with the Bad Creek Project and suggest ways that Duke Power Company might have used to minimize environmental impact.

10. Locate power line corridors.

Locate, on the LAKE JOCASSEE REGION LITHOGRAPH and the LAKE JOCASSEE REGION TOPOGRAPHIC MAP, several sets of power lines that come together at the Lake Jocassee Dam. Also locate these power lines on the JOCASSEE HYDRO STATION LITHOGRAPH inset. Which lines are shown on the lithograph, but not on the topographic map? Why is this so? Use a wipe-off pen to draw the missing power lines onto the topographic map. Are any power lines shown on the topographic map, but not on the lithograph? Can you determine which direction the electricity is flowing in a power line from map or lithograph information? Explain your answer.

11. Determine whether power lines are visible from center of lake.

Power companies usually try to place their power lines so they are not easily seen. Determine whether the power lines to the east and to the west of Lake Jocassee (as seen on the LAKE JOCASSEE REGION LITHOGRAPH) are visible from a boat located in the exact center of the lake. The easiest way to determine this is to draw a topographic profile, using information on the LAKE JOCASSEE REGION TOPOGRAPHIC MAP, from the center of the lake to the location of the power line in question and see if the power line lies in a direct line of sight. The center of the lake can be assumed to be the location where the Whitewater and Toxaway Rivers used to join together (before Lake Jocassee was constructed) to form the Keowee River. Group A should draw a topographic profile from the western power line to the center of the lake, while group B should draw a topographic profile from the eastern power line to the center of the lake. How easy is it to hide power lines from view?
12. **Compare ease of identification of features on map and photo.** ✪ ✧ ✈

Use the **JOCASSEE HYDRO STATION LITHOGRAPH** inset to identify the dam, substation, parking lot, roads, power lines, and the peregrine falcon cliff (shaded shoreline area at very top center of inset image). Locate these same features on the **LAKE JOCASSEE REGION TOPOGRAPHIC MAP**. Which features are easier to identify on the map? Which features are easier to identify on an aerial image? How high is the peregrine falcon cliff? How deep is the lake at the base of this cliff? What is unusual about the way this cliff is illustrated on the topographic map?

13. **Analyze vegetation types by examining infrared color signatures.** ✪

Use the **OCONEE AND KEOWEE STATIONS LITHOGRAPH** inset and Figure 2B-2 "Oconee Nuclear and Keowee Hydroelectric Stations" to identify the cold-water intake area, warm-water release area, dam, hydroelectric plant, nuclear plant, waste storage facility, visitor center, parking lots, roads, and power line corridors. Analyze the different types of vegetation shown on this image by examining the infrared color signatures. Speculate as to what kind of ground cover is present on the dam, surrounding the nuclear plant buildings, along highways, along lakefront property, and in power line corridors. What advantages would each vegetation type have in each of these locations?

14. **Calculate change in lake levels when pumped storage water is released.** ✧

Use the **BAD CREEK HYDRO STATION LITHOGRAPH** inset and the Transparent Grid Overlay to calculate the surface area of Bad Creek Reservoir. The volume of many lakes can be approximated by multiplying the area times two-thirds of the maximum depth (or take volume value from task #3). Next use the **LAKE JOCASSEE REGION LITHOGRAPH** and the Transparent Grid Overlay to calculate the volume of Lake Jocassee the same way. Using these data, determine a method to predict the total rise in elevation of Lake Jocassee when Bad Creek Reservoir is drained to generate electricity. You may assume (for simplicity) that the entire reservoir drains, although this does not actually happen. Determine the percentage increase in volume of Lake Jocassee and use this information to determine the new elevation of the water surface.

15. **Explain why contour lines do not line up with lake shoreline.** ✪

Examine closely the shoreline of Lake Jocassee as shown on the **LAKE JOCASSEE REGION TOPOGRAPHIC MAP**. Notice how the shoreline seems to cross contour lines in several places. Is such a situation physically possible? Explain your answer. Explain how such a situation could happen during the process of printing a topographic map.
ENRICHMENT

1. **Determine how much power people generate in one day.**
   Use a variety of references to determine how much horsepower the average person can generate in one day. How many light bulbs would this much power be able to light? How many hair dryers? Can you invent a way that human power could be harnessed to operate light bulbs and hair dryers? Share your results with the class. If any of the ideas seem practical, make it a class project to produce a working model of the invention.

2. **Research advantages and disadvantages of coal-fired energy facilities.**
   Research the requirements and environmental impact of coal-fired energy facilities. Would it be feasible to substitute coal-power for the Oconee Nuclear Power Station? Would it be feasible to substitute coal-power for a pumped-storage hydroelectric facility? What would be the long-term effects of such substitutions?

3. **Research the Duke Power Management Plan for the Bad Creek Project.**
   Obtain a copy of the Duke Power Management Plan for the Bad Creek area. Identify all of the partners who worked with the power company to plan and implement the pumped storage project. What did each group hope to accomplish by being a part of the partnership? Did they achieve their goal?

4. **Research public opinion of nuclear power plants through time.**
   Research various historical media to locate articles, documentaries, etc. that reflect changing public opinion toward the nuclear power industry at various points in recent history. For example, compare the treatment of nuclear power by postwar cartoonists and columnists in the 1940’s to public reaction to the more recent Three Mile Island and Chernobyl nuclear plant accidents.
SECTION 3
PIEDMONT REGION

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  p. 3B-4 1. locate the study site
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  p. 3B-6 1. analyze the newspaper article
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  p. 3B-7 5. evaluate reasons for abandoned roads
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  p. 3B-7 7. calculate statistics based on areas of fields
  p. 3B-7 8. estimate area of contoured field
  p. 3B-8 9. relate topography to distribution of agricultural fields
  p. 3B-8 10. select agricultural products to display on water tower
  p. 3B-8 11. interpret agricultural market changes through time
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  p. 3B-8 1. identify where kudzu was planted to control erosion
  p. 3B-8 2. research egg production
  p. 3B-8 3. evaluate information in Farmers' Almanac

- STUDY SITE 3C: KINGS MOUNTAIN
  (ICONS) Overv = Sci = Math = Hist = Lang Arts =
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  - Rationale
  - Brief Site Description
  p. 3C-2 - Transportation Corridor and Land Use
  p. 3C-2 - Historical Battlefield
  p. 3C-4 - figure 3C-1 - "Battle of Kings Mountain"
  p. 3C-5 - story - "Doak's Famous Sermon and Prayer"
  p. 3C-6 - story - "Ferguson's Address to Loyalists"
  p. 3C-6 - Mining and Environmental Restoration
  p. 3C-7 - story - "Case Study I - Blacksburg Quarry"
  p. 3C-8 - story - "Case Study II - Henry Knob Kyanite Mine"
- **Activity 3C-1 : Transportation Corridor**
  - Materials
  - Performance Tasks
  p. 3C-9 . . . . . . . . 1. locate the study site ❍
  p. 3C-9 . . . . . . . . 2. identify Kings Mountain on map and lithograph ❍
  p. 3C-9 . . . . . . . . 3. examine pattern of transportation routes ❍
  p. 3C-10 . . . . . . . . 4. explain parallel routes of transportation systems ❍
  p. 3C-10 . . . . . . . . 5. compare grade of transportation right-of-ways ❍
  p. 3C-10 . . . . . . . . 6. relate transportation routes to drainage patterns ❍
  p. 3C-11 . . . . . . . . 7. describe appearance of utility corridors ❍
  p. 3C-11 . . . . . . . . 8. examine effect of interstate highway on local towns ❍
  p. 3C-11 . . . . . . . . 9. write letter and report recommending site for new factory ❃

  - Enrichment
  p. 3C-12 . . . . . . . . 1. investigate reasons businesses locate in an area ❃
  p. 3C-12 . . . . . . . . 2. interview owners of small businesses ❃

- **Activity 3C-2 : Kings Mountain Battlefield Site**
  - Materials
  - Performance Tasks
  p. 3C-13 . . . . . . . . 1. locate features at battle site ❃
  p. 3C-13 . . . . . . . . 2. calculate slope of Kings Mountain ❃
  p. 3C-13 . . . . . . . . 3. analyze choice of Kings Mountain as British outpost ❃
  p. 3C-14 . . . . . . . . 4. describe the battle of Kings Mountain ❃
  p. 3C-14 . . . . . . . . 5. analyze the newspaper article ❃
  p. 3C-14 . . . . . . . . 6. discuss effects of speeches on public opinion ❃
  p. 3C-14 . . . . . . . . 7. explain location of springs on Kings Mountain ❃
  p. 3C-14 . . . . . . . . 8. write obituary for Ferguson ❃

  - Enrichment
  p. 3C-15 . . . . . . . . 1. research African-American military heroes ❃
  p. 3C-15 . . . . . . . . 2. document importance of Kings Mountain Battle ❃
  p. 3C-15 . . . . . . . . 3. research careers of Kings' Mountain commanders ❃

- **Activity 3C-3 : Mining and Environmental Restoration**
  - Materials
  - Performance Tasks
  p. 3C-16 . . . . . . . . 1. locate strip mine sites ❍
  p. 3C-16 . . . . . . . . 2. analyze land use changes through time ❍
  p. 3C-16 . . . . . . . . 3. identify mineral resources of Kings Mountain area ❍
  p. 3C-16 . . . . . . . . 4. document changes in mine site ❍
  p. 3C-16 . . . . . . . . 5. document environmental problems at Henry Knob ❍
  p. 3C-17 . . . . . . . . 6. predict size of smallest detectable object ❍
  p. 3C-17 . . . . . . . . 7. describe impact of environmental restoration ❃

  - Enrichment
  p. 3C-17 . . . . . . . . 1. write to a mining company ❃
  p. 3C-17 . . . . . . . . 2. research mining operations ❃
POWER THINKING ACTIVITY - "The Dilemma of the Desperate Deer"

Your group is attending a town meeting in the community of Silverstreet to decide what to do about the steadily increasing number of deer which are causing accidents on the highways and eating up farmers’ crops because of a shortage of natural food. The deer live in the forest along the Bush River near Silverstreet (upper right-hand quarter of the SILVERSTREET LITHOGRAPH and middle left-hand side of the SILVERSTREET TOPOGRAPHIC MAP). Each person in your group should choose one of the following positions to defend. Use the topographic map and lithograph to provide evidence for your case. Debate the issues within your group and try to arrive at a consensus plan for solving the problem. Compare your final group plan with the plans of other groups. Which group plan has the best chance for success?

<table>
<thead>
<tr>
<th>Position</th>
<th>Argument</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FARMER</strong></td>
<td>&quot;I'm losing money because of the crop damage. I want to get rid of the deer completely. I don't care how.&quot;</td>
</tr>
<tr>
<td><strong>DEVELOPER</strong></td>
<td>&quot;I want to build more homes in the forest. I don't want any hunting there. Besides, homeowners like to see deer.&quot;</td>
</tr>
<tr>
<td><strong>HUNTER</strong></td>
<td>&quot;I want to be able to keep hunting in the forest. I want the deer to stay. Let the hunters keep the population down.&quot;</td>
</tr>
<tr>
<td><strong>CONSERVATIONIST</strong></td>
<td>&quot;I want to see the deer protected, even if it means moving them somewhere else. We need to create a park for them.&quot;</td>
</tr>
<tr>
<td><strong>TAXPAYER</strong></td>
<td>&quot;It's not my problem. I don't care what happens to the deer. Do whatever you want as long as it doesn't raise my taxes.&quot;</td>
</tr>
</tbody>
</table>

PERFORMANCE OBJECTIVES

1. Explain the geological processes that produced characteristic Piedmont Region landscapes and drainage patterns.
2. Interpret the meaning of Catawba tales and their relation to the natural environment and practice retelling folklore stories.
3. Trace the routes taken by families entering South Carolina on the Great Wagon Roads and settling in the Piedmont Region.
4. Analyze agricultural soil conservation and land restoration practices by identifying distinctive patterns of land use on maps and lithographs.
5. Design a typical Piedmont reservoir and describe shape of shoreline and environmental effects of reservoir on surrounding areas.
6. Examine the location of active and inactive gold mines with respect to rock sources, topography, and geologic belt.
7. Construct topographic profiles of several areas in the Piedmont Region to represent landscape diversity.
8. Analyze folktales to identify and locate references to distinctive Piedmont landscape features.
9. Differentiate land use in the Piedmont Region with respect to slope, land elevation, type of soil, and type of vegetation as determined from maps and lithographs.
BACKGROUND INFORMATION

**Description of Landforms, Drainage Patterns, and Geological Processes**

**Characteristic Landforms of the Piedmont**

The word **Piedmont** is derived from a French word meaning Foot of the Mountains. Although the South Carolina Piedmont certainly qualifies, it is only the northwestern portion that is technically at the foot of the mountains. The rest of the region stretches over 100 miles towards the southeast in a gradually sloping, mostly flat plain. The eastern boundary of the Piedmont Region can be identified by drawing a line on the map from North Augusta on the Savannah River through Columbia and to the place where the Pee Dee River enters South Carolina.

The land surface is quite hilly in the higher elevations towards the northwest, but becomes more gently rolling at the lower elevations next to the **Sandhills** Region. Modern Piedmont rivers, usually wider and flowing more gently than **Blue Ridge** streams, are actively eroding into the Piedmont causing steep-walled valleys with locally high relief. Piedmont rivers often have dendritic (branching) drainage patterns and are usually full of suspended sediment transported from the mountains. Occasionally, this suspended sediment is temporarily deposited in wide flood plains which provide rich and very productive soil for agriculture. Between river valleys, the broad upland areas are essentially flat.

Occasionally, the relatively flat rolling topography is interrupted by deeply dissected stream valleys and a few scattered hills, called **monadnocks**. These are single mountains, typical of the Piedmont, left comparatively undisturbed by erosion. Monadnocks are usually surrounded by relatively flat ground and can therefore be seen from many miles away. Sometimes these hills are composed of harder rock which accounts for their greater resistance to erosion. In other cases, it seems to have been pure chance which has allowed them to escape erosion.

**Geographic Features of Special Interest**

Because of their elevation over surrounding areas, monadnocks are perfect locations for TV, radio, and microwave broadcasting towers. Some examples include Paris Mountain near Greenville, Six Mile Mountain in Pickens County, Little Mountain southeast of Newberry, and Kings Mountain east of Blacksburg. In addition, many large non-mountainous bodies of granite rock occur throughout the Piedmont. These features show up as bald rock exposures scattered around the landscape. In reality, the total granite rock mass underground is much greater than the small amount visible at the land surface. The largest and most famous of these exposures is called "Forty Acre Rock" (although only about fourteen acres are actually visible at the surface), located near Taxahaw in Lancaster County. Another famous outcropping, called "Ten Acre Rock," located near Rion in Fairfield County, is the site of a large quarry operation which mines the prized "Winnsboro Blue Granite."

Great Falls, on the Catawba River, used to be one of the largest waterfalls in the state before the river was dammed to form several small reservoirs. Old-time residents
claim that the roar of the falls could be heard for miles around whenever the river level was high.

Shallow sections of flat rock exposed in streams are called shoals. These were typically places where horse-drawn wagons could cross the stream safely during times of low stream flow. Two well-known examples are Ware Shoals on the Saluda River in Greenwood County and Fork Shoals on the Reedy River in Greenville County.

Almost every Piedmont river, stream, creek, and branch has at least one dam and reservoir combination. These reservoirs range in size from local farm ponds to large impoundments like Lake Hartwell and Clark Hill (Thurmond) on the Savannah River, Lake Murray on the Saluda River, and lakes Wylie and Wateree on the Catawba River.

**Piedmont Rock Types**

Rock types of the Piedmont are remarkably similar to those of the Blue Ridge Region, differing only in specific mineral content and in regional distribution. Both igneous and metamorphic rocks are present in great variety in the Piedmont. Large igneous intrusions (plutons) range in composition from rocks rich in iron and magnesium silicate minerals, such as the gabbro in Abbeville County, to rocks rich in aluminum, potassium, or sodium silicates, such as the granites in Fairfield and Kershaw counties. All such intrusions represent previously molten rock formed deep within the earth's crust during episodes of tectonic activity, primarily due to continental collisions, during the Paleozoic Era. Several of these igneous rocks are mined for monuments, memorials, tombstones, and foundation stone. The most famous rock type is the Winnsboro Blue Granite which is mined at the Anderson Quarry near Rion in Fairfield County. Blue Granite has been designated as our state rock.

A small but significant outcropping of Mesozoic age sedimentary rocks occurs in northern Chesterfield County. These rocks, identified mostly as sandstone and shale, were deposited in downfaulted basins (usually called Triassic Basins) associated with rift zones which became active at the time the Atlantic Ocean first opened. At about the same time, a series of narrow igneous dikes intruded the older Piedmont rocks and the overlying sedimentary deposits. While the sedimentary deposits have been eroded almost completely away, the intrusive dikes remain as evidence of the geologic activity which accompanied the continental separation. Many geologists believe that this activity caused the opening of the Atlantic Ocean in the Mesozoic Era. Such dikes can be found today in most areas of the Piedmont in South Carolina.

Metamorphic rocks are primarily gneiss and schist, but local deposits of marble exist in Cherokee County and other less common types of rock occur locally. These rocks vary considerably in their mineral content throughout the Piedmont, but more importantly, they differ in the extent of their metamorphism. Piedmont metamorphic rocks are broadly grouped into several parallel bands crossing the state from southwest to northeast, a trend produced by the pattern of the Paleozoic Era, Pennsylvanian Period, continental collisions.
**Geologic Belts of the Piedmont**

Refer to the figures of the "Geologic Time Scale and South Carolina" and the "Cross-Section of South Carolina" in Section 1, Background Information, to determine the location and extent of the Piedmont rock belts. The four most prominent belts or parallel bands crossing the state are designated as follows:

<table>
<thead>
<tr>
<th>Belt</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner Piedmont Belt</td>
<td>Strongly folded, recrystallized, metamorphic rock</td>
</tr>
<tr>
<td>Kings Mountain Belt</td>
<td>Less metamorphosed, economically valuable mineral assemblages, including lithium, tin, kyanite, and barite</td>
</tr>
<tr>
<td>Charlotte Belt</td>
<td>Moderately metamorphosed rocks, containing igneous intrusions</td>
</tr>
<tr>
<td>Carolina Slate Belt</td>
<td>Only slightly metamorphosed rocks, containing original sedimentary structures, includes sandstone, mudstone, volcanic sediment, granite intrusions, gold mines</td>
</tr>
</tbody>
</table>

The Inner Piedmont Belt is the northwesternmost major division of metamorphic rock. Once a thick sequence of volcanic and marine sediments, these rocks were at the center of the continental collision zone and were the most severely deformed, folded, and recrystallized during regional metamorphism.

The Kings Mountain Belt, next towards the southeast, is a much less metamorphosed narrow zone containing some rather unique mineral assemblages. Some of the more economically valuable materials being mined today include lithium, tin, kyanite, and barium. Most of these rocks were originally volcanically produced sediments, but they include some deposits of quartzite and marble.

The third zone is the Charlotte Belt, a moderately metamorphosed region which contains the majority of the igneous intrusions found in the Piedmont. Rock types found in this belt vary from metamorphosed granites (biotite and amphibolite gneisses) to metamorphosed gabbros or volcanic rocks.

The final zone, at the southeastern edge of the Piedmont, is the Carolina Slate Belt. Rocks in this region have been only slightly metamorphosed and can contain some original sedimentary structures and some occasional fossils. The major rock types are sandstone, mudstone, and volcanic sediments, although some large granite bodies occur in this zone. All of the current gold mining in South Carolina is in the Carolina Slate Belt in volcanic deposits and other sediment which were metamorphosed by hot fluids released from localized igneous intrusions.
Influence of Topography on Historical Events and Cultural Trends

The Catawba Nation

It has been estimated that there were originally at least twenty-eight Native American nations inhabiting South Carolina. While many of these nations were small, one of the largest in the state was the Catawbas who spoke a Siouan language. Their lands were centered along the present North Carolina - South Carolina boundary line. Like other Southeastern nations, the Catawbas hunted, fished, and cultivated corn, beans, squash, and pumpkins. They lived in bark-covered houses within villages surrounded by stockades.

The coming of the English had a dramatic and lasting impact upon the Catawbas, as well as other Native American cultures within South Carolina. Whiskey and smallpox did much to weaken the Catawbas’ ability to resist the white settlers encroaching upon their ancestral lands. The Treaty of Pine Tree Hill (near Camden) in 1760 promised the natives protection from the settlers who illegally seized their lands and also promised them a fifteen-mile-square reservation (225 square miles or 144,000 acres) in return for their ceding over eight million acres. In 1763, the Treaty of Augusta reaffirmed the Catawba’s 144,000 acre homeland.

By 1826, most of this 225-square-mile reservation had been leased to whites. Then in the Treaty of Nation Ford (1840), the state agreed to purchase the remaining Catawba lands in South Carolina but promised to purchase a new homeland for them in North Carolina. However, North Carolina refused to agree to this arrangement and the Catawbas were left homeless. The fact that South Carolina had not obtained federal approval of the treaty (as required by the federal 1790 Non-Intercourse Act*) meant that the treaty was legally questionable. In 1842, the state did purchase some 600 acres as a reservation for the Catawbas (now referred to as the Old Reservation).

Through often changing and conflicting state and federal policies regarding Native Americans, the Catawbas struggled to maintain their cultural identity. Their pottery serves as a historic link with their past. Their pottery continues to be made using ancient traditional pottery techniques. It is made from special clay taken from the banks of the Catawba River (at a secret location). This special clay is filled with bits of mica and contains a relatively high percentage of iron oxide.

Throughout the years, the Catawbas have continued to claim 144,000 acres of land in York and Lancaster counties and filed a lawsuit to reclaim it in 1980. On October 28, 1993, President Clinton put an end to this 150-year-old land dispute and a twelve-year federal court suit by signing into law a settlement of the Catawba land claims. Under the terms of the settlement, the federal government agreed to contribute $32 million, and state and local sources agreed to contribute an additional $18 million to settle the claims against South Carolina. Inhabitants of the reservation are also eligible for federal benefits. Throughout a long, drawn out struggle, the Catawba nation has managed to maintain a large portion of its cultural identity in an ever changing world.

* The Non-Intercourse Act was the name of a law passed by the US. Congress that forbade states to make treaties with any Indian tribe unless approved by the US. Government.
Little is known about the origin of the ancient people that have come to be known as the Catawbas. From stories recorded by Spanish chroniclers we know that the Catawba people called themselves ye iswa (nea eswa) meaning "river people." Much of the history and culture has long been forgotten. Some of the remnants, though, such as the pottery tradition and folk stories told in their native Siouan language, as well as historical sketches recorded by the first Europeans to make contact, are still with us today.

Ye Iswa (People of the River)
Collected stories retold by Bob Ward from interviews at the Catawba Reservation

The old chief stirred before the fire and murmured a moment in the tongue of his fathers. Then he turned again to his tale. "I think the Catawba have always been here on the river. And why not? Are we not People of the River?" The flames crackled and I did not dispute him...

Thus goes the story of the chief of the mighty Catawba who called themselves Ye Iswa, People of the River. The Catawba Nation originated from tribesmen who were members of a Canadian community driven from their homes by the Connewango Nation. From Canada they wandered and settled at times in Kentucky and Virginia. Finally, they reached a river where they fought with the Cherokee, each side losing more than 1,000 men. The site of this bloody battle was said to be Nations Ford. These two tribes at last reached a settlement. The Cherokee would live on the territory west of the Broad River while the Catawba would live along the east banks of what would be known as the Catawba River. The land between was to be neutral territory--they could hunt on the nightfall. The Catawba River was named for this great aboriginal tribe probably from the Choctaw word "katapa," meaning "separated." The last of the Catawba soon will pass to the happy hunting ground--the "humbari," the "where-you-never-die" --of their fathers. And with them will die a thousand tales of a vanished people.

The wind whispered and sighed; and the wind and the night were part of the tales. With the firelight etching the wrinkles deep on his dark Indian face and warming his copper hands, the chief spoke the tales softly to the flames across the pines and red gullies to the banks of the Catawba River, now slow and muddy in the eye of his minds. He recalled the days when King Hagler and his children walked in the shade of their ancestors, the masters of the forests.

Old Bob Harris said it was understood by the Catawba of generations past that storytelling was intended to develop the mind, to make children think, to
teach them the ways of life. Tales or stories as some prefer to call them should never be told at night according to the wise warriors of the Catawba. Such tellings cause trouble from snakes. Once a mighty warrior left his home knowing that he would be away until late at night; however, he never said aloud the time he meant to leave or return. Instead, he told his family that he was leaving on the following day--this might sound a bit confusing and that's good. If you couldn't figure it out hopefully the snakes couldn't either!

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**The Story of the First Woman**
Retold by Libby W. Carnohan

Once the world was nothing but an unbroken waste of rocks and mountains except for one small, lovely valley where lived the sole inhabitant of earth—a beautiful woman. The woman lived on honey and sweet berries and fruit during the eternal summer. For music, she listened to the singing of the birds; her friends were the beaver and the doe. Dressed in the bright green leaves of the water lilies, she was the ruling spirit of this world which never grew old. Even the flowers bloomed and never faded or died in this paradise.

One morning, she was sitting at the entrance to her cave when a scarlet butterfly with fluttering wings drew her away. Up, up far into a rocky ravine, she followed the butterfly until she reached the foot of a tall waterfall. There she lost sight of her scarlet guide. She searched and searched, but she could not find the way out of the ravine. She felt fear for the first time. She wandered farther and farther astray until finally she fell to the ground, weary and broken-hearted.

During the dark night, she woke in pain. The dew had fallen and the damp, cold air had caused her legs to cramp. When she turned her face toward the moon, she saw a form much like her own, though fiercer, bending over her. Dressed in a cloud this inhabitant of the sky raised her up and comforted her. “He” told her that he had been traveling from the evening to the morning star when her plight aroused his compassion.

By rescuing her, this sky-man had broken the Great Spirit’s command. Afraid, then, to return to the sky, he asked if he might remain with her on earth. She consented and the two found their way back to the magical valley where “as man and woman” they lived together for many moons in perfect peace and joy.

In time, the woman gave birth to a child and their happiness increased, but so did their troubles and cares. Soon, they thought the earth might be as filled with people as the trees are covered with leaves and the dark with stars. Afraid for the future, they sought the guidance of the Great Spirit.

The Great Spirit looked down upon the man and woman with pity and caused a mighty wind to range mountains together and open valleys and prairies. From the rising to the setting of the sun the earth was beautiful. The Great Spirit told the children that the earth was a gift to them from his hand and was to be their inheritance. Because, however, the man had broken his command, they must work for their food and each year would have a season of bitter cold. Moreover, their lives would be limited in years—then they must die. They would know the time was near when their heads became white as the plumage of the swan.
The Woman Who Became an Owl
Traditional

A woman who became an owl, yamusi, became an owl. Woman old night fire road chimney out went. Old woman the two were bara yere. ustugri o me ya ket cere du g ya phapki wa re ustugri hi xhi x these now sisters were. Hoot owl alone transformed home tree up sat. ha tikire yamusi ki ye dapa ikto nere ustugri kere watka in yere hoot owl exclaims old woman the. One witch is hoot owl this chicken steal.

Free Translation
An old woman sitting beside the fire one night went up through the chimney. The two old women were sisters. One had become transformed and had taken the form of a hoot owl and sat up in a tree. "Hoot Owl," exclaimed the old woman. One witch is a hoot owl that stole the chicken.

The Legend of the Comet
Traditional

Once a woman’s son was stolen by another woman. The mother searched and searched. Finally she found her son and together they escaped from the earth and rose high up into the sky. The thief who had stolen the boy caught hold of a rope the mother and her son had let down to the earth. Ungi, for that was her name, lost her hold and fell down through the sky leaving behind her a brilliant streak like a tailed star. She became a comet. Delighted to never fear Ungi again, the mother and son soon went to humbari (heaven) and the son became a perfect little cloud.

The Legend of the Brownies
Traditional

In the old Catawba cemetery and elsewhere along the Catawba river live the little “Brownies” who have always been known to the Catawba people. Brownies are tiny dwarfs who sometimes capture children and take them away and tie their hair in the bushes. Old folks say that just the mention of a Brownie could keep a child from wandering off.

The Rooster and the Fox
A trickster tale as retold by Libby W. Carnohan from notes of Bob Ward

Rooster was feeding up in a tree one day when along came Fox. “Come on down,” said Fox. “Don’t be scared of me. I won’t hurt you. Haven’t you heard that peace has been declared between all birds and animals?” “Why, no,” said Rooster. “Nobody told me.” “Well, it’s true,” said Fox. “The news has gone around and I thought everybody had heard, so come on down.” From up in the tree, Rooster could see a pack of dogs coming following Fox’s trail. He said, “Well, if that’s true, I’ll be down directly. Then you and me and that pack of dogs headed this way can sit down peacefully and talk.” With that, Fox saw the dogs coming over the hill and ran away. I guess you might say Rooster out foxed him.
Catawba Pottery

Out of two riverbeds, the Catawba dig the clay they use for the pottery which has allowed their culture to continue. These clays are cleaned and mixed to remove all foreign substances and then strained until workable. This part of the process can take weeks. Finally, the potter takes the prepared clay and using a coiling method, begins to make a pot or bowl. Potters use their hands, sticks, shells, knives, spoons and rocks to form the clay in the desired shape. The unusual finish found on Catawba pottery is applied with a rubbing rock. A good pot will have a finish like velvet. The last step in the process is the firing. The Catawbas use the old ways. They burn the pottery in a bonfire fueled with seasoned oak. Most potters burn three fires to produce a finished pot. The entire process is slow, but the results are some of the finest native American pottery you can find. This pottery, regarded as "a pure aboriginal art form," sells for as much as $500 a piece to museums and collectors around the country. Many of the Catawbas use their pottery in exchange for goods and services. For instance, one potter has paid all of his medical bills over the years with pottery. This is the old system of bartering.

During the dispute over the land claim, where the Catawbas sought restitution for land which once belonged to the them, one of the sources of the clay was endangered. Many say this particular clay, found in a deposit near Van Wyck, produces a unique form of burned pottery which is especially rare. This clay can only be harvested from this deposit, and the owner, who was a defendant in the lawsuit, refused to allow the Catawbas to continue digging. Since this dispute began, the potters have run dangerously low on clay and are actively searching for a quality deposit elsewhere. This clay is typically found in deep gullies along the Catawba River, five to six feet under the topsoil.

Figure 3-2: Map of the Great Philadelphia Wagon Road
Immigration into the Piedmont

The Great Philadelphia Wagon Road was a major immigration route for German and Scotch-Irish settlers who moved into the Piedmont of South Carolina. The wagon road stretched seven hundred miles from Philadelphia, extended through the Carolina Piedmont, and ended at Augusta, Georgia. It was German settlers living in Pennsylvania who developed a covered wagon, known as the Conestoga, which was used extensively on this road. This heavy wagon was constructed of hardwoods and required six horses to pull it. It was covered by a canopied top that was called a "poke bonnet" due to its similarity to a women's bonnet. When fully loaded these wagons could travel approximately thirty miles a day. It was in such wagons that Andrew Pickens and the parents of Andrew Jackson followed the Great Wagon Road into the Waxhaw section of South Carolina. During the last years of the colonial period, the Great Philadelphia Wagon Road became one of the most heavily traveled roads in America.

Settling the Piedmont: Act of 1743

Due to a combination of factors such as lack of roads, lack of navigable rivers, and fear of Native American attacks, settlers were reluctant to move into the Back Country (a term used during colonial times to describe the area above the Fall Line Zone) of South Carolina. The Royal Assembly of South Carolina attempted to encourage immigration into this area by passing a law in 1743, known as The Act of 1743, which would provide potential settlers with transportation, tools, a year's provisions and even livestock. This act provided that each settler over the age of twelve would be provided 300 pounds of salted beef, 50 pounds of salted pork, 200 pounds of rice, 8 bushels of corn, 1 bushel of salt, 1 ax, 1 wide hoe and 1 narrow hoe. Every five men were to receive a cross-cut saw, and every family of 5 or more was to receive a cow and calf. Also, under colonial law, a settler could claim 50 acres for each member of his family (referred to as a head-right) and also for each servant he might have.

Farming in Colonial Times

During the colonial period of South Carolina's development, it was mostly farmers who settled in the Piedmont Region. They arrived with a pair of horses or yoke of oxen, a small wagonload of household goods and farm tools, and a few cattle, hogs, and chickens. Many received land grants for small farms of about 175 acres. They preferred hillside locations near creeks rather than large rivers. Often the rivers flooded the bottomlands making the rivers hard to cross. Smaller creeks could easily be crossed providing more mobility to the settlers. Many natural springs in the hillsides provided a good source of water. The early settlers arrived in the winter months so that a shelter could be built and a few acres of land cleared in time to plant a spring crop of corn and other food. As time went on, apple and peach trees were planted to provide cider and brandy. The soil was very rich at first, but with continuous planting of crops and the subsequent soil erosion, it soon became depleted. Later when cotton was introduced, it was planted extensively and caused increased erosion and more depletion of soil nutrients.
South Carolina Regulators

After peace with the Cherokees in 1761, settlers poured into the Back Country of South Carolina. The Assembly, in 1757, created St. Marks Parish which covered one-third of South Carolina. It stretched from the Pee Dee River to the Santee-Congaree-Saluda river system. By 1776, almost half the total population of the colony (and four-fifths of the white population) lived in the Back Country. Yet, the region had inadequate representation, no courts, and few roads, churches, or schools. Reverend Charles Woodmason (an Anglican clergyman) published his observations of the depredations of the numerous outlaws who terrorized, robbed, and murdered the settlers in the Back Country.

The Back Country settlers' needs and petitions for help were ignored for a long time by the Assembly. Yet the Assembly spent thousands of pounds to construct the Exchange in Charleston, purchase a statue of William Pitt, support the Wilkes Fund, and pay for a delegate to attend the New York Stamp Act Congress. In seeking to protect themselves and their property, the settlers formed local associations known as "Regulators" and refused to pay taxes until their grievances had been addressed. Moving to enforce the Law locally, they soon began defying orders from the courts in Charleston. The Regulators clashed with sheriffs and "loyal militia." With the very real threat of major violence in the Back Country, the Assembly set up new circuit courts in Cheraw, Camden, Orangeburg, and Ninety Six. Still, many of the Back Country grievances against Charleston had not been settled when the American Revolution started.

Battlegrounds in the Piedmont

The Back Country of South Carolina played an important role in the American Revolutionary War. The first military action in the state between American patriots and British loyalists that resulted in bloodshed occurred at the town of Ninety Six. Loyalist forces attacked Major Andrew Williamson's patriot force at the fort which the patriots had previously constructed. These rival forces fought from November 19 to November 21, 1775, before finally agreeing to a truce. In response to the continuing loyalist threat, Colonel William Richardson marched a group of patriots across the Back Country crushing loyalist resistance in what became known as the Great Snow Campaign in December of 1775.

A new threat to the American patriots developed in July 1776, when the Cherokee Nation went to war and attacked settlers and settlements in the Back Country. Colonel Williamson called out the militia, marched against the Cherokee Nation, and burned their towns and crops. North Carolina and Virginia also sent troops to assist in the campaign against the Cherokees. With their homes, orchards, and fields destroyed, the Cherokee Nation was forced to ask for peace. Meeting at DeWitt's Corner (present site of the town of Due West), the Cherokee leaders signed a treaty on May 20, 1777, that forced them to give up all of their lands in South Carolina except for a small strip in Oconee County. Most of the present-day counties of Greenville, Pickens, Anderson, and Oconee were created from this ceded Cherokee land.
With the defeat of the Cherokee Nation, the Back Country returned to relative peace until the British captured Charles Town on May 19, 1780. In order to secure the state for the loyalist cause, British General Clinton dispatched troops to establish military posts at Camden, Ninety Six, Augusta, and Georgetown. Despite this show of force, the Back Country patriots began a campaign of organized resistance to the British occupation. Colonel William Hill and Colonel Andrew Neil rallied their Back Country militias and were the first to raise the new American flag after the fall of Charles Town. The war that was ignited in the Back Country ranged in strategy from guerrilla warfare to major military engagements, from the relatively minor skirmishes at Fish Dam Ford to major battles at Kings Mountain and Cowpens. All these efforts served to help keep the spirit of independence alive and contributed to the final patriot victory over the British in the state and the new nation.

The Naming of Rock Hill

It is interesting to note that the necessity for railroad transportation brought on by the extensive cotton crop helped open the Up Country (the term used after the Revolutionary War to refer to land areas above the Fall Line Zone) and caused numerous towns to be founded. It was the granite outcropping coupled with the coming of the railroad that was the basis for naming an important Piedmont city, Rock Hill. When the railroad was first surveyed, the train was to have gone through the community of Ebenezerville. The townspeople refused to sign right-of-ways, as they feared the train would frighten their people and smoke would destroy the beauty of the community. The railroad line was moved to a rocky knoll nearby. While the railroad construction gang was blasting the cut through the area, they referred to it as rock hill. When they reached a specific place, someone asked "what shall we name this place?" The supervisor of the railroad said, "Rock Hill." This city has grown and prospered, encompassing Ebenezerville (Ebenezer) as one of its nicer residential areas.

Cotton Mill Towns Become Part of Industrial Region

For years the settlers of the Piedmont were almost single-mindedly concerned with growing cotton, but the region was still able to become an early industrial location because of the wide availability of water power. Almost every stream, at every falls or shoals, was dammed to provide power for water wheels to run cotton mills. Small mill towns flourished for years, even after cotton was no longer a profitable crop. Textile mills have consistently been the Piedmont's most important industry. Recently, with improved transportation systems, educational opportunities, and governmental promotion and incentives, South Carolina has attracted an increasingly diverse set of industries and businesses to the Piedmont area, especially to the Greenville-Spartanburg metropolitan area. With the textile mills came a variety of environmental concerns. At one time the Reedy River was nicknamed "Rainbow River" due to the dyes poured in the rivers from various plants. Now tighter controls coupled with public awareness are eliminating many of these problems.
The Most Beautiful Girl in South Carolina
Retold by Bob Ward

Intriguingly strange are the stories which are suggested by weatherworn tombstones in Ebenezer Cemetery--the oldest in this section. And one of the most interesting is the story of how Mary America Avery Toland, once known as the "most beautiful girl in South Carolina," came to rest under these cedars. The story goes back into another century, not so long ago amid the gravestones which date back to 1750:

In 1832, in Ebenezerville (now part of Rock Hill), a daughter was born to Col. Edward Avery and Mrs. Mary Elizabeth Vaughn Avery. They chose to call her Mary America Avery. The home where she was born still stands to this day. As a child, dark-haired little Mary Avery sometimes played near the walls of the old Ebenezer churchyard. As a child, she may even have traced the inscriptions inlaid in gold on some of the monuments.

As she grew older, she grew into a beautiful young woman with dark blue eyes behind long dark lashes. The charm of her oval face has been preserved in a portrait painted by a noted artist of the day. During those ante-bellum days, the state ball, held in Columbia, was the social event of the year. When Mary Avery was 21 years old, she was presented at the ball and acclaimed the "most beautiful girl in South Carolina," later often referred to as the "state beauty."

One of the guests that year at the ball, was a Dr. Hugo Toland, a prominent doctor in Columbia. He met Mary Avery and said, "She is the most beautiful woman I have ever seen, and I expect to marry her." Although years older than she, after a whirlwind courtship, Dr. Toland married Mary. A man of vision and adventure, Dr. Toland planned a trip to the West for his delicate bride. He spared no expense for the journey outfitting a caravan with every luxury and convenience. Before they left on this extended trip, Mary's mother exacted a curious promise from her new son-in-law. She made him promise that if anything should happen to Mary that she would be brought back to Ebenezer Cemetery to rest.

For nearly six months, the caravan moved slowly along the plains of wild and unsettled country. One September night, they camped a few miles from San Francisco, a small city of the day. Little did they know of the cholera epidemic prevalent in that district. That night, Mary Avery Toland contracted the disease and three days later on September 22, 1852, she died. Dr. Toland, stricken with grief, took the body of his bride to San Francisco and under his direction had her embalmed. Then he built a glass casket and placed her body inside. There, in his office, he kept her for almost twenty-five years.

To console himself, Dr. Toland threw himself into his work and built up a large practice. He founded San Francisco's Toland University. Later, he remarried and had a son, Arthur Toland, who became an actor. However, he never forgot his promise to bring Mary home to South Carolina, to Ebenezer Cemetery to rest. In 1877, Dr. Toland decided to fulfill that promise, and he brought the body of Mary America Avery Toland home. Mary traveled this time, not by caravan across the plains, but by train in seven different coffins.

When she was finally buried there under the cedars to the left of the drive approaching the old red church, which leads up through Ebenezer Cemetery,
she was as beautiful as on the day she died. Her life was short, her beauty such that when she died there was written for her epitaph these lines, now worn from the stone which marks her grave. Even today, if you go to that final resting place, you can just barely read part of the epitaph her husband composed:

“No one as beautiful as she,
Fairest of form and face.
A queenly mien with modesty,
Crowned every other grace.”

The Anderson Car

Rock Hill, South Carolina, was also the home of one of the first car companies in America. On January 17-22, 1916, John Gary Anderson held the grand opening for his Anderson Motor Company which had grown out of his Rock Hill Buggy Company. He produced a car driven by a six-cylinder engine equipped with oversized tires. The Anderson Motor Company was the first in the automobile industry to use a foot dimmer to control the car lights. The dimmer was invented by C.A. Deas of Anderson.

Anderson cars were sold throughout the United States. The company's peak was reached in 1920 when it produced thirty-five cars a day. However, strong competition and the higher cost of the car forced the company to cease production of the Anderson car in 1924. Today, only six Anderson cars are still known to exist.

The Interstate 85 Corridor

The automobile has become a major influence in 20th century culture and has changed the way South Carolinians travel and do business. Prior to 1940, most people traveled by train and every small town had a commercial center where local residents could do their shopping. Industries selected their locations based on the availability of power (either water power or electrical power), and access to a railroad line. Almost all shipping was done by rail. As a result, small industries and commercial centers were spread widely across the Piedmont Region.

Construction of the Interstate Highway System started in the 1950’s under the leadership of President Dwight D. Eisenhower. Begun as an emergency transportation route for national defense purposes, the Interstate Highway System has expanded into all parts of the United States and now provides fast, efficient transportation for cars and trucks across the state and the country. Where interstates bypassed cities, shopping malls, commercial facilities, and industrial parks followed, until an entire suburban culture sprang up like a series of satellites around the town center. Most people preferred to shop in large suburban stores forcing former commercial districts in town or city centers, faced with a major loss of business, to either close completely or make drastic changes in their operations. As a result, many people in both rural and urban areas now had to travel a lot farther to do their shopping, an inconvenience for both poor people and those who do not drive or own a car.

The commercial and industrial development along Interstate Hwy. 85 is a prime example of the type of cultural and land use changes brought about by the construction of a major transportation link. Interstate 85 connects the major southeastern urban areas of Charlotte, North Carolina, and Atlanta, Georgia. It follows approximately the route of the Southern Railroad main line and passes through or near the major South Carolina
cities of Anderson, Greenville, Spartanburg, and Gaffney. New businesses and industries have sprung up all along this route, mostly around major interchanges. New malls and housing subdivision developments have followed closely behind. Although these developments have brought a newfound prosperity to the communities in the Interstate 85 corridor, they have also siphoned off business from other towns and cities which are not near an interstate highway.
Climate and Water Resources

The Piedmont Region receives annual rainfall amounts ranging from 45 inches to 60 inches and has a 200 to 240 day growing season. In contrast to the Blue Ridge, Piedmont streams flow more gently and have numerous tributaries. Stream systems often show a rectangular drainage pattern where faults and rock fractures intersect the surface. In areas of homogeneous rock, dendritic drainage patterns are more common. Most stream waters are colored to some extent by suspended sediments composed of silt and clay-sized soil particles. This brownish coloration is especially noticeable during heavy rainstorms, when runoff from farmland brings great amounts of eroded soil into the adjacent stream systems. All but the smallest streams are perennial, and rainfall is usually equally sufficient for most agricultural needs. Groundwater resources are highly variable because of the complex geologic structures underlying the Piedmont landscape. Fracture zones serve as conduits for groundwater and are the best sites for locating wells.

Piedmont Reservoirs

South Carolina was also an early leader in the development of hydroelectric power. Since 1900, several large lakes have been constructed for that purpose along most of the major rivers which flow through the Piedmont. Lake Hartwell on the Savannah River and Lake Greenwood on the Saluda River are prime examples. Lakes such as these provide benefits far beyond hydroelectricity. Recreation, tourism, and flood control are three immediate benefits which have been important to regional development. Many of these lakes have also become centers for retirement homes or bedroom communities, where people live while working in nearby cities. A large amount of waterfront real estate was produced by the flooding of these river valleys. Some of the environmental effects have been the loss of forest and agricultural bottom land, increase in thermal pollution in waterways, and controlled stream flow.

In recent years the impoundments both within and on the borders of the state, e.g. lakes Keowee and Hartwell, have become the sites of significant recreational fishing. Striped bass, hybrid and largemouth bass, and catfish are important fish for recreational purposes. The rise of the fisheries is a reminder that until 1830, the rivers of South Carolina provided a supplementary income to large numbers of people who caught sturgeon, salmon, bass, and shad in great quantities. But over-fishing and the large amount of sediment that the streams carried due to topsoil erosion from cotton fields ended significant commercial fishing. Only in the past six decades with careful management practices has fishing been restored to a place in South Carolina life.

Soils and Red Clay

Soils in the Piedmont are generally found on gentle to moderate slopes, although some slopes are occasionally steep. These soils are usually thick and have formed in rock that has weathered in place for many years, producing extensive exposures of the crumbly rock and soil mixture called saprolite. For many millions of years, the Piedmont
has been an erosional region. Only in a few stream valleys and **floodplains** can any thick depositional sequences be found. Soils along such river and stream valleys are usually formed in alluvial material transported and deposited by streams.

Most Piedmont soils are moderately deep, well drained, and have clayey to **loamy** surface layers and clayey subsoil layers. Most are also residual, having formed directly from the underlying chemical **weathering** of crystalline rocks, and as a result, soil types are strongly related to the rock type in which it formed. These soils are well known to farmers and homeowners for having a layer (or horizon) of reddish clay beneath the surface. Insoluble iron and aluminum oxides cause the red to reddish-yellow color often seen in the subsoil. The red color is one indication of the soil's extreme age - several million years old. The Piedmont soils are, in fact, some of the oldest found anywhere on the earth.

**Agriculture and Erosion**

The high clay content contributes to the compact nature of most Piedmont soils, a feature which prevents them from easily absorbing rainfall. As a result, most heavy precipitation runs off the land creating a high risk of serious soil erosion. Extensive sections of the Piedmont have been eroded over the past several hundred years, resulting in the presence of only very thin topsoil layers or just subsoil layers at the ground surface. Planting crops on steep slopes without the use of proper conservation practices and techniques caused periods of devastating erosion. The abuse of Piedmont soils over the years is well documented through the dust bowl days, when the federal government purchased the most severely abused lands and turned them into National Forests.

Suitability classification for most soils of the region is fair to good for row crops. Approximately two-thirds of the land area is now covered by forest and about 30 percent is devoted to farming, with corn, soybeans, cotton, and small grains being the major crops. Orchards, pastures, and forests grow on the lands more susceptible to erosion. Only about 20 percent of the area is considered to be prime farmland. At one time much of this land was not thought to be fertile because the leaves on the cotton crop developed rust colored spots while the leaves on the corn curled in a pattern called frenching. After the soil was chemically examined in the late 1800's, it was found to be lacking in the nutrient potash. When this fertilizer was added, the soil became as productive as any in the state.

**Reforestation and Soil Conservation**

Travelers and naturalists passing through the Piedmont in the 18th century described mature forests of hardwoods and shortleaf pines. Beginning in the 19th century, large areas were cleared for cotton production to the extent that little of the natural vegetation remained undisturbed. Because soil conservation was not an issue at that time, much of the Piedmont Region of South Carolina became a victim of extensive soil erosion with the rolling hills cut by gullies and the soil nearly exhausted. When land became too gullied to work productively, farmers simply picked up and moved westward to find new land. By the early 1900's, much of the upstate consisted of abandoned farmland or subsistence farms which could barely support the families living on that land.
Reforestation and soil conservation programs, started by the New Deal in the 1930's, permanently changed the appearance of forests and farmlands in the Piedmont. The Federal Soil Conservation Service was established in 1935. This government agency provided technical assistance to farmers in terracing, strip cropping, crop rotation, pond construction, and the planting of legumes such as soybeans and kudzu. An important discovery made by Dr. Charles Herty, a Georgia chemist, in 1930 also had a major impact upon Piedmont forestry. Dr. Herty invented a method for making paper from loblolly pine, the most common pine tree in the Piedmont. The promise of profits from growing pines encouraged farmers to plant their worn-out cotton lands in pine seedlings. The planting of pines furnished by the State Commission of Forestry has helped to fight soil erosion in the Piedmont and led to a major reforestation of the upstate.

In addition, the Agricultural Stabilization and Conservation Service (ASCS) administered a variety of federal subsidy programs. It also encouraged farmers to practice better farming methods and allowed them to reduce agricultural output in return for government benefits. As farming declined and farmland was abandoned, particularly after 1950, a succession of vegetational changes began. This natural biologic succession progressed through various stages from cleared land, to pine forest, to a mature climax oak-hickory forest. Loblolly pine was "seeded-in" to many abandoned agricultural fields or was intentionally planted to help control erosion over large areas. It continues to be planted by forest companies, state forestry officials, and private landowners, so that it is today the most common tree in the Piedmont landscape.

**Establishment of National Forests**

During the Great Depression, the Federal government moved to restore the forests of South Carolina. It purchased 54,000 acres (approximately one-seventh of the total area of Newberry County) as part of the Enoree division of the Sumter National Forest. The Santee National Forest was divided into three divisions: (1) the mountain division located in Oconee and Pickens counties; (2) the Enoree division located in Chester, Fairfield, Laurens, Newberry, and Union counties; and (3) the Long Cane division located in Abbeville, Edgefield, Greenwood, McCormick, and Saluda counties.

**Unique Natural Habitats in the Piedmont**

Located within the Piedmont are several Heritage Trust Preserve sites containing landforms that create special environmental conditions for unique plants. The John de la Howe Museum Tract in McCormick County surrounds a special school for young adults, which has been operating for nearly 200 years. The grounds contain areas of virgin forest, uncut for over 300 years, which include the largest shortleaf pines in the state. The Stevens Creek Preserve, also in McCormick County, is one of the state's most diverse and unique historical areas. The well-drained north-facing slope and acidic soils occur in a cooler and wetter habitat than is usually found in the Piedmont, and the wildflowers and large trees resemble plant communities usually found much farther north.

The Flat Creek Preserve in Lancaster County surrounds Forty Acre Rock, which is actually only 14 acres. It is a massive exposure of solid bare granite with no significant soil layer to hold moisture. Consequently the granite surface strongly resembles habitats normally found in deserts. Slight depressions in the granite, formed by chemical weathering, can hold water temporarily after a rain. It is in these pools that small, fragile...
plants and animals slowly build even more complex communities. Surrounding the granite exposure is a vast pine forest and a nature trail three miles long. Forty-Acre Rock is a typical example of a granite outcropping found in the Piedmont Region of South Carolina.

The lower Piedmont offers the largest expanse of forest lands in the region, and provides some of the best deer and turkey hunting and outdoor recreation in the state. Many of the land tracts of the Piedmont are managed for multiple use, a term used to describe the practice of land management that provides for timber production and harvest, while also encouraging wildlife management, recreational use, and other benefits to the landowner. Two large districts of the Sumter National Forest are located within the lower Piedmont which, in combination with several large reservoirs in the area, provide many recreational opportunities including a well known and highly productive warm water bass and bream fishery.

**Underground Storage in Granite**

An interesting use of the underground granite formation is the storage of propane in the York County community called Tirzah. Two caverns dug out of solid granite 450 feet below the earth’s surface are used as storage for millions of gallons of propane. Trucks and trains arrive daily and are loaded with propane to service a large region of the southeast. A six inch pipeline is also used to transport the fuel.

**Gold Mining**

South Carolina has become one of the leading gold producing states east of the Mississippi River. Recent gold mining operations have been centered in Lancaster County, the Piedmont Mining Company (Haile Gold Mine); Chesterfield County, the Brewer Gold Company; and Fairfield County, the Ridgeway Mining Company. The first gold rush in the United States started when a 7.7 kg nugget was found in the Piedmont section of the Carolinas in 1799. This was fifty years before the gold rush in California. The site was in what is now North Carolina. In 1829, the first gold was mined in Lancaster County with the first shipment leaving the Haile Mine. About the same time, the Brewer gold mine in Chesterfield County became productive. The Dorn gold mine in McCormick County was opened in 1852 with peak production occurring around 1859. During the Civil War, Billy Dorn outfitted an entire company of Confederate soldiers from the profits he made from gold. Gold from the Haile Mine was used by the Confederate Army to finance the war effort. As a result, Sherman made a special effort to destroy the buildings and equipment during his historic march through South Carolina. It was not until the 1970’s when the price of gold skyrocketed and new mining and extracting processes were designed, that the gold mining industry in South Carolina was revitalized. The process is expensive as it takes about 20 to 30 tons of rock to extract one ounce of gold using a chemical dissolving process. The Ridgeway Mine, opened in 1988, is now the largest gold producer in the state (1995 data).
Summary

The Piedmont constitutes the second largest of South Carolina's landform regions. It comprises about one-third of the state's total area and has been especially important as a source of economically valuable rocks and minerals, such as granite and gold. Other assets are the rich agricultural land and a prolific source of water power that made possible the development of cotton mills and other early industries. Much of South Carolina's current population growth has been concentrated in the Piedmont and is due to the increased industrialization and urbanization in the region, especially along the corridor of Interstate Hwy. 85. Former agricultural misuse of the land created severe erosion problems but the transition from an agricultural to an industrial society has helped to encourage conservation and effective land use planning.

Removed from the coast and the easily navigable rivers of the Coastal Plain, the Piedmont was the second frontier in the European settlement of South Carolina. A broad, rolling region underlain primarily by parallel bands of various metamorphic rocks, the Piedmont surprises with occasional isolated mountains and deeply incised rivers. The Catawbas highlighted the abundance and importance of these rivers with the name they called themselves: Ye Iswa--People of the River. These Native Americans lived throughout the Piedmont in early colonial times, and still live there now. Although their current land holdings do not compare to the great area they once inhabited, their feat of maintaining much of their native culture through stormy and often hostile years is a victory which they celebrate in art forms such as storytelling and pottery.

Urged on by the Settlement Act of 1743, which granted incentives of food, tools, and land to European settlers of the Piedmont, and by improved transportation routes into the area, colonists began to arrive in ever-greater numbers during the second half of the 1700's, and several important Revolutionary War battles were fought in the Piedmont. Despite the lawlessness and isolation of a frontier area, the Piedmont was populated and powerful enough to force a relocation of the state capital away from the coast in the late 1700's.

For much of the 1800's, cotton was king in the Piedmont, and agriculture in general has historically driven the Piedmont's economy, but poor agricultural practices such as a failure to rotate crops and heedless plowing contributed to soil exhaustion and rampant erosion, especially in the late 1800's and early 1900's. However, increased knowledge and improved farming techniques have led to greatly improved conditions since then. Although it is still extremely important in some areas, a dramatic economic shift has made agriculture less important in this region as a whole. Industry, expanding from the textile towns of the past into the high-skill manufacturing of today, is now a major force in the economy of the Piedmont.

What changes will the future bring to this region of South Carolina? The Piedmont seems to be continuously in transition. After decades of severe soil erosion, it is the place where successful soil conservation has been pioneered. After domination by cotton and the mill town economy, it is the place where new industry and urbanization are flourishing. After free-flowing streams offered the promise of virtually unlimited water power, it is the region where almost every stream has been dammed, and where we have altered not only the stream flow but also the vegetation, animal habitat, sediment transport balance and even local weather conditions. The Piedmont Region contains
very few places that preserve the original natural setting. As human modification continues, as it unquestionably will, we must assure that the few remaining natural areas are not lost by neglect or apathy. In a region as vibrant and active as the Piedmont, natural pockets of serenity are ever in demand.
PLACES TO VISIT

John De La Howe Museum Tract. Little River and Thurmond Reservoir. For information call 803-391-2131.

Steven’s Creek Heritage Preserve. SC 23, 15 mi. from Edgefield to Sec. Rd. 139 to Sec. Rd. 143. For information call 803-734-3893.

Molly’s Rock/Sumter National Forest. SC 121 N from Newberry, US 176 SE. For information call 803-765-5222.

Flat Creek Preserve/Forty Acre Rock. US 601/SC 903 junction N on 601. For information call 803-734-3893.


Brewer Gold Company. For directions and information call 803-658-3039.

Piedmont Mining Company. For directions and information call 864-475-1220.

Ridgeway Mining Company. For directions and information call 803-252-2550.

Cowpens National Battleground. At 4001 Chesney Hwy., Gaffney, SC. For information call 864-461-2828.

Joe Adair Environmental Education Center. Laurens Conservation District. For directions and information call 864-984-5492.

Landsford Canal State Park. 6 miles west of Lancaster off US 21. For information call 803-789-5800.

REFERENCES AND RESOURCES


Catawba oral history records. University of Florida’s Museum of Natural History, Museum Road, Gainesville, FL.


Mining Association of South Carolina. (1989). *Carolina gold*. (Brochure). Irmo, SC.


"Pine Flat." (January 31, 1963). Speech given to the Kershaw County Historical Society, Camden Archives, Camden, SC.


For more interesting information about the Catawbas, The River People, contact:

**Catawba Cultural Preservation Project**
611 E. Main Street
Rock Hill, SC 29730
803 324-5214
STUDY AREA 3: PIEDMONT OVERVIEW

Activity 3-1: Overview

Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale</th>
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<td>STATE BASE MAP #1, SHADED RELIEF</td>
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<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<td>LAND USE/LAND COVER MAP</td>
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<tr>
<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<td>GENERAL SOIL MAP</td>
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<td>Map of Catawba Nation</td>
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<td>Wipe-off Pens</td>
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<td>Transparent Grid Overlays</td>
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</table>

PERFORMANCE TASKS

(Icon Key) Overview = ; Science = ☓; Math = ▼; History = ▼; Language Arts = ❝

1. **Locate steepest slopes in Piedmont.**
   Using the **STATE BASE MAP #1, SHADED RELIEF**, trace with a wipe-off pen the eastern and western boundary of the Piedmont Region. Look over the relief features of the Piedmont Region. Describe the typical landscape appearance. Where, in relation to streams and rivers, are the steepest slopes usually found in the Piedmont? How can you identify the steepest areas? Why are these areas so steep? Refer to the **GEOLOGIC AND MINERAL RESOURCE MAP** to locate five Geologic Belts. Trace these onto the base map and determine the correspondence between slope and geologic belt.

2. **Relate development of cities to river location.**
   On the **STATE BASE MAP #2, WITH HIGHWAYS**, locate Interstate Hwy. 85 and the Southern Railroad line (now Norfolk-Southern) running parallel to the highway. Name four large Piedmont cities that these major transportation lines run through. Most Piedmont towns began as small villages located near sources of water power. Go back to the **STATE BASE MAP #2, WITH HIGHWAYS**, and identify the river or stream flowing through each of the four cities you located previously. Also locate the towns of Lancaster Mills, Lancaster County, and Pacolet Mills, Spartanburg County. On which rivers are those two towns located? What effect did the building of the railroads and the Interstate Highway have on the development of all these cities?

3. **Locate gold mines.**
   Using the **STATE BASE MAP #2, WITH HIGHWAYS**, locate the towns nearest to these gold mining sites:
   - Brewer Gold Mine, Jefferson, Chesterfield County;
   - Haile Gold Mine, north of Kershaw, Lancaster County;
   - Ridgeway Mining Company, Ridgeway, Fairfield County; and
   - Dorn Gold Mine, McCormick, McCormick County.

   Draw straight lines connecting the locations of the gold mines. Find the actual straight-line distance in miles and kilometers between Brewer Gold Mine, Haile Gold Mine, Ridgeway Gold Mine, and Dorn Gold Mine. Use string or a ruler for measuring...
and the scale bar on the map for reference. What is the overall pattern representing the geographic distribution of gold mines? What is the orientation of this pattern? How does that relate to the orientation of the landform regions of South Carolina? Name the Piedmont geologic belt in which all these gold mines are found. Which rock type contains the gold? Use your map information to select a possible site for a new gold mining operation. Mark this location on the map and justify your site selection.

Place the transparent grid overlay on the STATE BASE MAP #2, WITH HIGHWAYS, with the origin at 34° latitude and 81° longitude. Graph the mathematical distribution of the gold mines by finding their approximate coordinates (ordered pairs) and marking these locations on the grid. Draw the straight line that best represents the path of all these points. Find the slope of this line using the coordinates plotted on the grid. Find the equation of the line you drew using the equation \( y = mx + b \).

4. **Keep travel log for gold mine trip.**
   You have been commissioned by the Governor of South Carolina to make a surprise inspection of the state’s four major gold mines to determine environmental compliance. Plan this trip starting from your school. Use the STATE BASE MAP #2, WITH HIGHWAYS. Your inspection will take one hour at each site. Be sure not to exceed the speed limit of the roads you are traveling. Will you be able to make it to all four gold mines in the same day (8 hour working day)? You must keep a travel log as you will be reimbursed at the rate of $.25 per mile. What is your most direct route? How many total miles will you travel before you get back to your school. Use the scale bar on the map for determining distances. How long will each segment of your journey take? Use the travel log chart below to document your trip. How much will you be reimbursed for your entire trip?

<table>
<thead>
<tr>
<th>NAME</th>
<th>SCHOOL LOCATION</th>
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<td>DESTINATION FROM TO</td>
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<td>TOTAL</td>
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5. **Examine General Soil Map.**
   On the GENERAL SOIL MAP, which map colors represent the Piedmont Region? Name the counties in South Carolina that are at least partially located in the Piedmont Region. Locate the map legend and read the descriptions of those particular soils. Name the original rock types that produced each of the Piedmont soils.
6. **Trace watersheds of stream systems.**

Recently, erosion problems in the Piedmont have been handled using the watershed concept. The watershed is defined as the entire drainage basin of a particular stream. Flood prevention and erosion control over an entire drainage basin have proved much more effective than attempting to correct isolated trouble spots individually. Why is it easier to deal with the entire stream system rather than with isolated segments? The first major Soil Conservation Service watershed project in South Carolina was the Twelve Mile Creek Pilot Project in Pickens County, started in 1954. On the **STATE BASE MAP #1, SHADED RELIEF**, locate Twelve Mile Creek. With a wipe-off pen, trace all streams which are part of the Twelve Mile Creek drainage basin. Use a broad-tipped wipe-off pen to outline the entire watershed. Use the transparent overlay to determine approximately how many square miles of land are drained by this stream drainage basin. Follow this same procedure to estimate the size of nearby watersheds. Does the size of the stream relate to the size of the drainage basin? Explain your answer.

7. **Outline Catawba claims and reservation.**

Using Figure 3-1, "Geat Seal and Map of Catawba Nation," outline on the **STATE BASE MAP # 2, WITH HIGHWAYS**, the territory in South Carolina held by the Catawba Nation in the 17th century. With a different color pen, identify the land reserved for the Catawba Nation after the treaties of Pine Tree Hill in 1760 and Augusta 1763. What percentage of their original South Carolina lands did they retain? Use the transparent grid overlay to estimate the percentage.

8. **Make a Land-Man Relationship chart.**

From your previous reading, contrast the way the Catawba Nation and early English colonists used the land, obtained their food, used trees, and constructed dwellings in the Piedmont Region. Summarize your conclusions in the chart provided below.

<table>
<thead>
<tr>
<th>TOPIC</th>
<th>CATAWBA PEOPLE</th>
<th>ENGLISH COLONISTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Use</td>
<td></td>
<td></td>
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<tr>
<td>Food Source</td>
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<tr>
<td>Use of Trees</td>
<td></td>
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<tr>
<td>Type of Dwelling</td>
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</table>

Now refer to the **LAND USE/LAND COVER MAP** and determine what current land uses dominate the Catawba Reservation lands. What problems would both Native Americans and early Colonists face trying to sustain their original cultures in this area?
9. **Identify Native American place names.**
   While most of South Carolina's Native American Nations have long since vanished, their memories are preserved in South Carolina place names. Using the **STATE BASE MAP #2, WITH HIGHWAYS**, make a list of the towns, cities, counties, rivers, creeks, and streams in the Piedmont Landform Region with Native American place names.

10. **Trace Great Philadelphia Wagon Road.**
    On the **STATE BASE MAP #2, WITH HIGHWAYS**, outline with a wipe-off pen the two major routes taken by families entering South Carolina on the Great Philadelphia Wagon Road. Refer to Figure 3-2 "Map of the Great Philadelphia Wagon Road." What were the obstacles on the eastern route to Augusta? What were the obstacles on the western route to Augusta? Which is the shortest route? Identify the rivers and swamps that had to be crossed on the eastern route. Identify the rivers and swamps that had to be crossed on the western route. Explain why the Great Philadelphia Wagon Road did not go through Columbia. Plan a trip down the Great Philadelphia Wagon Road to the Back Country of colonial South Carolina. Enter the state through Rock Hill. Next select a suitable place for your destination in the Piedmont Region of South Carolina. If your school is in the Piedmont Region, use it as your destination. Trace your route on the map. What supplies will you need? Where will you find water? Plan for your overnight stops. How long will it take you to go from Rock Hill to your destination? How many rivers will you cross? Name these rivers. What could go wrong during your trip?

11. **Compare early travel routes with present day transportation.**
    Many of the early wagon roads later became state or United States highways. Using the **STATE BASE MAP #2, WITH HIGHWAYS**, and your tracing from Performance Task #10 identify the US highways which most closely match the eastern and western routes of the Great Philadelphia Wagon Road from Rock Hill to North Augusta. Use a wipe-off pen to mark the location of these highways on the state base map. Often railroads were built parallel to these early roads. In a different color wipe-off pen, trace the railroad lines between Rock Hill and North Augusta which most closely follow your marked highways. Locate other examples on the state base map where highways run parallel to a railroad. Identify towns and cities along these routes. In a third color wipe-off pen, trace the interstate highway routes which most closely follow your original marked highways. What is the role of physical geography in the location of highways? How has the location of interstates changed the development of towns along the original US highways?

12. **Reconstruct pioneer diet from Act of 1743.**
    The Act of 1743 passed by the Royal Assembly of South Carolina was intended to encourage settlers to move into the Back Country. Answer the following questions. Refer to the paragraph entitled Settling the Piedmont: Act of 1743 on page 3-10.
    a. Outline a typical diet from the list of provisions cited in the act.
    b. Explain why salt was essential to the settlers’ diet.
    c. Identify the purpose of the tools and livestock that were furnished by the Act.
    d. Besides the materials provided in the Act, identify other materials that would be essential for life on the Carolina frontier.
    e. Why was rice a staple food rather than potatoes or beans?
f. Using the Act of 1743, make an inventory list of tools, provisions, and livestock that your family would have received if you were entering South Carolina during this period. Why would these items not have been available in the Piedmont Back Country?

g. How much land could your own family claim based on the head-right system? Where in the Piedmont would you claim your land? Mark this area on the STATE BASE MAP #1, SHADED RELIEF, with a wipe-off pen. Explain why you decided to settle in that location. Refer to Piedmont landscape features in your explanation.

13. Discuss solutions for settlers terrorized by outlaws.
Imagine you're a settler in the Back Country terrorized by outlaws in the 1770's. Why was it so hard to catch outlaws in the Back Country? Was this difficulty related in any way to the Piedmont landscape? Explain your answer. Brainstorm in your group to identify as many possible solutions as you can to the problem. Then, discuss the possible consequences of each of these solutions. Choose the best solution. Compare your group's solutions with those of the Regulators.

14. Plan Native American style gathering to share legends.
Catawba stories were meant to be shared orally. Plan a gathering in your class where you share these and other stories that form part of the tradition and heritage of every culture. Each student telling a story should locate a site on the STATE BASE MAP #2, WITH HIGHWAYS, where the story might have occurred and explain why. Look carefully at Figure 3-1, "Great Seal and Map of Catawba Nation," and relate images on the seal to objects and animals which might be common in the Piedmont Region.

15. Compare costs of shipping propane by train versus truck.
Millions of gallons of propane destined for distribution in South Carolina are stored in granite caverns near the town of Tirzah. Locate the town of Tirzah on the STATE BASE MAP #2, WITH HIGHWAYS, (in the center of York County northwest of Rock Hill). Notice the railroad line running through the town. One railroad tank car can hold up to 280,000 pounds of propane. Tank trucks can each hold only 40,000 pounds of propane. The fixed cost of shipping by rail is $.01 per thousand pounds per mile, but rail cars have a separate loading fee of $150 per load, whether the rail car is full or not. The fixed cost of shipping by truck is $.04 per thousand pounds per mile, but trucks have a separate loading fee of only $50 per load. Assume that the average town needs a weekly shipment of 40,000 pounds of propane. What is the maximum distance for which trucks can be used for shipping this amount and still be cheaper than shipping by rail? Using this distance number as radius, and the town of Tirzah as the center of your circle, draw this circle on the map with a wipe-off pen. Which major South Carolina cities could be serviced more economically by truck than by rail cars (which cities lie within your circle)?

16. Assess compatibility of future resources with current land use.
Examine the GEOLOGIC AND MINERAL RESOURCE MAP and make a list of five major mineral resources which occur in the Piedmont Region. Briefly note any alterations to the landscape which you think may be necessary to extract these resources. Examine the LAND USE / LAND COVER MAP and list the one or two primary categories which occur in the geographic area associated with each
resource. For each resource, indicate whether or not the resource extraction activities would be compatible with current land uses.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Alterations</th>
<th>Land Use/ Land Cover</th>
<th>Compatibility</th>
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ENRICHMENT

1. **Research Catawba pottery.**
   - Research the type of Native American pottery found closest to your area of the state. Use modeling clay to make examples of this pottery. Contact the Catawba Cultural Preservation Project, 611 E. Main Street, Rock Hill, SC 29730 (803-324-5214) for additional information about the pottery and potters of the Catawbas. Research local libraries to find pictures of different types of pots. Which other Native American Nations have been known for their pottery? Can you determine the process that they use to make their pottery? Plan a trip to dig for clay. Try making an artifact with your clay. Write or talk to someone at the Preservation Project about the clay deposit near Van Wyck—is it still off limits to the potters? If so, how are the Catawbas able to continue making pottery, and where are they getting their clay?

2. **Make time line of Catawba History.**
   - Make a time line of the history of the Catawba Nation. Find out what land was involved in the Catawba land claim. When was the lawsuit settled? Use your South Carolina history textbook as a reference. Mark location of noteworthy events on the **STATE BASE MAP #2, WITH HIGHWAYS.** Be sure to include the recent Catawba dispute involving rights of access to the Van Wyck clay deposits.

3. **Research competitiveness of Anderson cars.**
   - Locate Rock Hill on the **STATE BASE MAP # 2, WITH HIGHWAYS.** It was the home of the Anderson Motor Company. Research the early car manufacturers such as Anderson, Ford, Studebaker, and Dodge. Complete the following chart. After comparisons are made, explain why Ford out competed the other early car manufacturers. Make drawings of these early cars and compare design and style to that of present day automobiles. Report your findings to the class.
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<tr>
<th>Years Produced</th>
<th>ANDERSON</th>
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<td>Manufacturing</td>
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<td>Process Used</td>
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<td>Other Special</td>
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<td>Features</td>
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<td>Location of Plant</td>
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4. **Write to gold mining companies, graph production.**
   Write to one of the gold mining companies in South Carolina and ask for a sample of gold ore. Investigate the history of gold mining in South Carolina and the various processes by which gold is mined today. How do the processes differ from each other? Explain why gold mining is more profitable today than it was 25 years ago. Research data on gold production in South Carolina. Using these data, graph gold production in each of the four active gold mines over the last 20 years by using a bar graph. How do you account for these changes?

5. **Write to a mill town Chamber of Commerce.**
   Write to the Chamber of Commerce of each of the following cities and ask them how the town got its name, what kind of mill originally operated there, and whether the mill is still operating.
   - **Lancaster Mills:** Lancaster, SC; Lancaster County
   - **Winnsboro Mills:** Winnsboro, SC; Fairfield County
   - **Baldwin Mills:** Chester, SC, Chester County
   - **Lydia Mills:** Clinton, SC; Laurens County
   - **Inman Mills:** Inman, SC; Spartanburg County
   - **Monarch Mills:** Union, SC; Union County
Lancaster News
October 10, 1993

Rare plants find home on Forty Acre Rock
by Barbara Howell

Although called Forty Acre Rock, the name of this feature is misleading because only about fourteen acres of bald rock are exposed.

But what the Flat Creek attraction features is an environmental wonderland with its unusual granite outcrop, the largest in South Carolina. At one time this rock provided the foundation for many surrounding houses. Now it provides habitat for wildlife and some species of rare plants.

Many of the rare plants that make their home at Forty Acre Rock do so in the pools of water found in the granite's indentions.

During dry spells the seeds survive and then flourish when the pools fill again. Spring is the best time to view the blooming of these plants.

Though the place appears like a desert in the fall and winter, there is one plant that makes its presence known in the fall.

The portulaca blooms underneath the gnarled cedar trees, said Doug Rainer, who teaches biology at Wofford College.

"Cedars release a high level of calcium whereas most other trees tend to hold their calcium," said Rainer, who was formerly with the S.C. Wildlife Department.

Rainer often takes his classes on field trips to the rock to study the rare ecosystems and to help keep the area clean. "It's very difficult to manage in that people abuse this area by spray painting the rocks, cutting trees, and, riding vehicles over the rock," said Rainer.

RATIONALE

The Forty Acre Rock Study Site is an excellent example of a granite outcropping in the Piedmont of South Carolina. Many such rock exposures occur throughout the region, including the Winnsboro Blue Granite in Fairfield County, which is mined heavily as an economic resource and which has been designated as the official State Rock. Although Forty Acre Rock is not quarried, it represents a valuable resource nonetheless. As part of the Flat Creek Preserve, the granite is home to several species of rare plants and offers a truly unique biological habitat. The site is also near the boundary of the Sandhills and Piedmont regions and clearly illustrates landform features characteristic to each. Forty Acre Rock is not advertised as a state tourist attraction because of the sensitive and fragile nature of the ecosystem, although many school groups and other educational agencies do take field trips there. Much of the site is preserved in its natural state and features wetlands, unique geologic features such as the Great Diabase Dike, and a variety of land uses typical of the Piedmont Region.
Introduction

In reality, Forty Acre Rock covers only fourteen acres of ground. Even so, it still qualifies as the largest single exposure of granite rock in South Carolina. A hiking trail is maintained by the Nature Conservancy, which manages the area as part of the Heritage Trust Program. The trail starts in the Valley of Flat Creek, runs past a wetland associated with a large beaver pond, and slowly winds its way gradually uphill until it reaches some large waterfalls and several caves (which are really small openings eroded out between resistant granite layers) near the top of the rock exposure. Along the way, a hiker will pass through wooded areas, open fields beneath a power line, floodplains of small meandering streams, geologically important exposures of diabase dike rock, and several areas of bare granite rock.

Just to the east of the vast expanse of granite is the Sandhills Region, which lies on top of the granite and is easily recognized by the presence of loose, white, sandy soil. To the west lies the Flat Creek Valley which has cut below the overlying Sandhills layers to expose typical Piedmont rock exposures. The granite itself stands high above the valley, but slopes gradually, and in a few places steeply, downhill toward Flat Creek. Chemical weathering of the granite has produced shallow depressions in the rock which fill with water during rainstorms and are populated by several species of rare plants. In between rainstorms, these depressions are drier than a desert. Agriculture is a major land use outside of the Flat Creek Preserve boundaries, as is logging.

The Devil’s Cave and His Footprint
By Christy Clonts

If you ever go to Forty Acre Rock, be sure to look for the Devil’s Cave and the Devil’s Footprint. My husband’s Uncle Bob says that the Devil’s Footprint is a foot shaped indentation in the rock just outside the entrance to the Devil’s Cave. Sometimes the indentation is so slight that you can’t find it. Then another time it will be deep and clear. The sharpness of the print wears away with time and erosion, but before it completely disappears the print mysteriously resurfaces. Uncle Bob says that every 10 years the devil comes back and reprints it. The footprint is a warning to stay away from the cave which has a mystery of its own.

Many a dog has been lost in Devil’s Cave. The cave narrows quickly so while people can go in, they can’t go in very far. A dog, on the other hand, can keep following the narrow tunnel deeper and deeper. Dogs that go in never come out. Uncle Bob had a dog that followed him into Devil’s Cave and no matter how much he whistled and hollered, that dog never would come out. After several hours he gave up and went home. He said a dog would always come home when he got hungry. But the dog didn’t come home that night or the next, or the next week. Uncle Bob decided those stories about Devil’s Cave must be true.

Two months later an acquaintance from the community dropped by Uncle Bob’s house and said that he had seen a dog that looked just like Uncle Bob’s while he was visiting relatives over in Winnsboro county. When he asked the people where they got the dog, he was told it had just shown up at their back door hungry and filthy a few weeks back. Uncle Bob went with his friend to check out this dog and sure enough it was his.
He has told this story many times through the years and afterwards he has been told of the same thing happening to other dogs. Locals think that there must be another opening to the cave in the next county because that is where the lost dogs always show up. Devil's Cave is a great place to visit, but you might want to leave your dog at home!

The Great Diabase Dike of South Carolina

Just south of Forty Acre Rock lies a long, narrow wooded ridge composed of diabase, a dark, basalt-like rock commonly found in areas which have experienced volcanic activity in the past. Diabase usually forms as the result of an igneous intrusion of high temperature magma (underground lava) into the surrounding rocks. Sometimes the intrusion reaches the surface and volcanoes form from the erupting lava. Other times, the magma does not reach the surface and slowly cools in place, underground, forming a dense, crystalline mass. When the intrusion is long and narrow in shape, it is referred to as a dike. Several of these dikes appear in the Forty Acre Rock Study Site area, and throughout the Piedmont, but the largest and most easily recognized is referred to as the Great Diabase Dike of South Carolina. It is about 35 miles long and close to 1,000 feet thick in places. It usually shows up on the landscape as a low ridge because the crystalline diabase is more resistant to erosion than the surrounding Piedmont rocks. Because of the ridge's naturally dense vegetation and tree cover, the rock is visible at the surface only along roadcuts and streams where the overlying soil and vegetation have been removed. The best exposure of diabase in the area is found along U.S. Hwy. 601 one mile north of the town of Midway.

About 200 million years ago, geologists speculate that a huge supercontinent, called Pangea, existed on the earth, with North America and South America connected to Africa and Europe. There was no Atlantic Ocean at that time. Due to a massive buildup of heat within the earth, beneath the supercontinent, the surface crust all along the east coast of present day North America was pushed upward and stretched tight, sometimes to the breaking point. As a result, many fractures and faults began to develop and formed a series of fault basins extending from South Carolina to New England. Because these basins formed during the Triassic Period of geologic time, they are usually referred to as Triassic Basins. One such basin is exposed at the ground surface nearby in the northern part of Chesterfield County. Many of the fractures served as passageways for hot liquid rock which later cooled to form the diabase dikes. Once the Atlantic Ocean began to open up, volcanic activity in South Carolina came to an end and subsequent erosion has removed any land surface volcanoes which might have existed at that time.
Activity 3A-1: Forty Acre Rock and Flat Creek Preserve

Materials

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<tr>
<td>GENERAL SOIL MAP</td>
<td>1 : 594,000</td>
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<tr>
<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<tr>
<td>FORTY-ACRE ROCK LITHOGRAPH</td>
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<td>FORTY ACRE ROCK TOPOGRAPHIC MAP</td>
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<tr>
<td>State Map of Major Drainage Basins</td>
<td>Figure 1-2</td>
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<td>Transparent Grid Overlays</td>
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<td>Wipe-off Pens</td>
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PERFORMANCE TASKS

(Icon Key) Overview = ; Science = ☀; Math = ☐; History = ☐; Language Arts = ☛

1. Locate the study site.  ☀

   Locate the Forty Acre Rock Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. Identify Forty Acre Rock on map and lithograph. ☀

   Locate Forty Acre Rock on the FORTY ACRE ROCK TOPOGRAPHIC MAP. Use this information to locate Forty Acre Rock on the FORTY-ACRE ROCK LITHOGRAPH. On which of these is Forty Acre Rock easier to find? Why? What is the elevation of Forty Acre Rock? With a wipe-off pen, transfer the boundary line of Flat Creek Preserve onto the lithograph by matching up landforms and forest cover. Locate the place with the highest elevation in Flat Creek Preserve. Within the Preserve, locate the lowest elevation. Locate some wetland areas on the lithograph. What evidence did you use to determine that an area is wet?

3. Locate Piedmont/Sandhills boundary. 

   The FORTY-ACRE ROCK LITHOGRAPH depicts part of the boundary between the Piedmont and Sandhills regions. From a soils standpoint, the ground in this area is covered with material from different parent rocks and different ages. Many farmers and other land users are natural soil scientists who, by a combination of intuition and trial and error, select different kinds of plants to go in each type of soil. In this area of the state, the Sandhills soils are superior to the Piedmont soils for agricultural purposes. As a result, the Piedmont soils are managed mostly as forest, while the Sandhills soils harbor a patchwork of field and forest sites. Using the GENERAL SOIL MAP and LAND USE/LAND COVER MAP identify each soil type and land use type on the lithograph. Based on the soil and land use information, mark on the lithograph, with a wipe-off pen, your best guess of where the boundary line between

3A-4
the Piedmont and the Sandhills is actually located. Explain in detail, by referring to
the lithograph, how you determined where to draw the line. Why is the boundary not
a straight line? In the northern section of the lithograph there is a small 'island' of
Sandhills soil surrounded completely by the Piedmont landscape. Can you find this
'island'? How did you recognize it?

4. **Analyze the newspaper article.**

Read the newspaper article on page 3A-1 "Rare Plants find home on Forty Acre
Rock." Explain how the story relates to the Piedmont Landform region. Identify on
the FORTY ACRE ROCK TOPOGRAPHIC MAP (refer to the FORTY-ACRE ROCK
LITHOGRAPH if needed) where the plants named in this story would likely be found.
Explain why the publisher thought this story would be of interest to newspaper
readers. Using the same references and setting, write another newspaper article
related to this same situation, but date it far enough either before or after the given
story so that you will have some changes to report. Choose an appropriate title
(headline) and draw an appropriate picture to illustrate your main point.

5. **Compare scale of lithograph to scale of topographic map.**

Locate Flat Creek School in the Midway Community in the southeastern corner of the
FORTY ACRE ROCK TOPOGRAPHIC MAP. Use a ruler and the map scale bar to
calculate the shortest distance from the school to the power corridor. Now locate the
same features on the FORTY-ACRE ROCK LITHOGRAPH and use a ruler and the
lithograph scale bar to calculate that same distance. Do your numbers come out the
same, even though the map and the photo are printed at different scales? Explain
your answer.

6. **Write creative story.**

Take 20-30 minutes to complete one of the two following writing assignments. BE
CREATIVE!! You should write at least a page. Use the FORTY-ACRE ROCK
LITHOGRAPH and the FORTY ACRE ROCK TOPOGRAPHIC MAP for reference.

Assignment 1-- Imagine you’re a settler first coming to this Piedmont area. Looking
at the environment around you, describe what your life might be like. What kind of
hardships might you encounter? What kind of resources would you find in the
environment and how would you use them? Remember to think about the
environment.

Assignment 2-- Write a descriptive essay of the environment around you. You must
be very descriptive-search for adjectives that convey what you’re trying to
communicate. Be sure to include auditory, tactile, and visual descriptions.

7. **Estimate value of timber.**

Clear cutting is one practice used by the timber industry when harvesting trees. An
example of a large clear-cut area can be seen on the FORTY-ACRE ROCK
LITHOGRAPH. This area is on the left side of the lithograph near the middle of the
image. It can be identified by the gray-greenish area with a number of windrows
running through the area. A windrow is a bulldozed row of piled up stumps and other
debris. Compare this area on the lithograph with the same area on the FORTY
ACRE ROCK TOPOGRAPHIC MAP. Use the transparent grid overlay to determine
the approximate number of acres that have been clear cut. First, use the scale bar
on the lithograph to calculate the area in square feet contained in one square of the
transparent grid overlay. Then use the overlay to find the approximate number of grid
squares that overlay the clear cut area. Next, multiply the number of grid squares counted by the value in square feet covered by each square. Finally, express your answer in units of acres. Recall that one acre is equivalent to 43,560 square feet.

Timber is sold by the board foot, which is 1 foot by 1 foot by 1 inch (1' x 1' x 1"). Assuming this was a mature forest and the average tree was 50 feet tall and 5 feet in circumference, how many board feet did each tree provide after it was trimmed at the lumber mill? You may assume that a tree with a five foot circumference will provide a one foot by one foot cross section of usable wood. Pine timber (in 1996) was selling for $275 per 1000 board feet. If there were 300 trees per acre, what was the total value of the trees harvested from this clear cut area near Forty Acre Rock?

ENRICHMENT

1. **Interview residents about legends.**
   - Interview long time residents of your community. Find out what they know about any local legends that explain strange occurrences around local landmarks. Collect the stories in writing or on tape. Your community library would probably be excited to receive a copy. Collect other stories or create stories that explain unusual geographical features. Describe the unusual geographical feature which they attempt to explain.

2. **Determine volume of waste from logging operations.**
   - Assume that the average tree harvested in timber operations around Forty Acre Rock was 50 feet tall and 5 feet in circumference. Once that tree is put through the sawmill, the resulting usable lumber has a square cross section measuring one foot by one foot. Using several appropriate mathematical operations, determine the volume of waste generated from each tree harvested.
Activity 3A-2: Reservoirs, Dams and Piedmont Drainage

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<tr>
<td>6 STATE BASE MAP #1, SHADED RELIEF</td>
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<td>6 FORTY-ACRE ROCK LITHOGRAPH</td>
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<td>6 Wipe-off Pens</td>
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PERFORMANCE TASKS

(Account Key) Overview = ➔; Science = ☮; Math = □; History = △; Language Arts = ⬜

1. Trace path of Flat Creek on map. ➔☽
   On the FORTY ACRE ROCK TOPOGRAPHIC MAP, trace the course of Flat Creek with a wipe-off pen. Just south of Forty Acre Rock, Flat Creek makes two extremely sharp bends near the word "Flat" on the map. Flat Creek cuts through a high ridge at this point. What kind of rock or mineral composition do you think the ridge might be made out of? Why? Why do you think the river turns so sharply here? Locate where this same ridge crosses U.S. Hwy. 601. This is actually a part of the Great Diabase Dike of South Carolina. Use the map information to locate the exact same spot on the FORTY-ACRE ROCK LITHOGRAPH. How does the roadcut area show up differently than the rest of the ridge on the infrared image? Explain why the colors are slightly different.

2. Trace 400 ft. elevation contour to create reservoir. ☮
   Assume that the Army Corps of Engineers has decided to build a reservoir in the Flat Creek area just south of Forty Acre Rock using the 400 ft. elevation contour line as the projected water level. Most Piedmont lakes are formed by building dams along natural constrictions in a stream's flow. The ridge you located south of Forty Acre Rock in the previous activity represents such a constriction. Use the wipe-off pen to identify the place on the FORTY ACRE ROCK TOPOGRAPHIC MAP where this proposed dam would best be located. The dam should cross Flat Creek at its narrowest point (just west of the word "Flat") and must connect the 400 foot contour line on the north side of Flat Creek with the 400 foot contour line on the south side.

Trace the boundary of the future lake (the shoreline) by following the 400 ft. elevation contour line starting at the dam. You will need to determine which direction Flat Creek is flowing so you know which side of the dam will fill up with water. Where is the deepest part of your newly designed lake? Describe the topography along the banks of this lake. How deep will the water be just west of the dam? Will there be any islands in your lake? Explain. Give an appropriate name to your lake based on its shape as drawn on your map. Standing on top of Forty Acre Rock, describe what you would see looking south and west before and after the reservoir was built. Would any unique environmental areas be destroyed if this area were flooded?

The outline you just drew represents the typical configuration of an artificially constructed Piedmont lake. Compare the outline of the pattern formed by the configuration of your lake to the shape of several other Piedmont lakes shown on the STATE BASE MAP #1, SHADED RELIEF. Why is this pattern typical of Piedmont lakes? How is it different from patterns of Coastal Plain Lakes, such as Lake Marion?
3. **Evaluate location of farm ponds.**

   Locate several farm ponds on the **FORTY ACRE ROCK TOPOGRAPHIC MAP**, especially on the left half of the map. What do all these have in common? Why are these ponds located where they are? What benefits do farmers receive from such ponds?

4. **Compare soils of bottomland vs. highland.**

   Locate an area on the **FORTY ACRE ROCK TOPOGRAPHIC MAP** which contains stream valley flat bottomland. How can you recognize flat bottomland by using contour line information? Next, locate an area of higher elevation flatland. How can you recognize this topography using contour line information? Which area would likely produce the best agricultural land? Why?

5. **Analyze land use changes through time.**

   Look in the margins of the **FORTY ACRE ROCK TOPOGRAPHIC MAP** and the **FORTY-ACRE ROCK LITHOGRAPH** to determine the year the map was printed and the year the aerial photography was flown. Examine each cartographic product carefully to identify any changes which have occurred during that time interval. How many of these changes are manmade? How many have occurred naturally?

**ENRICHMENT**

1. **Investigate Heritage Trust site selection.**

   Write to the Nature Conservancy to find out how they select and purchase Heritage Trust Sites? Specifically inquire about the Forty Acre Rock Preserve. Ask when it was purchased, what the purchase price was, who it was purchased from, etc.

2. **Assess lake construction process.**

   Assess problems encountered in constructing lakes today. Make a list of pros and cons for constructing a man-made lake in your area. Consider various points of view such as: farmers, land owners, industrialists, forresters, hunters, fishermen, water sport enthusiasts and environmentalists.
The State
October 7, 1985
Welcome to Utopia

by John Collins

"If you could see and walk along Beaver Dam Creek, you would understand," said Newberry Judge Walter T. Lake.

Mazell Owen, 38, theorized that the area's name might have derived from its suitability for farming. "The land isn't too hilly and it isn't too flat, the soil isn't too clayey and it isn't too sandy, and the weather isn't too hot or cold or dry or rainy, she said.

The community of rolling pastures and woods is more sparsely populated now than it was around the turn of the century.

Lois Boulware, 90, says life in Utopia has changed considerably since she came to the area from Chapin 70 years ago. "In those days everything was worked with animals," she said. "Why, we had a nine horse farm back then. Animals plowed the fields and you didn't need a tractor."

Rebecca Perdew, who has lived all her 90 years along the same highway, also has seen many changes in the area through the years. "This road -- 395, I call it Kimpson Ferry Road -- is nine miles to Newberry, and the other way goes all the way to Georgia," she said. "It's so busy now with trucks all the time."

Perdew recalled when a wooden bridge was built to replace the ferry near where a concrete bridge now spans the Saluda River at the backwaters of Lake Murray. The wooden bridge "was slanted so bad on the Saluda side, they had to put slats across it to keep mules from sliding off," she said.

Now there is a new generation living in Utopia -- including some who don't remember the past. But most say they wouldn't live anywhere else. Said Mayzell Owen waving at a neighbor, "There's just a feeling of being on your own out here. There's not a hurried pace and the people are so nice. It really is a utopia."

| RATIONALE |

The Silverstreet Study Site lies just west of the town of Newberry and contains many features representative of a typical farming region in the Piedmont of South Carolina. Patterns of contoured agricultural fields mix with a patchwork of other landforms to provide a striking visual image of the diversity of land use in this region of the state. Timber management practices in forests along the Bush River, control of erosion from farm fields, and the placement of chicken houses by the poultry industry illustrate some of the potential environmental problems faced by Piedmont farmers. Although there is no actual public access site in the immediate area, several farmers are willing for student groups to tour their farms to study soil conservation methods and modern crop rotation practices as well as visit modern, highly mechanized chicken houses. Such tours and visits must be arranged through the County Extension Agent's Office in Newberry County.
Introduction

The Silverstreet farming area in Newberry County is typical of the rolling hill landscape of the Piedmont. The soils are ancient, and have formed saprolite, a rotten rock material that has been left undisturbed on site for millions of years until the introduction of European-style agriculture. Soil productivity in the region has been greatly reduced by unchecked erosion, reaching its low point during the dust bowl days of the 1930’s. The Piedmont had originally been settled by small independent farmers but the spread of cotton into the Piedmont quickly changed its landscape and economy. Newberry County’s history has been reflective of the dramatic changes brought by the cotton kingdom. The economy of Newberry shifted in the Antebellum period to one based upon large farms and slave labor.

While the Civil War had wrecked the economy and much of the Piedmont's farmland suffered from soil erosion, cotton continued to dominate the economy until World War II. Most farmers were dependent upon local merchants for credit and these merchants helped to maintain the place of king cotton because they insisted that farmers grow an easily marketable crop. Finally, a combination of factors broke the hold of cotton. These factors included the boll weevil invasion, the agricultural depression of 1921, exhaustion of the soil, the Great Depression of the 1930’s, and competition from western farmlands. Cotton cultivation was finally replaced by a more diversified agricultural economy in Newberry.

Poultry began to become an economic factor at the end of the nineteenth century and by 1970 Newberry County had become the largest producer of chickens and eggs in South Carolina. John R. Spearman (of Silverstreet) brought the first Guernsey cows to the state in 1880. Many more farmers moved into the business so that by 1987 Newberry was the second-highest South Carolina county in milk-production. Moreover, starting in the 1930’s and continuing today, the raising of beef cattle has increased in the county. Soybeans have also become a major crop for farmers in the county.

The Legend of the Silverstreet Special

A story from John Bozeman, retold by Christy Clonts

In the early 1900’s Silverstreet was a bustling little town with several passenger trains stopping daily. During special occasions such as the Little Mountain Reunion, State Fair Week, or during peak fall colors in the mountains, special trains operated.

One Saturday, as one of these special trains was taking a large group from Silverstreet to the State Fair in Columbia, the fire stoker was busily shoveling coal into the engine. Out of the corner of his eye he thought he saw the figure of a woman fall under the wheels of the train. It was such a gloomy, foggy day that he couldn’t be sure. He called to the engineer to stop the train. Brakes squealed as the train ground to a halt.

The engineer checked under the entire train and back down the track, but there was no sign of anyone or anything. While waiting for the engineer to complete his inspection, a passenger strolled up the track until he came to the trestle which was to carry the train across the river. Peering through the fog and mist, he was shocked to see that the center part of the trestle had been completely
washed out by raging flood water. Had the fire stoker not “seen” the mysterious woman, every passenger on the train would have certainly tumbled to their death.

Dead Fall
A story from Mr. Charlie Senn, retold by Christy Clonts

Back in the early 1800’s the town of Newberry, S.C., was called Newberry Village. Seven miles southwest of Newberry Village was a tiny crossroads town named Dead Fall. Head’s Tavern, a busy and thriving place in those days, stood at the crossroads. Beside the tavern was a great oak tree with widely-spreading branches. Two of the lower branches grew horizontal to the ground and the moss was worn away on the upper sides of these branches. It was said that these two branches had served as the local gallows. Highwaymen, horse thieves, and murderers were quickly sentenced in local trials and were hung from that tree. Some local people believed that this gallows tree was the reason for the name Dead Fall. Others insisted the name had a Native American origin.

The Cherokee and Salutah (Saluda) had formerly built an ingenious trap for wild animals before the first white settlers had arrived. Rows of stout stakes driven into the ground channeled passing animals to a narrow gateway. Then a baited trigger was so arranged that when it was disturbed by an animal it would release a heavy log, or deadfall, which would crush the creature. Such traps were deadly to bears, panthers, and wolves. This particular trap was still in place when the early white settlers arrived. The settlers left the trap in place as a curiosity, but they sprung it so as to prevent injury to children or domestic animals. Though the trap finally decayed, the name Dead Fall survived.

Suspended Sediment as a Type of Non-Point Source Pollution

When a significant portion of land is used to grow row crops like corn, soybeans, tobacco, etc., eroded soil becomes a potential pollution source for streams and rivers. Forest clearcuts also lay the soil bare and invite erosion. The Piedmont is particularly susceptible to erosion and sediment pollution because of its high rainfall amounts, sloping ground surfaces, large exposures of bare soil, and its clay rich soils which limit infiltration and encourage runoff. Since humans cannot control factors such as rainfall amounts and soil composition, good environmental stewardship dictates that landowners do as much as possible to control the remaining factors.

Bare soil can be eliminated by planting a ground cover of some sort. Plant roots physically hold the soil in place while leaves intercept falling raindrops and lessen their force of impact. Even when certain land uses require the removal of vegetation, the application of straw mulch or other dead plant litter can help protect the soil until new vegetation or crops can take hold. Steep slopes can be reduced by terracing, and terrain roughness can be increased by contour plowing. Long slopes can be broken up by strip cropping or a variety of physical barriers which will slow down the water. Choosing an appropriate land use for the terrain conditions can go a long way towards reducing the amount of sediment eroded from the land and entering Piedmont streams and rivers.
## Activity 3B-1: Piedmont Landscapes

### Materials

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<td>LAND USE/LAND COVER MAP</td>
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<td>GENERAL SOIL MAP</td>
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<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<td>SILVERSTREET LITHOGRAPH</td>
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<td>State Map of Major Drainage Basins</td>
<td>Figure 1-2</td>
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### PERFORMANCE TASKS

(Icon Key) Overview = ⚫; Science = ⚫; Math = ⚫; History = ⚫; Language Arts = ⚫

1. **Locate the study site.** ⚫ ⚫
   
   Locate the Silverstreet Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Construct topographic profiles of Piedmont landforms** ⚫
   
   Making profiles of the landscape aids in describing the topography of an area. A comparison of two profiles made in different locations on the SILVERSTREET TOPOGRAPHIC MAP will show that these areas vary considerably in slope depending on how close the land is to major streams. After the two profiles have been made, compare the results. Relate the major differences to map location? Where are erosion gullies most likely to form? Why?

   Construct topographic profiles along the two base lines described below. Fold a piece of graph paper lengthwise and place the fold along the base line drawn on the map. Mark on your graph paper the spot where each index contour (the dark contour lines) intersects your fold line. Write the elevation represented by each index contour line next to your mark for that line. Also label the relative positions of creeks and other landmarks. These marks along the fold line will serve as place holders along the horizontal axis of your diagram and will have the same horizontal scale as the topographic map. Now unfold your graph paper and draw a line along the fold crease to represent your horizontal axis. Next, draw in your vertical axis, making sure your line is at least one inch away from the left edge of the paper to allow room to label your axis. The vertical scale should be approximately 1 inch = 100 feet (depending on the grid size of your graph paper). Plot each point on the graph paper using the elevation value as the vertical coordinate and the position mark on the horizontal axis as the horizontal coordinate. Draw a smooth line through these points on your graph paper to complete the topographic profile.
Group I Landscape Near Streams
Draw a straight line, using a wipe-off pen and a ruler, between Mt. Olive Church, located in the extreme northwestern corner of the map, and the benchmark "BM 519," located in the center along the top edge of the map. Use this as your base line for drawing the topographic profile.

Group II Landscape Away From Streams
Draw a straight line, using a wipe-off pen and a ruler, between the benchmark "BM 582" in the Community of Gary (upper left hand section of the map on Hwy. 76) and St. James Church in the Community of Jalapa (about two miles east of Gary on Hwy. 76). Use this as your base line for drawing a topographic profile. Use non-index contour lines if you need to get additional information.

3. Relate landscape to "The Legend of the Silverstreet Special." Locate several railroad tracks on the SILVERSTREET TOPOGRAPHIC MAP. Using the landscape clues given in the story, "The Legend of the Silverstreet Special," on page 3B-2, examine the map to locate the place where the incident might have happened. Once you have located the exact position of the railroad trestle, write two descriptive sentences which tell about the landscape and the way it looked to the passengers. Use plenty of adjective in your sentences. Insert your sentences into the existing story and read the result to the class. Why do we use railroad trestles and bridges instead of just filling in the valley with dirt?

4. Find possible location of "Dead Fall." Read the story "Dead Fall," on page 3B-3, being careful to note any information which would help you locate this spot on the SILVERSTREET TOPOGRAPHIC MAP and the SILVERSTREET LITHOGRAPH. Examine the map and the image carefully. Are there any intersections on either the map or the lithograph which completely fit the description of "Dead Fall?"

ENRICHMENT

1. Compare ghost stories with "Silverstreet Special." Interview classmates, family, and friends. Collect their favorite ghost stories. Decide on an appropriate format for sharing class favorites. Some possible examples are a storytelling event, a video, or an audio tape. Analyze favorite ghost stories for their type and similarities. Which ones foretell danger? Which qualify as jump stories? Which are urban legends? Which tell of a ghost recurring at particular times and or places? Once you become familiar with several types of ghost stories and the format each uses, you can create your own stories based on the "Silverstreet Special," on page 3B-2, and on other models that you have studied.

2. Research crime and punishment, past and present. For what crimes would a person be hanged during the 1830’s in South Carolina? Who decided guilt or innocence? Who passed the sentence? Research crime and punishment from that time period. Refer to the "Dead Fall" story on page 3B-3.
Activity 3B-2: Agricultural Land Use

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PERFORMANCE TASKS

(Icon Key) Overview = ➔; Science = ⚫; Math = ☐; History = ☐; Language Arts = ☐

1. **Analyze the newspaper article.**
   Read the newspaper article on page 3B-1, "Welcome to Utopia." Explain how the story relates to the Piedmont Landform Region. Identify on the SILVERSTREET TOPOGRAPHIC MAP (refer to the SILVERSTREET LITHOGRAPH if needed) where some of the places mentioned in the article might be found and also where some of the events mentioned in the article might have taken place. Explain why the publisher thought this story would be of interest to newspaper readers. Using some of the same people as characters and the same location as your setting, write another newspaper article related to this situation, but date it far enough in the future or the past so that you will have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

2. **Identify farm-to-market transportation routes.**
   Locate Newberry County on the STATE BASE MAP #2, WITH HIGHWAYS. Where is the county seat? Use a wipe-off pen to outline the stream drainage pattern for Newberry County. Trace the path of the surface water leaving Newberry County on its way to the ocean. In which of the four major state drainage basins is Newberry County located? If you were a cotton planter in 1850, how would you get cotton to the Charleston market? Locate Silverstreet. If you're a poultry farmer today living near Silverstreet, how would you transport your chickens, eggs or turkeys to a market in Columbia or Greenville? Trace your route on the map.

3. **Estimate number of chickens in study site area.**
   Currently the poultry industry is the major farming enterprise in Newberry County. Identify poultry houses on the SILVERSTREET LITHOGRAPH. Count the poultry houses on this lithograph by circling each one with a wipe-off pen. How many did you find? Now count your birds. Use the scale bar on the lithograph to estimate the approximate dimensions of one of these poultry houses. If every bird needs 1 square foot, how many bird can be raised in your selected poultry house at one time? In reality, poultry cages are often stacked several rows high. So the actual number of cages will be several times your previously calculated answer.

4. **Analyze land use changes through time.**
   Look in the margins of the SILVERSTREET TOPOGRAPHIC MAP and the SILVERSTREET LITHOGRAPH to determine the year the map was printed and the year the aerial photography was flown. Examine each cartographic product carefully.

3B-6
to identify any changes which have occurred during that time interval. How many of these changes are manmade? How many have occurred naturally?

5. **Evaluate reasons for abandoned roads.**
   Locate the Trinity Community in the lower left-hand corner of the SILVERSTREET TOPOGRAPHIC MAP. Use a combination of landmarks and map patterns to locate this same area on the SILVERSTREET LITHOGRAPH. Note that several local roads shown on the topographic map (dated 1969) are not visible on the lithograph (dated 1989). Why do you think those roads were abandoned? Are there any traces of those roads visible on the lithograph? Have any other features changed in the Trinity Community during that 20 year period? Describe the changes and give a possible explanation for why they occurred.

6. **Identify soil conservation practices.**
   With the SILVERSTREET LITHOGRAPH in front of you, use a wipe-off pen to circle examples of soil conservation efforts such as terracing, strip cropping, pond construction, and reforestation of land in pines. Locate on the lithograph the striped patterns of farm fields, which show a combination of at least two types of soil conservation techniques, contour plowing and strip cropping. A third practice, terracing, may also be employed here, but you cannot tell from the lithograph alone. Also locate the positions of these striped fields on the SILVERSTREET TOPOGRAPHIC MAP. Explain how each of these conservation practices works. When plowing and planting a terraced field, in which direction do you plow? What effect would contour plowing have on the movement of water? Why don't all farmers employ these kinds of conservation practices?

   Look on the SILVERSTREET LITHOGRAPH. Estimate the percentage of cultivated land, including pasture land, visible on the lithograph. Because this is in an area of poultry and cattle farming, most of the fields are alternated with winter wheat, oats, or rye and corn--crops that are suitable for feed grains. Why is every other 'strip' bare soil? What are the benefits? Identify the different geometric shapes formed by the contour patterns. Justify why you think each field was contoured in its particular pattern. Why do farmers contour their land in Newberry County and not in the Coastal Plain counties such as Sumter, Williamsburg, or Hampton?

7. **Calculate statistics based on areas of fields.**
   On the SILVERSTREET LITHOGRAPH outline the boundary of any five contoured fields with a wipe-off pen. Use the transparent grid overlay on the lithograph to determine the approximate area of each field. What is the range of field areas? Calculate the mean, the median, and the mode of the field areas.

8. **Estimate area of contoured field.**
   Using the SILVERSTREET LITHOGRAPH, find the large contoured field located within the lower portion of the extensive wooded area near the center of the lithograph. Find the center point of the radius for each of the contours (concentric arcs). Compare the length of these radii to determine if the contour bands are of equal width. Calculate the area of the entire circle made with the longest radius. Then estimate the percentage, in square miles, of the circle that is being cultivated.
9. **Relate topography to distribution of agricultural fields.**

Compare the **SILVERSTREET LITHOGRAPH** and the **SILVERSTREET TOPOGRAPHIC MAP** to identify areas occupied by agricultural fields versus areas occupied by forest. On the topographic map, what color designates fields? What color designates forests? Examine the patterns of contour lines that typically are associated with fields and with forests. Look at several places on the map until you can get enough information to generalize. What is the typical relationship between contour line patterns and the distribution of agricultural fields?

10. **Select agricultural product to display on water tower.**

Some South Carolina towns have chosen to become famous by decorating community water towers to resemble the agricultural products they are famous for. Gaffney has decorated their water tower to look like a giant peach. Newberry has decorated its tower to look like a giant egg. Locate Newberry and Gaffney on the **STATE BASE MAP #2 WITH HIGHWAYS**. What agricultural products are produced in your local area? Which one would be easiest to adapt to the shape of a water tower? Sketch a drawing of what your decorated water tower would look like and write a short slogan or poem that would attract tourists to come see it.

11. **Interpret agricultural market changes through time.**

The Silverstreet area is situated perfectly for supplying perishable agricultural products like milk and eggs to surrounding metropolitan areas. Locate the Silverstreet study site on the **STATE BASE MAP #2 WITH HIGHWAYS**. Which city is closest? What major towns and cities are less than fifty miles away? Why was it important in the 1800’s and early 1900’s for dairy and egg farmers to be close to market? Which town or city was the primary market for Silverstreet farmers in 1900? Which towns and cities are probably the primary markets in modern times? What technological advances have made this change possible?

**ENRICHMENT**

1. **Identify where kudzu was planted to control erosion.**

Identify in your community places where kudzu was planted in the 1930's and is now covering fields and wooded areas. In addition, contact your County Agriculture Stabilization and Conservation Service (ASCS) office to learn about present-day soil conservation programs available to land owners and farmers.

2. **Research egg production.**

Look up egg production tables for South Carolina. What percentage of this product is produced in Newberry County?

3. **Evaluate information in Farmers’ Almanac.**

Locate a copy of the Farmers’ Almanac in your school or community library. Many farmers used to use this book as a guide to planning all aspects of their business, from planting seeds to gathering the harvest. Some of the information in the Farmers’ Almanac is still useful today. Explore the Table of Contents with your group and identify information, which would likely be useful to farmers in the Silverstreet area.
Evidence indicates that blacks fought at Kings Mountain

Call him Ishmael Titus. Born a slave, he substituted for his master in the Patriot Army during the American Revolution. The promise of freedom lured him into a string of battles that lead to the one at Kings Mountain on Oct. 7, 1780.

The discovery of the black names delighted officials at the Kings Mountain National Military Park: Ishmael Titus, Essius Bowman, John Bruddy, Andrew Ferguson (and his father) and a man known only as Primes or Primus. Legend has it that Bowman was among those who shot Patrick Ferguson, British commander at Kings Mountain.

Ironically, the most fully-documented black participant is also a Ferguson.

Andrew Ferguson "and his father were free blacks," says Moss. "Andrew was a blacksmith and was shanghaied by a British naval press gang".

The Fergusons escaped at Charleston and were making their way northward when they were intercepted by a patriot militia. The leader explained to Andrew that he was in big trouble with the British and would probably be hanged for treason if he were caught. "He probably had Andrew scared a little bit," says Moss. "He told Andrew he needed to be drafted so they could protect him." Andrew later wrote that both he and his father were lucky enough to be drafted. They saw action at the battles at Camden, Musgrove's Mill and Kings Mountain. Andrew Ferguson turned up at the Cowpens fight and later at Guilford Courthouse where he was seriously wounded. "They made a plate by beating silver coins," says Moss, "and put the plate in his head."

RATIONALE

The Kings Mountain Study Site provides an excellent example of how landscapes and landforms can affect historical events. When the British and American armies met at Kings Mountain during the Revolutionary War, the British forces were not used to fighting in this type of landscape, while the American troops took advantage of their knowledge of the terrain to gain a quick victory. The landscape has also figured prominently in the development of the trails and monuments that were later constructed within the national park. As the population of the Piedmont region grew larger, the Kings Mountain area became part of a national transportation route between Charlotte and Atlanta. The Kings Mountain Belt is also known for its distinctive geology and economically valuable mineral deposits. Several surface mining sites illustrate both the benefits and potential environmental hazards associated with resource extraction. Many of the inactive mines have been reclaimed, although some have not, providing a comparative framework for analyzing and discussing a variety of environmental issues.
Transportation Corridor and Land Use

The settlement of Cherokee and York Counties began in 1755 when a large number of displaced Pennsylvania colonists moved southward to take advantage of free land, an absence of conflict, and the promise of rich iron deposits. Many hoped to "strike it rich" mining the seemingly limitless natural resources. The Pennsylvania connection is still evident today in town and county names like Lancaster, York and Chester, all of which were important Pennsylvania towns during the colonial period.

Throughout the Revolutionary War period and even into the late 1800's, the King's Mountain Iron District produced a variety of weaponry and other implements, such as cannons and cannonballs, guns and ammunition, nails, farm tools, and iron wire. Finished products were shipped all over the country and abroad, usually through the Port of Charleston. In fact, almost all transportation routes in South Carolina before 1900 ran in a north-south orientation, following the major river systems. Just before the Civil War, several iron manufacturing companies pressured the South Carolina legislature to build additional railroads and canals in the area, but the war prevented any action being taken.

Around 1900, a new railroad line, the Southern, linking Washington to New Orleans, was routed through the upstate of South Carolina. This main line rapidly gained freight business and put an end to South Carolina's almost total dependence on the Port of Charleston for commercial exports. Highways soon followed the railroad, connecting many of the railroad towns that had sprung up along the new rail line with other major cities. National Highway 29, designated the "Bankhead Highway", paralleled the Southern Railroad line and became an important travel route even though it was "paved" only with crushed stone. Other less obvious types of transportation systems which carry oil and natural gas (pipelines), electricity (power lines), and telephone and cable TV lines preferentially follow this same transportation corridor to achieve maximum efficiency for their respective distribution networks.

Once the east-west connection was established, the upstate of South Carolina became much more commercially tied to cities like Atlanta and Charlotte than to Columbia and Charleston. Increases in both commercial and personal highway traffic necessitated the construction of Interstate Route 85, first opened in 1964, along basically the same Atlanta-Charlotte route. This corridor has continued to be a magnet to new industry and commercial development all across the upstate. In contrast, areas bypassed by the interstate highway system have experienced major problems in attracting new industry and many have lost existing industries through relocations to sites with easier access to major transportation and utility routes.

Historical Battlefield

The Battle of King's Mountain was one of the turning points in the American Revolution in the South. It was a battle fought between American patriots and American loyalists, who remained faithful to England. In fact, the only non-American present was the commander of the loyalist force, Major Patrick Ferguson. As a result of the patriot victory at King's Mountain, the momentum in South Carolina shifted to the patriots.
After the surrender of Charles Towne on May 12, 1780, the British had quickly moved to gain control of South Carolina. Partisans (guerrillas) harassed the British occupying forces but were unable to force the British out of the state. Many of the state's citizens pledged loyalty to the British Crown, and the British moved to enlist these "Loyalists" into a militia that could be used to secure the state for the Crown.

British General Clinton appointed Major Patrick Ferguson to be inspector of militia. Ferguson, a Scottish officer, had invented a breech-loading rifle. It was superior to the standard issue British musket but the British army failed to adopt it for general use. A courageous officer, he had lost the use of an arm at the Battle of Brandywine. Ferguson quickly recruited a loyalist militia which he used in the summer of 1780 in the Carolina Backcountry to hunt the "rebels (patriots)" while raiding their farms for provisions. Resistance often times came in the form of militia units of "over-mountain men" who entered South Carolina periodically to challenge the British. Most of these over-mountain men were frontiersmen from the fertile mountain valleys west of the Blue Ridge. While a number of ethnic groups were represented, the majority of these frontiersmen were of Scotch-Irish descent.

The patriot disaster at the Battle of Camden (August 16, 1780) encouraged British Commander General Cornwallis to make plans to invade North Carolina. Major Ferguson was ordered to protect Clinton's left flank, gather intelligence, seize supplies from patriot farms, and enlist more loyalists. The forces commanded by Major Ferguson consisted of both loyalist provincial troops and regular militia units. Major Ferguson made his headquarters at Gilbert Town, North Carolina, and sent a message to the over-mountain men. In the message, he threatened that "if they did not desist from their opposition to British arms, he would march his army over the mountains, hang their leaders, and lay their country waste with fire and sword."

Instead of intimidating these over-mountain men, Ferguson's message led them to decide to strike first. At Sycamore Shoals (near present day Elizabethton, Tennessee), the over-mountain men mustered on September 25, 1780, under the commands of the patriot militia Colonels Charles McDowell, John Sevier, William Campbell, and Isaac Shelby. After a rousing sermon by the Reverend Samuel Doak who urged the men "to wield the Sword of the Lord and Gideon," they began their march from Tennessee to find Ferguson. Five days later, they made camp at Quaker Meadows on the Catawba River. Here they were joined by men commanded by Colonels Benjamin Cleveland and Joseph Winston. By this time the patriot army was composed of North Carolinians, Tennesseans, and Virginians. To avoid any personal conflict, the officers chose Colonel William Campbell as their commanding officer.

Upon receiving news of the approaching patriot army, Major Ferguson began to retreat from Gilbert Town toward Cornwallis' forces at Charlotte, North Carolina. Ferguson sent for reinforcements and on October 1, 1780, appealed to North Carolina loyalists for help. On the afternoon of October 6, 1780, Ferguson arrived at King's Mountain, a location which controlled travel routes in this area, where he decided to wait for reinforcements. Confident in his ability to defend his position, he bragged that even "God Almighty can't get me off this mountain."
During their pursuit of Major Ferguson, the over-mountain men rested at Cowpens, South Carolina, where they received information that Ferguson's force was at King's Mountain. While still at Cowpens, an additional 400 South Carolinians under Colonels James Williams, William Hill, and Edward Lacey joined the patriot forces. The patriots traveled through the night in a pouring rain and arrived at Kings Mountain after noon on Saturday, October 7, 1780. Dismounting, they moved to encircle the mountain. After some initial skirmishing, the battle started around 4 p.m. and was over in about an hour.

Figure 3C-1: Battle of Kings Mountain
The Battle of King's Mountain was a contest between the British bayonet and the over-mountain men's rifles; between American patriots and American loyalists. Unfortunately for Ferguson, the landscape at King's Mountain favored the riflemen who used the terrain to their advantage. The mountain rose some sixty feet about the surrounding land, was covered in large pines, and was topped by a ridge running from sixty to one hundred feet in width. Major Ferguson ordered a series of bayonet charges. The over-mountain men simply fell back seeking cover behind trees and rocks where they then fired into the loyalist lines with well-aimed rifle fire. Ferguson's men relied on massed volley fire and bayonet charges; while the over-mountain men, using the cover available, were able to pick off Ferguson's men one by one with their rifles. As Major Ferguson's bayonet charges were beaten back, the patriots gradually tightened the circle (frontiersmen called encircling your enemy a "ring fight") around Ferguson's troops.

The air was filled with the noise of guns, the screams of the wounded, and the smell of sulfuric smoke. As Colonel Shelby recalled, the "mountain was covered with flame and smoke and seemed to thunder." Seeking to escape, Major Ferguson attempted to break out, but was cut down in a hail of bullets. Ferguson's second-in-command then surrendered. However, some of the patriots refused to recognize the white flag. They shouted "Tarleton's Quarter (meaning no surrender accepted). Nevertheless, the patriot leaders were able to retain control of their men. The British defeat was complete with every loyalist either killed (225), wounded (163), or captured (716). The patriot losses were much less-28 killed and 62 wounded.

After the battle, King's Mountain was covered with the dead and wounded. Fearing the arrival of a British relief force, the patriots failed to properly bury the bodies. Wolves, vultures, and hogs soon descended upon the battlefield and unearthed many of the bodies from their shallow graves. On October 8, 1780, the patriot army then withdrew with their wounded and their prisoners into North Carolina and quickly disbanded.

The patriot victory won by the over-mountain men at King's Mountain was one of the turning points of the American Revolution. The news of this victory served to boost patriot spirits while depressing loyalists. It led General Cornwallis to withdraw completely from North Carolina to Winnsboro, South Carolina. This bought time for patriot General Greene to organize a new Southern offensive while the British General Cornwallis had to remain on the defensive.

Doak's Famous Sermon and Prayer  
(At Sycamore Shoals Muster September 26, 1780)

"My countrymen, you are about to set out on an expedition which is full of hardships and dangers, but one in which the Almighty will attend you."

"The Mother Country has her hands upon you, these American Colonies, and takes that for which our fathers planted their homes in the wilderness - OUR LIBERTY."

"Taxation without representation and the quartering of soldiers in the homes of our people without their consent are evidence that the Crown of England would take from its American Subjects the last vestige of Freedom."
"Your brethren across the mountains are crying like Macedonia unto your help. God forbid that you shall refuse to hear and answer their call - but the call of your brethren is not all. The enemy is marching hither to destroy your homes."

"Brave men, you are not unacquainted with battle. Your hands have already been taught to war and your fingers to fight. You have wrested these beautiful valleys of the Holston and Watauga from the savage hand. Will you tarry now until the other enemy carries fire and sword to your very doors? No, it shall not be. Go forth then in the strength of your manhood to the aid of your brethren, the defense of your liberty and the protection of your homes. And may the God of Justice be with you and give you victory…and help us as good soldiers to wield the SWORD OF THE LORD AND GIDEON."

Ferguson’s Address to Loyalists  
(October 1, 1780)

Hoping to frighten and arouse the Loyalists in Tryon County, North Carolina, Major Ferguson made reference to the impending arrival of the over-mountain men in an address "To the inhabitants of North Carolina."

Gentlemen:  
Unless you wish to be cut up by an inundation of barbarians, who have begun by murdering an unarmed son before the aged father, and afterwards lopped off his arms, and who by their shocking cruelties and irregularities, give the best proof of their cowardice and want of discipline: I say, if you wish to be pinioned, robbed, and murdered, and see your wives and daughters, in four days, abused by dregs of mankind - in short, if you wish or deserve to live, and bear the name of men, grasp your arms in a moment and run to camp.

Mining and Environmental Restoration

The Kings Mountain Mineral Belt runs from the Catawba River, in North Carolina, southwest through the Gaffney area of South Carolina. Its total length is approximately 50 miles. This geologically important region has been mined for iron, lithium, tin, kyanite, and barium, as well as more common resources such as limestone (marble) and granite (pegmatite).

The mineral wealth in Kings Mountain played a big part in the historical development of the region. When the Native American residents first agreed to let settlers live in the Kings Mountain area, a floodgate was opened for people with iron mining knowledge, particularly from the southeastern section of Pennsylvania. They applied what they knew to the local iron deposits that run the length of the Kings Mountain Belt. Mining operations began even before the Revolutionary War, and Bessemer City and Lincolnton in North Carolina soon became the top iron manufacturers in the region. By the time the Civil War started, the iron supply was large enough to contribute significantly to the Confederate war effort. After the war, but before the turn of the century, the iron industry in the area collapsed due to the shallowness of the local deposits and tremendous competition from richer iron mines in the Lake Superior region.
The next resource to be exploited in Kings Mountain was marble. The marble belt was discovered west of the iron ore deposits. The marble was first mined to be used as flux in the iron furnaces and to burn in kilns to produce lime. Historically, most lime production has been located near Gaffney, South Carolina, but the Campbell Limestone Company opened a large quarry just south of Grover, (which is now run by Vulcan Materials Inc.) and other quarries are operated in North Carolina by Martin Marietta Company. Today the most important mineral resource in the area is Lithium. Lithium is obtained from a type of granite (pegmatite) and can be used in a number of ways including: greases, rubber products, catalysts for aluminum production, and hypochlorite gas which is used in swimming pools. Secondary mineral production of lead, pyrite, barite, kyanite, sillimanite, silver, and gold, also attracted many newcomers to this area.

CASE STUDY #1
Vulcan Materials - Blacksburg Quarry (just south of Grover, NC)

The Campbell Limestone Company began to produce marble at this site to meet the booming industrial and agricultural demand for lime. Production started in 1954 and continued until 1978 at the original site when the mine was sold to Vulcan Materials. In 1978, Vulcan Materials moved to a new site, half-mile away, which was discovered by following the orientation of the marble rock. The marble ore has an orientation of southwest to northeast with approximately a 35-degree tilt, or dip, to the northwest. Joining the two quarry sites proved impossible because of landowners who were established on the intervening ground. In the mid 1980's, because mining operations were nearing the property line of the landowners, and because they were running out of high quality rock, Vulcan Materials began exploring other nearby properties for additional concentrations of high quality marble they could mine.

At this new site, once the land had been purchased, five years of research still had to be performed before digging and drilling could be started. After exploratory drilling revealed the exact location of the ore, the land was stripped of trees and excavation of the overburden (loose rock and soil) began. This material was placed away from the quarry to avoid the possibility of it being eroded back into the active pit. To help insure stability, and to comply with new environmental standards, the overburden was seeded with grasses and small plants. During any strip mining operation, a number of potential hazards must be anticipated. Falling rocks are controlled by terracing the sides of the quarry, and hard hats are worn by all personnel at all times on the site. Flooding is controlled by pumping out the excess water, and road dust is controlled by frequent sprinkling of water. Most quarries have a separate area for service and repair of heavy equipment. All large oil or gas containers must have their own retention basins to contain any spills that might occur.

After the mine has run out of material to produce, the mine site must be restored to an environmentally stable situation, in harmony with the surrounding properties. If the site is being vacated completely, then all structures must be removed and any concrete left must be covered by 5 feet of topsoil. The slope going down to the mine edge has to have a maximum ratio of 3:1 with a shelf at the quarry edge. The whole property must be enclosed with fence and barbed wire if the quarry is to remain empty. All of this remedial work must be planned and approved before the first shovel touches the ground. The original Campbell Quarry already has been filled in and is now a lake. The surrounding support areas have been seeded and planted with trees and other plants.
that are indigenous to the area. This restoration blends in with the landscape of the surrounding area, which contains lakes of its own.

Most of the Gaffney marble is taken from the quarry and crushed into various sizes for sale as road gravel. A small portion is used to produce agricultural lime. The stone is sent through a series of crushers to get the desired size. The finer the material, the more expensive the product becomes. In 1997, the active mine removed 600,000 tons of rock, which breaks down to about 75 truckloads a day. Only 15-20% of this material is waste, and most of this ends up in settling ponds. Eventually these ponds also will be environmentally restored after being covered with topsoil and seeded with grass.

CASE STUDY #2
Henry Knob Kyanite Mine (Southeast of Kings Mountain)

Henry Knob was once the highest point in all of York County. Composed of hard quartzite rock, the mountain was much more resistant to erosion than the surrounding rock, which was composed of a metamorphosed mud rock called schist. However, the quartzite rock also contained an aluminum-rich mineral known as kyanite, and in 1935 some enterprising miners began carving up pieces of the mountain to extract and process this valuable mineral. Production increased greatly after 1948 to the extent that, for the most of the 1960's, South Carolina was the second largest producer of kyanite in the entire country. By the time mining operations ceased, in 1966, the top of the knob had been completely removed and its elevation was lowered by over 300 feet. The main excavation pit cut almost all the way through the hill from one side to the other.

Kyanite is a hard, bluish mineral which has a very high melting point. It is used in the manufacture of ceramic items, such as spark plugs, which must withstand not only high temperatures, but sudden changes in temperature as well. Although the mineral itself is non-toxic, the refining process uses a highly acidic liquid, which was collected in open pits and left to seep into the groundwater system. The leftover rock waste, or tailings, was likewise dumped over large areas of the hillside. At the time of the closing of the mine, close to 2,000 acres of land had been turned into a dead zone with high levels of contamination all around.

When the Henry Knob Kyanite mining operation became unprofitable, the operators simply left the area with no clean-up and no attempt at reclamation. In most mine closings, the owners will either allow the open pit to fill with water and become a lake or they will fill the pit with trash and tailings and turn it into a landfill. But in the case of Henry Knob, various buildings and parts of buildings were left standing, concrete and other foundation structures were left in place, unburied, and rock waste from screening ponds was left covering most of the perimeter of the site. Some of this material still washes into nearby streams every time it rains.

Fortunately, after decades of neglect, nature has begun to reclaim portions of Henry Knob. Vegetation is slowly starting to cover some of the tailing areas, but it will be a very long time before this corner of York County can again blend in harmoniously with its surroundings.
### STUDIO AREA 3C: KINGS MOUNTAIN BELT

#### Activity 3C-1: Transportation Corridor

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<thead>
<tr>
<th>Materials</th>
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<tr>
<td>6</td>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<tr>
<td>6</td>
<td>LAND USE / LAND COVER MAP</td>
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<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<td>GENERAL SOIL MAP</td>
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<td>Battle of Kings Mountain</td>
<td>Figure 3C-1</td>
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<tr>
<td>6</td>
<td>Magnifying Glasses</td>
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<td>6</td>
<td>Wipe-off Pens</td>
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#### PERFORMANCE TASKS

(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts = 

1. **Locate the study site.** 
   
   Locate the Kings Mountain study site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is the site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain does this site drain?

2. **Identify Kings Mountain on map and lithograph.** 
   
   Locate Kings Mountain on the KINGS MOUNTAIN TOPOGRAPHIC MAP and the KINGS MOUNTAIN LITHOGRAPH. Locate the mountain range that runs diagonally across these maps. Name the mountains that are included on this range. On which of the maps is Kings Mountain easier to find and identify? Why? What is the highest elevation on Kings Mountain? With a wipe-off pen, transfer the boundary line of Kings Mountain National Military Park onto the lithograph by matching up landforms, highways, and areas of forest cover. How is land use different inside and outside of the Park boundaries?

3. **Examine pattern of transportation routes.** 
   
   Kings Mountain lies along the most direct route between the major metropolitan areas of Atlanta, GA, and Charlotte, NC. Using the STATE BASE MAP #2, WITH HIGHWAYS, locate interstate Highway 85 (passing through Oconee, Anderson, Greenville, Spartanburg, and Cherokee counties) and trace its path on the map with a wipe-off pen. Also locate the Norfolk-Southern Railroad main line (labeled as "Southern" on the map) that follows approximately the same route, and trace its path on the map with a different color wipe-off pen. Which major South Carolina cities lie along the route of Interstate 85? Which major cities lie along the route of the Norfolk-Southern (Southern) Railroad? Explain why there is so much overlap between the
two lists. What topographic barriers might have been encountered by the railroad and highway engineers who selected this route? How did they overcome these barriers?

4. **Explain parallel routes of transportation systems.**
Locate the following transportation related features on the **KINGS MOUNTAIN TOPOGRAPHIC MAP**. Trace each category with a different color wipe-off pen. Your group may divide up the work, but all color tracing should be done on the same map.

- RED = U.S. Highway Route 29, Interstate 85, and Southern Railroad
- BLUE = pipelines
- GREEN = electric power transmission lines
- BLACK = other landmark lines (telephone, etc.)

Notice the mostly parallel nature of the lines you drew on the map. In what general compass direction are the majority of these features oriented? Why do you think these different modes of transportation follow each other so closely? Do any of these transportation features follow topographic or landscape features? Explain.

5. **Compare grade of transportation right-of-ways.**
The grade, or gradient (slope), of a transportation right-of-way is determined mainly by the total change in elevation along that route. For each travel mode listed in the table below, examine its route on the **KINGS MOUNTAIN TOPOGRAPHIC MAP**, find the highest and lowest elevation shown on the map, and calculate the total topographic relief (highest elevation - lowest elevation). Which mode has the most level right-of-way? Which has the highest relief? Why do some modes require a more level right-of-way than others do?

<table>
<thead>
<tr>
<th>Travel Mode</th>
<th>Highest Elevation</th>
<th>Lowest Elevation</th>
<th>Total Relief</th>
<th>Rank (flattest = 1)</th>
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<tr>
<td>I-85</td>
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<td>Pipeline</td>
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<td>Electrical Powerline</td>
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6. **Relate transportation routes to drainage patterns.**
Examine the **KINGS MOUNTAIN TOPOGRAPHIC MAP** and trace with a wipe-off pen all streams lying within two miles of either side of Interstate 85. Which way do most streams north of I-85 flow? Which way do most streams south of I-85 flow? Note that both the highway and the railroad tend to follow a drainage divide. Why do you think transportation engineers prefer to locate roads and railroads along a drainage divide?
7. **Describe appearance of utility corridors.**

On the infrared aerial photograph inset of the mine site on the **KINGS MOUNTAIN LITHOGRAPH**, locate the electrical substation just southeast of the mine. Also locate this substation on the **KINGS MOUNTAIN TOPOGRAPHIC MAP**. Note the power line corridors that intersect at the substation. Describe the appearance of these corridors on the photograph. In general, how can you recognize a utility corridor on an aerial photograph? Use a magnifying glass to examine the corridors more closely. You should be able to see the individual metal towers that hold up the electrical power lines (you can see the shadows of these towers if you look closely). Are the towers equally spaced? Give one reason why they probably should be, and one reason why, in some cases, they are not. There is also a pipeline corridor just south of the electrical substation (refer to topographic map to identify). Does a pipeline corridor look any different on an aerial photo than a power line corridor? How can you tell the two apart?

8. **Examine effect of interstate highway on local towns.**

On the **KINGS MOUNTAIN LITHOGRAPH**, trace the route of U.S. Highway 29 with a wipe-off pen. With a different color wipe-off pen, trace the route of Interstate Highway 85. Refer to the **KINGS MOUNTAIN TOPOGRAPHIC MAP** to get reference information. Note that U.S. 29 and I-85 meet in several places. Be sure you follow U.S. 29 all the way to the town of Kings Mountain. Examine the lithograph to determine the land uses along each route. Which route goes through more small towns and commercially built-up areas? What effect do you think the opening of Interstate 85 might have had on traffic on U.S. Highway 29 and on the small businesses located on that road? Examine the lithograph, all along I-85, to find areas where commercial development is starting to show up. What are the problems associated with commercial development between two interchanges? What kind of business might do better today on U.S. 29? What kind of business might do better along the interstate? Explain your answers.

9. **Write letter and report recommending site for new factory.**

Your group represents a team of investigators hired by a large manufacturing company, Grandco, Inc. The company wants to open a new factory in the Kings Mountain area. Your task is to examine the **KINGS MOUNTAIN LITHOGRAPH** and the **KINGS MOUNTAIN TOPOGRAPHIC MAP** to find the perfect parcel of land for Grandco, Inc. to build its new factory. This company uses lots of raw materials and ships its product all over the country, so it needs quick and easy access to both railroad and highway transportation.

After you have completed the site selection process, you must compose a report to the company explaining why you are recommending that location. The report should be accompanied by a cover letter using proper format for a business letter. Be sure your report includes the following parts:

- description of the exact location in relation to local landmarks
- description of land surface of site, including current land use
- explanation of why this site is a good one for the factory (be persuasive)
ENRICHMENT
1. **Investigate reasons businesses locate in an area.**
   Write to the Chamber of Commerce or Town Council in your own hometown and ask for a list of reasons why new businesses and industries might want to locate in your area. Determine how many of these reasons are related to the landscape or other natural features.

2. **Interview owners of small businesses.**
   If your town is near an interstate highway, or any other limited access highway, write or telephone owners of small businesses that are located on the "old road" that used to be the main highway before the new highway was built. Ask them how the new highway has affected their business and how they handled it.
Activity 3C-2: Kings Mountain Battlefield Site

Materials

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
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<tr>
<td>6</td>
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<tr>
<td>6</td>
<td>KINGS MOUNTAIN TOPOGRAPHIC MAP</td>
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<td>6</td>
<td>KINGS MOUNTAIN LITHOGRAPH</td>
<td>1:24,000</td>
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<tr>
<td>1</td>
<td>Battle of Kings Mountain</td>
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<tr>
<td>6</td>
<td>Wipe-off Pens</td>
<td></td>
</tr>
</tbody>
</table>

PERFORMANCE TASKS

(Icon Key) Overview = ⬤; Science = Ⓑ; Math = Ⓐ; History = Ⓒ; Language Arts = Ⓟ

1. **Locate features at battle site.** ⬤Ⓒ
   
   Refer to Figure 3C-1 "Battle of Kings Mountain" to locate the positions of the British army and the American patriot forces at the beginning of the battle. Transfer all of this information to the battleground inset map on the KINGS MOUNTAIN TOPOGRAPHIC MAP using a wipe-off pen. Note that the "Highest Point" is the same location as the Centennial Monument and that the "Surrender Site" is now marked by the U.S. Monument. Based on the topography (refer to contour lines), what landform obstacles did the American patriots have to overcome to reach the British forces? How did landform features influence the result of the battle? Where was Ferguson trying to lead his troops prior to the British surrender?

2. **Calculate slope of Kings Mountain.** ⒷⒸ
   
   American patriot forces approached the British position on Kings Mountain from all sides. Use the information in figure 3C-1, "Battle of Kings Mountain" to mark the movement of each regiment of patriot troops up the slope of Kings Mountain. Use wipe-off pens to draw lines with arrows on the Battleground Inset Map on the KINGS MOUNTAIN TOPOGRAPHIC MAP. Divide into groups to calculate the steepness of the slope each set of troops had to climb. Compare your results with other groups and decide which regiment had the hardest time climbing the mountain.

   Group A - Chronicle                           Group E - Shelby
   Group B - McDowell                             Group F - Williams
   Group C - Campbell                             Group G - Cleveland-Lacy-Hawthorne
   Group D - Sevier                               Group H - Winston

3. **Analyze choice of Kings Mountain as British outpost.** Ⓟ
   
   Ferguson chose to defend Kings Mountain in order to control transportation routes to and from Charlotte, NC, including the river valleys of the Broad and Catawba. Mark on the STATE BASE MAP #2, WITH HIGHWAYS possible road and river transportation routes that were within two days march of Kings Mountain. Explain how you determined the distance corresponding to "two days march." List towns that may have been connected by these routes. Discuss and record advantages of using Kings Mountain as a point of control for the region. Discuss and record advantages and disadvantages of stationing your troops at the top of a mountain.
4. **Describe the battle of Kings Mountain.**

   Read the description of the Battle of Kings Mountain beginning on page 3C-2. Then, on a separate piece of paper, set up columns labeled "Nouns," "Verbs," "Adjectives," and "Adverbs." Imagine that your group has taken part in the battle. Brainstorm parts of speech associated with the experience of being in battle. Put these words in the appropriate columns. Be sure to list words that describe the sounds, sights, smells, tastes, sensations, feelings, emotions, and textures of the battle. Use your brainstormed lists to compose an essay describing what it was like to be at the Battle of Kings Mountain. Be sure to cover the who, what, where, when, why, and how of the battle. Use the KINGS MOUNTAIN TOPOGRAPHIC MAP, KINGS MOUNTAIN LITHOGRAPH, and Figure 3C-1, "Battle of Kings Mountain," to help with the "where's" associated with the battle. Read your essay to the class.

5. **Analyze the newspaper article.**

   Read the newspaper article on page 3C-1: "Evidence indicates that Blacks fought at Kings Mountain." Explain why the publisher thought this story would be of interest to newspaper readers. Using the same references and setting, write another newspaper article related to this same situation, but date it far enough either before or after the given story so that you will have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

6. **Discuss effects of speeches on public opinion.**

   Read both "Ferguson's Address to the Loyalists" on page 3C-6 and "Doak's Famous Sermon and Prayer," on pages 3C-5 and 3C-6. Rewrite both of these persuasive arguments in modern day language so that your classmates can understand. (A dictionary and thesaurus might be helpful.) Why were Ferguson's words so persuasive to the Loyalists? Why were Doak's words so persuasive to the Patriots? Why did Ferguson's words upset the Patriots so much? Why did Doak's words upset the Loyalists? How do you think the words of each reached the ears of the opposite side? What changes or additions might have been made as the words of each spread?

7. **Explain location of springs on Kings Mountain.**

   Use the battleground inset map on the KINGS MOUNTAIN TOPOGRAPHIC MAP and figure 3C-1 "Battle of Kings Mountain" to locate the positions of the two springs used by the British soldiers camped on Kings Mountain. Mark these positions on the inset map with a wipe-off pen. Describe the pattern of the topographic contour lines at the locations of the springs. Why do you think springs occur at these locations (give a geologic explanation)? Locate at least two other points on this map where you think a spring might occur. Justify your selections.

8. **Write obituary for Ferguson.**

   Locate on figure 3C-1, "Battle of Kings Mountain," the spot where British Major Patrick Ferguson was wounded and mark this location on the battleground map inset on the KINGS MOUNTAIN TOPOGRAPHIC MAP with a wipe-off pen. Also note the location of his grave. Pay close attention to the landscape features at each of these sites. Obituaries are short tributes, usually printed in newspapers, written about famous people who die. Write an obituary for Major Ferguson, being sure to include references to landscape features at the spot he was wounded and at the spot he was eventually buried. Some groups should write his obituary from the British loyalist
point of view, other groups should write from an American patriot perspective. Take
turns reading the obituaries to the class and discuss the different "spin" put on this
event by the different sides.

ENRICHMENT

1. **Research African-American military heroes.**
   Read the newspaper article "Evidence indicates that Blacks fought at Kings
   Mountain." How does an ancestor's involvement in a famous event make it easier to
   trace one's own roots? Why would it be more difficult for a slave to trace his or her
   roots than a free person? Why is it harder today for African-Americans to trace their
   family trees than for other groups of Americans?

2. **Document importance of Kings Mountain Battle.**
   Pretend that your group is a team of lawyers trying to make the case that the victory
   at Kings Mountain was the most important victory for American patriots in the
   Revolutionary War. Be sure to brainstorm how this battle affected morale,
   confidence, and momentum for both sides in the conflict before your spokesperson
   states your group's case. Make reference as to how the battle's outcome was
   affected by the topography of the area covered by the maps and lithograph for this
   study site.

3. **Research careers of Kings' Mountain commanders.**
   Use the narrative section "Historical Battlefield " beginning on page 3C-2 to identify
   the patriot and loyalist commanders at Kings Mountain. Choose one to research.
   Explain their contributions before, during, and after the battle. Have any places in
   South Carolina been named for them?
STUDY AREA 3C: KINGS MOUNTAIN BELT

Activity 3C-3: Mining and Environmental Restoration

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<td>6 GEOLOGIC AND MINERAL RESOURCE MAP 1:1,000,000</td>
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<td>6 KINGS MOUNTAIN LITHOGRAPH 1:24,000</td>
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<tr>
<td>6 Wipe-off Pens</td>
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PERFORMANCE TASKS

(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts =

1. **Locate strip mine sites.**
   Locate and mark with a wipe-off pen all of the strip mine sites you can find on both the KINGS MOUNTAIN TOPOGRAPHIC MAP and the KINGS MOUNTAIN LITHOGRAPH. What features are common to all of these mines? Briefly describe how to quickly recognize a strip mine on a topographic map and on an infrared aerial photograph. Are these mine sites randomly distributed throughout the area, or is there a recognizable pattern to their occurrence? Explain your answers.

2. **Analyze land use changes through time.**
   Look in the margins of the KINGS MOUNTAIN TOPOGRAPHIC MAP and the KINGS MOUNTAIN LITHOGRAPH to determine the year the map was printed and the year the aerial photography was flown. Examine each cartographic product carefully to identify any changes which have occurred during that time interval. How many of these changes are manmade? How many have occurred naturally?

3. **Identify mineral resources of Kings Mountain area.**
   Locate the Kings Mountain region on the STATE BASE MAP #2, WITH HIGHWAYS and then on the GEOLOGIC AND MINERAL RESOURCE MAP. Make a list of all the mineral resources found in this area and indicate whether mining is "active," "inactive," or only "potential." Also indicate whether each resource is found only in the Kings Mountain area or occurs elsewhere in the state.

4. **Document changes in mine site.**
   Note that the infrared aerial photo inset of the mine site on the KINGS MOUNTAIN LITHOGRAPH looks a little different from the same feature on the main photo. The inset photo was taken in 1994. The main photo was taken in 1984. The KINGS MOUNTAIN TOPOGRAPHIC MAP, dated 1971, does not show this mine site at all. Read through Case Study I on pages 3C-7 and 3C-8 and identify features on the photos that correspond to events described in the case study. List specific features on the topographic map that were moved or removed when the strip mine was constructed. Pay special attention to changes in stream drainage in the area.

5. **Document environmental problems at Henry Knob.**
   Locate Henry Knob on the KINGS MOUNTAIN LITHOGRAPH and the KINGS MOUNTAIN TOPOGRAPHIC MAP. Read through Case Study II on page 3C-8 and identify features that correspond to the events described in the case study. Notice
the dates on the lithograph and topographic map. What changes have occurred to
the industrial waste ponds shown on the topographic map? How can you tell? What
changes in forest cover have occurred during that same time interval?

6. Predict size of smallest detectable object.
   The infrared aerial photo inset of the mine site on the KINGS MOUNTAIN
   LITHOGRAPH has been enlarged from the original photograph. With this kind of
   magnification you can see cars and trucks on Interstate 85 and individual houses and
   other buildings. However you cannot see individual people or animals (cows, horses,
   etc.). Based on your knowledge of typical dimensions of cars, houses, and other
   features you can see, use principles of ratio and proportion to predict the size of the
   smallest object that would be detectable on the inset photo. Now look at the main
   photo on the lithograph. Predict the size of the smallest object that would be
detectable on that image.

7. Describe impact of environmental restoration.
   Two muskrats (cousins named Mickey and Misha) have lived in the Kings Mountain
   region for many years. Mickey lives in Mill Creek just below the strip mine described
   in Case Study I on pages 3C-7 and 3C-8. Misha lives in a small tributary of South
   Fork Crowders Creek just below the Henry Knob mine site described in Case Study II
   on page 3C-8. Locate both of these places on the KINGS MOUNTAIN
   TOPOGRAPHIC MAP.

   Mickey and Misha do not see each other very often because they live so far away,
   but they do write letters back and forth. Misha is always complaining about the
   polluted conditions she has to live in because the Henry Knob mine site was never
   properly cleaned up and restored. Mickey is always bragging about the clean water
   and green fields he lives in because the marble quarry was reclaimed properly.

   Some groups should write a letter from Mickey to Misha. The other groups should
   write a letter from Misha to Mickey. Be sure your letters reflect the opinions of the
   muskrat doing the writing and use a lot of adjectives to describe your living
   conditions. Refer to the two case studies if you need additional information.

ENRICHMENT

1. Write to a mining company.
   Write to a mining company and ask them to describe their procedures for reclaiming
   used land. Also ask what resources they are mining and how they prevent water and
   air pollution during the mining operation.

2. Research mining operations.
   Choose a rock or mineral resource that interests you. Research how that resource
   was formed, where it can be found, and what it is used for. Also look up information
   on how the resource is usually mined and how it is processed into final products.
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<td>Forty Acre Rock (Granite Outcropping)</td>
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<td>5A</td>
<td>Savannah River Site (Habitat Restoration)</td>
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<td>The ACE Basin (Wildlife &amp; Sea Island Culture)</td>
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<td>10A</td>
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<td>SANDHILLS / MIDLANDS REGION</td>
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  p. 4-2  - Characteristic Landforms of the Sandhills / Midlands
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  p. 4-4  - Sandhills Soils
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- Summary

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  - Materials
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- STUDY SITE 4A : COLUMBIA (METROPOLITAN AREA)
  (ICONS)  Overv =    Sci =    Math =    Hist =    Lang Arts =  
  - Newspaper Article - "Studies indicate pollution could shorten life span"
  - Rationale
  - Brief Site Description
  p. 4A-2 . . . . . . - Introduction
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  p. 4A-3 . . . . . . - figure 4A-1 - "1850 Street Map of Columbia"
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  p. 4A-9 . . . . . . 1. locate the study site  
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  p. 4A-10 . . . . . . 3. compare Piedmont and Coastal Plain    
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p. 4A-14  1. research long term impact of human use of urban rivers

- Activity 4A-2: Urbanization of the City of Columbia
- Materials
- Performance Tasks
p. 4A-15  1. analyze the newspaper article
p. 4A-15  2. analyze land use changes through time
p. 4A-15  3. analyze assembly’s system for naming city streets
p. 4A-16  4. trace city streetcar routes
p. 4A-16  5. locate granite mines and calculate depth
p. 4A-16  6. determine set of ordered pairs to locate Columbia landmarks
p. 4A-17  7. estimate time of day air photo was taken
p. 4A-17  8. locate malls/shopping centers and determine reason for location
p. 4A-18  9. locate places people congregate; ask why; write story about a trip
p. 4A-18  10. compare modern day Historic Columbia to 1786 specifications
p. 4A-18  11. locate mill villages in Columbia
p. 4A-18  12. compare street patterns along Columbia riverfront

- Enrichment
p. 4A-19  1. explain why there were no paved streets in Columbia until 1908
p. 4A-19  2. contrast life in Columbia in 1900 with life today
p. 4A-19  3. estimate time of day air photo was taken using trigonometry
p. 4A-19  4. relate accomplishments of people to Columbia’s street names

- Study Site 4B: Graniteville (Mining Area)
  (ICONS) Overv =  Sci =  Math =  Hist =  Lang Arts =
  - Newspaper Article - "Graniteville: A company town no more"
  - Rationale
  - Brief Site Description
p. 4B-2  - Introduction
p. 4B-2  - William Gregg and Manufacturing
p. 4B-3  - Mill Town Legends
p. 4B-4  - story - "The Little Boy’s Grave"
p. 4B-4  - Kaolin Mining and Environmental Restoration

- Activity 4B-1: Impact of Mining
- Materials
- Performance Tasks
p. 4B-5  1. locate the study site
p. 4B-5  2. determine elevation of clay pits to assess rock structure
p. 4B-5  3. explain why there are no claypits around Langley Pond
p. 4B-6  4. interpret the white areas on Graniteville Lithograph
p. 4B-6  5. analyze why clay pits are not distinguishable by contour lines
p. 4B-6  6. evaluate and characterize reclaimed mine areas

- Enrichment
p. 4B-6  1. research construction materials made from clay
p. 4B-6  2. describe successful reclamation methods

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Activity 4B-2: Textile Mill Town

- Performance Tasks

p. 4B-7 1. analyze the newspaper article
p. 4B-7 2. analyze land use changes through time
p. 4B-7 3. trace the path of Horse Creek
p. 4B-7 4. explain use of Graniteville canal
p. 4B-8 5. evaluate site for Leavelle McCampbell Middle School
p. 4B-8 6. locate cemetery for "The Little Boy's Grave" story
p. 4B-8 7. explain why the old mills are located near water
p. 4B-8 8. identify changes associated with new high school
p. 4B-9 9. explain color change in Langley Pond
p. 4B-9 10. investigate features associated with a golf course
p. 4B-9 11. brainstorm questions about boy in "The Little Boy's Grave" story
p. 4B-9 12. explain relative decline in importance of Graniteville

Enrichment

p. 4B-10 1. research how your school got its name
p. 4B-10 2. compile a list of idioms commonly used in your community
p. 4B-10 3. write your Congressman about Superfund Clean-up Program

Activity 4C-1: Sandhills Topography

- Performance Tasks

p. 4C-7 1. locate the study site
p. 4C-7 2. locate and describe Sugarloaf Mountain
p. 4C-7 3. correlate soil map patterns to lithographic colors
p. 4C-8 4. compare routes of Old Wire Road, railroad, and Highway 1
p. 4C-8 5. analyze reasons for different names for same feature
p. 4C-8 6. explain choice of location for landing strip
p. 4C-9 7. describe the layout of the town of Patrick
- Enrichment
p. 4C-9 · · · · · · · 1. research significance of railroad location markers ☑ ☑
p. 4C-9 · · · · · · · 2. research Sandhills soils ☑

- Activity 4C-2: Wildlife Habitat Management
- Materials

- Performance Tasks
p. 4C-10 · · · · · · · 1. compare land use inside and outside of preserves ☑
p. 4C-10 · · · · · · · 2. analyze land use changes through time ✐
p. 4C-10 · · · · · · · 3. analyze the newspaper article ☑
p. 4C-10 · · · · · · · 4. express political opinion advocating your position ☑
p. 4C-11 · · · · · · · 5. rank relative ages of clearcut areas ☑
p. 4C-12 · · · · · · · 6. analyze Mays Lake Reservoir ☑
p. 4C-12 · · · · · · · 7. analyze percentage distribution of soil types ☑
p. 4C-12 · · · · · · · 8. correlate location of firebreaks with contour lines ☑
p. 4C-12 · · · · · · · 9. critique list of rules and regulations ☑

- Enrichment
p. 4C-13 · · · · · · · 1. find examples of habitat managed for endangered species ☑
p. 4C-13 · · · · · · · 2. document changes in timber cutting practices ☑ ☑
POWER THINKING ACTIVITY - "Traffic Troubles"

The mayor of Columbia has decided the downtown traffic jams during morning and evening rush hour have gotten so bad that something must be done to get cars off the highways. He has hired your team as mass transit consultants to plan a system which will be convenient for people to use and will take them where they want to go.

First, look over the COLUMBIA TOPOGRAPHIC MAP and the infrared lithograph to determine the places most people work or would like to visit. Then determine areas of the city where most people live. Finally, draw lines on the map or lithograph (using wipe-off pens) representing the best routes for commuter railroad lines, bus lines, subways, trolleys, monorail, or any other types of mass transit you can think of. Draw as many routes as you think are needed and can be economically supported.

Be prepared to defend your plan at a meeting of the city council.

PERFORMANCE OBJECTIVES

1. Analyze geological processes that have sculpted the landscape of the Columbia metropolitan area and influenced historical development.
2. Examine ways Columbians harnessed the river system for transportation, as a source of water for a metropolitan area, and for hydroelectric power.
3. Recognize the Fall Line Zone running through South Carolina as an extension of the same landscape feature found all along the eastern seaboard of the United States.
4. Use geometry skills to locate the center of a geographic region.
5. Explain the naming of streets in historic districts of cities and towns and research the connections of these names to South Carolina history and folklore.
6. Identify locations of commercial granite, sand and clay quarries, explain their origins, and document uses of these natural resources and their effect on human culture.
7. Identify commercial, industrial, residential, educational, and recreational areas of urban communities and analyze placement of transportation, waste disposal, and utility systems.
8. Classify landform regions along the Fall Line Zone by comparing features on topographic maps and lithographs.
9. Use origin point and scale bar information to establish coordinate points for historic landmarks and other landscape features.
10. Analyze stories in various literary formats to explain how people coped with difficult or oppressive circumstances.
Description of Landforms, Drainage Patterns, and Geological Processes

Characteristic Landforms of the Sandhills / Midlands

Extending across the middle of South Carolina is a narrow, irregular band of rolling hills known as the Carolina Sandhills. These rounded gentle sloping hills are the remains of sandy and clayey sediment deposits left between 55 and 100 million years ago when sea level was much higher than it is today and the newly opened Atlantic Ocean covered a large portion of eastern and southern South Carolina. The sandhills topography corresponds to the ancient shoreline, which is recognizable today primarily by old sand dune remnants. During that ancient era, weathering and erosion of the Blue Ridge and Piedmont rocks and soils provided clays and sands that were carried by water and deposited at the mouth of rivers. Ocean waves and tides reshaped the sediments to form beaches and sand ridges, the remains of which are still visible today. Marine sediments were also deposited offshore, in the ancient flooded coastal plain, creating the nearly horizontal strata of sedimentary rocks that are characteristic of the present day Coastal Plain Region.

The Sandhills Region, covering 12% of South Carolina, runs diagonally through South Carolina in a band parallel to the Piedmont. This band includes almost all of Aiken, Barnwell, Lexington, Richland, Kershaw, and Chesterfield counties, as well as the northeast tip of Marlboro County. A very small part of the Sandhills Region also dips into Allendale, Bamberg, Orangeburg, Sumter, Lancaster, and Darlington counties. Elevation ranges from 250 to 450 feet above sea level and is almost always higher than either the adjacent Piedmont or Coastal Plain regions. The topography is generally rolling to moderately hilly, but in places local relief can be as much as 200 feet. The region varies in width from 5 to 30 miles, however, it is technically absent along some large river systems, such as the Congaree River in Columbia, which has cut completely through the Sandhills deposits to expose the underlying rocks.

Geographic Features of Special Interest

In more recent years, the Columbia area has been called the Midlands because of its central location in the state. Yet, the term "Sandhills" best describes this narrow zone running all the way across South Carolina with its characteristically sandy soil. The Midlands is more of a land use term and is generally restricted to the metropolitan area around the city of Columbia. The western portion of the Sandhills, especially Aiken County, is known for rich, white kaolin clay deposits, which are mined extensively. Other mining operations, such as several surface pits near Columbia, specialize in mining pure quartz sand for specialty uses.

Peachtree Rock is an unusual landscape feature located a short distance southwest of the City of Columbia near the town of Gaston. It consists of a whitish sandstone outcropping complete with fossils and internal sand dune structures. This rock has resisted erosion due to a very high percentage of quartz-rich cement that holds the rock together and imparts both strength and durability. A somewhat similar rock outcropping,
called Sugarloaf Mountain, exists in Chesterfield County near the town of Middendorf. Sugarloaf Mountain is resistant because of an iron rich cement which has permeated and bound together the original loosely held sand grains. Other areas where mature Sandhills ecosystems can be observed include the Sandhills National Wildlife Refuge in Chesterfield County, and the Fort Jackson Army Base in Richland County.

Fall Line Zone

The Fall Line Zone can be roughly defined as the boundary between the Piedmont and the Coastal Plain. It is easily located along river valleys by documenting the first occurrence of rapids upstream from the ocean. The more resistant rocks of the Piedmont Region and the less resistant rocks of the Coastal Plain Region do not erode at equal rates. As a result, the river channel in the Coastal Plain Region is always slightly lower in elevation than the channel in the Piedmont, forming telltale rapids. The importance to commerce of the Fall Line Zone is confirmed by the large number of major cities located along the roughly defined boundary, including North Augusta, Columbia, Camden, and Cheraw. Even beyond South Carolina the Fall Line Zone is historically important. The list of state capitals located along this line includes Providence, Rhode Island; Hartford, Connecticut; Trenton, New Jersey; Richmond, Virginia; Raleigh, North Carolina; Columbia, South Carolina; and Montgomery, Alabama. Several other major cities are also located along this boundary.

Figure 4-1: Map of Fall Line Zone
Rivers begin to take on a much different character once they flow past the Fall Line Zone. Broad meanders, extensive **floodplains**, **oxbow lakes**, and **swamp**-like vegetation contrast with the straight channeled, narrow erosional valleys characteristic of the Piedmont. It is very difficult to trace the actual Fall Line between river valleys in South Carolina because of the locally extensive and elevated Sandhills Region. Throughout much of the state, the Sandhills act as a drainage divide preventing Piedmont streams from crossing into the Coastal Plain. The only exceptions are large, powerful rivers such as the Savannah, Congaree, Wateree, Lynches, and Pee Dee.

**Sandhills Soils**

Coastal Plain soils increase in age with distance from the ocean because soils cannot start forming until sea level has fallen sufficiently to expose the former ocean floor to surface weathering conditions. The soils of the Carolina Sandhills, then, are among the oldest in the Coastal Plain of South Carolina. Such extensive weathering, over a period of perhaps a million years or more, has removed much of the original nutrient content of the soil. Unfortunately, the original sandy material was notoriously low in nutrients and organic material to start with, meaning that almost all soil fertility has been lost and the only material left is the original quartz mineral grains, which are highly resistant to weathering. Some clay does occur, however, usually in thin horizons of red or pink sandy clay. Clay rich soil can present its own problems for agriculture, though, especially during long dry spells when the clay can bake dry into a brick-like hardpan. Overall, there is far less clay in Sandhills soils than in the Piedmont because of the different nature of the parent material.

The rolling nature of the topography and the sandy parent material combine to permit good surface and internal drainage so that the majority of soils here are very well drained, sometimes too well drained to hold sufficient moisture for typical agricultural use. Because the soil texture allows for rapid leaching, soils are also strongly acidic. It is not uncommon to find lenses or horizons in Sandhills soils where sand grains have been cemented together with iron oxides, forming a barrier to root growth and water movement. **Alluvial** soils are rare in the Sandhills Region, but where they occur, they are rich and productive.
Landforms Influenced the Development of Cities

The present landscape, shaped by geological processes that took place millions of years ago, as well as by much more recent stream erosion, has clearly shaped past and present land use in the Sandhills/Midlands Region. When early settlers first began to make an imprint on the land, there were many good reasons for developing cities along the banks of major waterways that crossed the Fall Line Zone. The placement of structures such as cotton mills, railroad centers, and canals along the banks of these river systems was not just by chance. Mills needed water power to run machinery, and canals provided transportation around rapids, rendering the unloading and reloading of boats unnecessary. Any persons or products traveling by boat would have to disembark or be unloaded to detour around the falls or rapids associated with the Fall Line Zone. Railroad centers developed as a means of distributing goods from the boats to the upstate. Many state capitals, including South Carolina’s, developed at Fall Line Zone locations along major river systems.

Choosing a Site for the New Capital

By 1785, bowing to increased pressure from the Up Country, the South Carolina Legislature decided to move the state's capital inland from Charleston. This process began officially on the 27th of January, 1785, when a petition from the inhabitants of the area between the Broad and Catawba rivers was presented to the South Carolina House of Representatives which read in part:

Therefore your petitioners humbly pray, that the seat of government may be fixed as centrical as possible for the ease and convenience of the community at large . . .

Following the request of this petition and numerous other similar ones, the General Assembly spent a year investigating the possibility of moving the capital of the new state to a more central location. Finally, on March 14, 1786, the Representatives accepted the report of the committee appointed to locate (as near as they could ascertain) the center of the state in order that the seat of government be moved there. Their conclusion was:

. . . that they have been very assiduous to accomplish the business they had in charge, that they examined and compared all the different maps of the state which they could possess themselves of, and are of opinion that the center of the state is included in the circle whose circumference strikes through the high hills of Santee crosses Santee at the confluence of Congaree and Wateree rivers and crosses the Congaree River at the confluence of the Saluday & Broad River and diameter of which circle is thirty miles . . .

Senator John Lewis Gervais had introduced a bill on March 6, 1786, to officially move the capital from Charleston to the center of the state. The exact location of the future capital was hotly debated; however, Senator Gervais and Representative Henry Pendleton finally carried the day with their suggestion of a site near Friday's Ferry on the Congaree River which included the plain of a hill then owned by Thomas and James Taylor. The Congaree River had always provided transportation to the Up Country, up to the rapids at the junction of the Broad and Saluda rivers. This location had proven to be a natural spot for a trading center as early as 1718 and the town of Granby had developed on the western shore of the Congaree River by 1748.
As part of an attempt to ridicule the Up Country wilderness settlers, Charlestonians suggested that the site be called, "Town of Refuge," but Gervais responded that he "hoped that the oppressed of every land might find a refuge under the wings of Columbia." The name Columbia* finally prevailed, winning over its rival name, Washington, which had been suggested as a way to honor George Washington, by an 11-7 vote in the Senate. The General Assembly met in Columbia for the first time in January 1790, in a temporary wooden State House. During the writing of the State Constitution of 1790, Charles C. Pinckney tried to have the capital moved back to Charleston; however, this attempt was defeated by a vote of 109-105, and Columbia became the permanent capital.

Laying Out the City of Columbia

The Senate bill introduced by Gervais, on March 6, 1786, also authorized the Assembly to elect commissioners who would lay off 650 acres of land in lots of one-half acres near Friday's Ferry on the land of James and Thomas Taylor. The House then proceeded to the second reading of Senator Gervais' bill to "appoint commissioners to purchase land for the purpose of building a town," and another debate ensued. The House added a stipulation which made the streets no less than sixty feet wide. Proposed on March 14, 1786 by Dr. John Budd of Charleston, the wide streets were thought to be of benefit in preventing the spread of diseases and fires, and were a wise precaution for a city situated in a warm climate. Dr. Budd also stated that no one could predict the future volume of street traffic, and wide streets would more easily accommodate such growth. Two other changes by the House placed the site of the new town "within two miles of the confluence of the Broad and Saludy (Saluda) rivers" and two miles square in place of 650 acres on Taylors Hill. The bill passed by a vote of 65 to 61.

The final bill, ratified on March 22, 1786, read that the commissioners were:

. . . authorized to and required to lay off a tract of land two miles square, near Friday's Ferry, on the Congaree river, including the plain of the hill whereon Thomas and James Taylor, Esquires, now reside, into lots of half an acre each, and the streets shall be of such dimensions, not less than 60 feet wide, as they shall think convenient and necessary, with two principal streets, running through the centre of town at right angles of one hundred and fifty feet wide; which said land shall be, and the same is declared to be, vested in said commissioners, and their lawful successors for the use of this state.

*Columbia is a derivation of the Columbiad or having to do with Christopher Columbus, discoverer of America, which became a refuge for people fleeing persecution.
The Columbia Canal and Water Transportation

The War of 1812 demonstrated to American leaders the inadequacy of the nation's internal transportation system. John C. Calhoun, of South Carolina, strongly supported Henry Clay in his political drive to provide federally-funded internal improvements. But even after the economic success of the Erie Canal launched the Canal Age, it was the states and not the federal government who funded most of these internal improvements. South Carolina was no exception. In 1818, South Carolina committed the equivalent of $1,900,000 toward improvement programs. One major project was the Columbia Canal which was begun in 1819 and completed in 1824. The canal was needed to overcome a total river fall of 34 feet. This drop in topography created rapids beginning two miles above the city and ending one mile below. The Columbia Canal was originally 3 1/8 miles long, beginning in the area between Lumber and Richland streets and ending across from Granby's Landing.

However, the Canal Age was short-lived. The growth of railroads soon made water transportation and the canal system obsolete. Although no longer a water trade route, the Columbia Canal eventually became used as a source of hydroelectricity. In 1891, the original canal was enlarged and extended several miles northward to increase its power-generating capacity. In 1893, the Columbia Mills Company selected a site beside the canal on Gervais Street to locate their duck cloth (coarse cotton) manufacturing plant. The powerhouse constructed at the canal supplied power for 14 alternating-current motors within the mill. Manufacturing at the world's first electrically operated mill began on June 11, 1895. The Columbia Mill later became Mt. Vernon Mill and is now the site of the South Carolina State Museum. The power plant built at the base of the Columbia Canal has generated electricity to make gun powder, run a grist mill, operate a state dispensary, pump water for Columbia, and even drive a saw mill. It has been in continuous operation since the 1890's providing electricity for Columbia. The plant is currently operated by the South Carolina Electric and Gas Company.

During the Great Depression of the 1930's, the Federal Writers Project interviewed former slaves about their occupations and lifestyle under slavery. The following account of transporting cotton to market by water was made by Alexander Scaife in Pacolet, South Carolina.

The Cotton Boat
Excerpt from Hurmence, Belinda. Before Freedom, When I Can Just Remember

It took a week to take the cotton boat from Chester to Columbia. Six slaves handled the flatboat: the boatman, two oarsmen, two steersmen, and an extra man. The steersmen was just behind the boatman. They steered with long poles on the way up the river and paddled down the river. Two oarsman was behind them. They used to pole, too, going up, and paddle down.

Seventy-five or eighty bales was carried at a time. They weighed around three hundred pounds apiece. In Columbia, the wharfs was on the Congaree banks. For the cotton, we got all kinds of supplies to carry home. The boat was loaded with sugar and coffee coming back. On the Broad River, we passed by Woods Ferry, Fish Dam Ferry, Henderson's Ferry, Henderson’s Island, and some others, that is all I recollect. We unloaded at our town ferry called Scaife Ferry.
The Secession Convention and the Onset of the Civil War

On December 17, 1860, the Secession Convention met in Columbia at the newly constructed First Baptist Church on Hampton Street between Sumter and Marion Streets. Before adjournment, the most "ablest and dignified body of men" declared their intention to withdraw from the Union. Because of a case of smallpox, the convention was moved to Charleston, where on December 20, 1860, they voted unanimously to secede making South Carolina the very first state to withdraw from the Union. When the news arrived in Columbia and other parts of the state, celebrations were held by hoisting palmetto flags, ringing church bells, firing cannons, lighting bonfires, and holding parades. On February 4, 1861, the Confederate States of America was created. Seven southern states left the Union. The War began April 12, 1861, when Confederate troops fired on Fort Sumter. Four more states seceded from the Union after the war began.

Columbia's Importance to the Confederacy

Columbia remained outside the war zone for almost the entire duration of the Civil War. Nevertheless, a military atmosphere pervaded the town because of its training academy, prisoner of war camps, Confederate offices, and army hospitals. The population of Columbia had soared from 8,000 to 20,000 during the War years, as many refugees came from Charleston and Georgia to find work. Goods manufactured in the Midlands for the Confederate Army included cannon balls, swords, bayonets, silver-plated copper buttons, wool hats, leather shoes, tents, knapsacks, socks, yarn and medicines. Confederate notes and bonds were printed in Columbia after the minting operation was moved from Richmond, Virginia. The building is still standing today at the northeast corner of Gervais and Huger Streets. In addition, the city became a safe depository for many public and private artifacts. Items such as the bells of St. Michael's church in Charleston, rare books from the Charleston Library, silver plated items, valuable papers, and bank funds were all sent to Columbia for safe keeping. Valuable possessions were sent from as far away as Georgia. Even large quantities of whisky had been shipped to Columbia by the Charleston merchants for safe storage.

Sherman's March Through South Carolina

Toward the close of the Civil War, Union General William T. Sherman made his infamous march through the South. As Sherman and his troops crossed South Carolina, they pillaged and destroyed mansions, homes, barns, fields, and forests. It was reported that huge columns of smoke and burnt chimneys marked his sixty mile wide path. When Sherman left Savannah, GA, most South Carolinians thought he would strike Charleston. Consequently, many citizens left Charleston for Columbia or sent their goods there for security reasons. Not until Sherman left Orangeburg in partial ruins on February 13th and turned his 20,000 troops and 250 wagons toward Columbia did most citizens realize that this city was his next target. By then all of the railway lines had been destroyed and there was no communication possible except by word of mouth. As he approached Columbia, the Congaree River Bridge was burned. The following excerpt is taken from Sherman's personal diary.
Early next morning (February 16) the head of the column reached the bank of the Congaree opposite Columbia, but too late to save the fine bridge which spanned the river at that point. It was burned by the enemy. While waiting for the pontoons to come to the front, we could see people running about the streets of Columbia occasionally small bodies of cavalry, but no masses. A single gun of Captain De Gress' battery was firing at their cavalry squads, but I checked the firing, limiting him to a few shots at the unfinished state house walls, and a few shells at the railroad depot to scatter the people who were seen carrying away sacks of corn and meal that we needed. There was no white flag or manifestation of surrender.

In Sherman's diary the enemy he referred to was a group of South Carolinians defending their city. Today, six brass star markers on the South Carolina State House facade indicate the damage to the structure done by Captain De Gress' twenty-pound Parrot cannons in 1865. The shells were fired across the Congaree River from what is now West Columbia. The Congaree River at that time was too broad and swift for a safe crossing; Sherman ordered his troops to go north and cross the Saluda and Broad rivers, which were less treacherous. It is also reported that Sherman and his troops spent the night on an island close to the present site of the Riverbanks Zoo. Articles written by Henry A. Rogers, describe Sherman's stay in Columbia:

On February 17 Sherman and his men entered Columbia and remained there three days destroying the great beauty of many fine town houses and public buildings. Controversy still reigns as to whether Sherman gave the order for the city to be burned or whether drunken soldiers did it out of wantonness of spirit. Nevertheless, the once magnificent and proud capital city of the first state to secede from the Union stood in ashes and shambles when the Union army departed on February 20.

The Fall of Columbia

Advised by Confederate General Wade Hampton, III, to surrender the city of Columbia, Mayor Thomas J. Goodwyn sent a message to General Sherman at 9:30 a.m. on the morning of February 17, 1865. At 10:00 a.m., Confederate General Beauregard and his staff rode northward out of Columbia. At the same time Mayor Goodwyn, riding in a carriage that bore a white flag, proceeded down Broad River Road to meet Sherman as he crossed the river. By 11 a.m., General Sherman, flanked by three of his generals, and leading the Fifteenth Corps, crossed the Broad River near the Saluda factory on a pontoon bridge and entered the city of Columbia. Lingering behind his troops at Main Street and Elmwood Avenue, Confederate General Wade Hampton looked northward until he saw the mayor in his carriage carrying the white flag of surrender. The mayor was flanked by columns of Federal troops, approaching Columbia. Hampton then turned, with a feeling of sadness and false sense of assurance that the capital city of South Carolina was safe and secure, to ride eastward to join the Confederate troops as they rode out of Columbia. It was just before noon when the Federal troops began marching toward the Capitol on Main Street. Most of these troops bivouacked around the outskirts of Columbia, while General Sherman was escorted to the Duncan Blanton home on Senate Street.

As the Federal troops entered the city, whisky stores were reportedly broken into and kegs were opened on the streets. Plundering by both citizens and soldiers became rampant. General Hampton's Millwood and Sandhills homes were burned along with many other dwellings owned by prominent citizens. By sundown, fires began breaking out all over Columbia. A strong wind was whipping up a dust storm out of the northwest.
In addition, pieces of cotton from broken bales blew like a snowstorm covering trees and shrubbery. Flames spread like a prairie fire over the downtown area of Columbia. Panic followed as buildings were engulfed in a holocaust. The streets of Columbia had turned into chaos. Of the 124 city blocks then occupied, 84 were burned to the ground.

One Account of the Burning of Columbia

Traditional

Sherman’s troops entered the city of Columbia on February 17. During the night a fire swept through the city and burned 84 of its 114 blocks. I’ve heard tales all my life about the night the city turned to fire — some accurate according to the historians, some fictionalized by the survivors and the storytellers. This is just one. You decide.

The day was filled with the necessary preparations anyone can take for impending disaster. Guns cleaned, silver hidden from enemy eyes. The men met, and the women prayed. A group of worshippers congregated at the First Baptist Church on Hampton Street, between Sumter and Marion Streets. Too innocent to imagine the worst, they sat solemnly in the pews and asked God Almighty to protect them from Sherman and his men. But, not every Christian waited for the Lord to do all the work. The custodian stationed himself outside the walls of sanctuary, and there he promised to stand against the on-coming enemy.

No one could have envisioned the devastation of fire balls blazing and the sound of guns echoing in the abandoned streets. No one. Not even the stoic figure who stood alone to face the enemy. Finally his opportunity came. A soldier approached him, and ordered him to name the place he guarded. Without so much as a hesitation, the man said, “Sir, this is the house of my Methodist brothers.” The soldier questioned him again, asking for the location of the First Baptist church, known to be the regular meeting place of the secession convention. This single saint replied, “Why, sir, that would be the spire you see down the street, that way.” With that the soldier turned and ordered those who had gathered around him to march on.

That night many prayers were offered to the Lord including the one of the guilt-ridden hero who had sent the army to burn down the Washington Street Methodist Church at the corner of Washington and Marion Streets.

To this day, the First Baptist Church is standing as a historic reminder of 18th Century architecture - illustrating columns, brickwork and interior decoration of the period.

A first hand account of Sherman’s troops in Columbia is described vividly in a diary kept by Emma LeConte, the seventeen year old daughter of Joseph LeConte who was the chemistry professor at South Carolina College. The college campus, which had been turned into a hospital, was not torched or pillaged. Neither was their campus residence. She imparts a civilian’s insight into the war years and conveys a graphic picture of the characteristic social structure and attitudes of the South’s upper class.
Entry for February 17, 1865

At about six o'clock, while it was still quite dark and all in the room were buried in profound slumber, we were suddenly awakened by a terrific explosion. The house shook—broken windowpanes clattered down, and we all sat up in bed, for a few seconds mute with terror. My first impression on waking was that a shell had struck the house, but as soon as I could collect my senses I knew that no shell could make such a noise . . . . What ever the cause, the effect was to scare us very effectively and to drive away all thoughts of sleep . . . . After breakfast the cannon opened again and so near that every report shook the house . . . . The negroes all went uptown to see what they could get in general pillage, for all the shops had been opened and provisions were scattered in all directions. Henry says that in some part of Main Street corn and flour and sugar cover the ground...the negroes are very kind and faithful. They have supplied us with meat and Jane brought Mother some rice and crushed sugar for Carrie . . . . A gentleman told us just now that the Mayor had gone forward to surrender the town.

One o'clock p.m.

Well they are here. I was sitting in the back parlor when I heard the shouting of the troops. I was at the front door in a moment, Jane came running and crying, 'Oh, Miss Emma, they've come at last!' She said they were then marching down Main Street, before them flying a panic-stricken crowd of women and children who seemed crazy. I ran upstairs to my bedroom just in time to see the US. flag run up over the State House.

Later

General Sherman has assured the Mayor that he and all the citizens may sleep as securely and quietly tonight as if under Confederate rule. Private property shall be carefully respected. Some public buildings have to be destroyed, but he will wait until tomorrow when the wind shall have entirely subsided . . .

Entry for February 18, 1965  (Written on February 18th about February 17th)

At about seven o'clock pm I was standing on the back piazza in the third story. Before me the whole southern horizon was lit up by camp fires which dotted the woods. On one side the sky was illuminated by the burning of Gen. Hampton's residence a few miles off in the country, on the other side some blazing buildings near the river . . . . The fire on Main Street was now raging, and we anxiously watched its progress from the upper front windows. In a little while, however, the flames broke forth in every direction. The drunken devils roamed about, setting fire to every house . . . . The firemen attempted to use their engines, but the hose was cut to pieces and their lives threatened. The wind blew a fearful gale, wafting the flames from house to house with frightful rapidity. By midnight the whole town (except the out-skirts) was wrapped in huge blaze.
Preservation of Historic Homes

Hampton-Preston Mansion

Another message received by Sherman on Friday morning, February 17, 1885, was a plea for protection from the Mother Superior of Ursuline Convent. In requesting special protection for the convent school and its girls, she informed Sherman that she had formerly taught at the school in Ohio where his daughter, Minnie, was a student. Sherman sent word to her that "we contemplate no destruction of any private property in Columbia." However, during the holocaust which followed, Ursuline Convent at the southeast corner of Main and Blanding Streets was destroyed. The nuns and their pupils fled to St. Peter's Catholic Cemetery on the southwest corner of Assembly and Taylor Streets, where they escaped the heat of the flames as they huddled by the tombstones on that cold winter night. On Saturday, February 18th, the Mother Superior of Ursuline Convent made a second plea to General Sherman, this time for shelter and protection. He replied that they could stay in any home they wanted. She selected John S. Preston's (brother-in-law to Wade Hampton) home, which was built in 1818 for Ainsley Hall and his wife. Upon Hall's death in 1823, the house was purchased by Wade Hampton I, and became the townhouse for three generations of Wade Hamptons. Today it is known as the Hampton-Preston Mansion. As Sherman's troops left Columbia, the nuns and their pupils moved into this spacious antebellum house. They found the rooms inside the mansion in shambles and learned that the troops had planned to burn this mansion as they left Columbia. Thus the Mother Superior of Ursuline Convent is credited with saving this magnificent home from a devastating fire. Facing Blanding Avenue, the mansion sits on a four acre block bounded by Pickens, Laurel, and Henderson Streets. Today, the Hampton-Preston Mansion is held in public trust by the Richland County Historical Preservation Commission and open to the public for tours.

Robert Mills House

Another historic antebellum house that escaped the fires was the Robert Mills House on Blanding Avenue. It is situated on a four acre block bounded by Blanding, Pickens, Taylor, and Henderson Streets and faces the Hampton-Preston Mansion. During Sherman's occupation of Columbia, the Robert Mills House was the Presbyterian Theological Seminary. Consequently, it was spared from destruction. The house takes its name from the famous federal architect Robert Mills, who designed the Washington Monument, the United States Treasury Building, and the Old Patent Office Building in Washington, DC. Columbia can boast of another Robert Mills building. Located on the South Carolina State Hospital grounds at Elmwood Avenue and Bull Street, the second Mills House served as a hospital during Sherman's invasion and therefore was spared from the fires. Both of these buildings have been restored to their original beauty and serve as a showcase for the architecture of the period.
Mann-Simons Cottage

Celia Mann was a slave in Charleston who purchased her freedom with money she earned as a midwife. Prior to the Civil War, she walked to Columbia and bought a cottage located on the northeast corner of Richland and Marion streets. She was residing there when Sherman marched through South Carolina, and the house was not burned. She lived to see the war end, but died a few years afterwards. Her family maintained ownership of the cottage until a grand niece sold it to the Columbia Housing Authority in 1970, under the condition that the house would be preserved and its history passed on to others. Today it is known as the Mann-Simons Cottage, is fully restored, and serves as a Museum for African American Culture.

Blanding Street House

Some ingenious ways were devised to preserve personal property as well as buildings. The owner of a bob-tailed horse, John A. Crawford, Esq., appreciated his horse highly. Although not a race horse, if any one attempted to pass this animal on the road, it would step out in a way that showed it could get over ground in a hurry. Realizing that Sherman's men were approaching, Crawford muffled his horse's hoofs and led the animal up the stairs to the second story of his dwelling, thereby foiling possible theft by robbers. The house still stands today on the southeast corner of Blanding and Bull streets.

After leaving Columbia, Sherman and his troops went to Winnsborough (Winnsboro) in Fairfield County, crossed the Wateree River at Rocky Mount in Chester County, and marched on toward Cheraw and then Bennettsville. By the time they crossed into North Carolina, the Federal troops under Sherman's command had destroyed and pillaged a sixty mile wide path all the way across the South Carolina.
Climate and Water Resources

The Sandhills Region has a 200 to 240-day growing season and receives an annual rainfall of about 44 inches. It is usually considered to be the hottest region in the state and can become quite humid during hot summer days. It is far away from the cooling breezes of the coast and equally far from cooler mountain elevations. There are very few large lakes, ponds, or other bodies of water to moderate the regional temperature. Most streams which originate in this area are intermittent, flowing only during periods of heavy rainfall. The extremely high porosity of the soil combines with the generally high elevation to produce ground water levels which lie fairly deep below the land surface. Surface water tends to sink rapidly into the soil.

Agriculture and Forestry

The Sandhills Region is generally not a very productive agricultural area because of rapid loss of nutrients, organic materials, and water from the soil. The loose sandy texture of the soil makes it almost impossible to retain moisture near the surface. The area is well suited for longleaf pine and turkey oak forests, and similar vegetation which easily adapts to water-starved conditions. Only eight percent of the soils in this region are classified as prime farmland. About two-thirds of the area is forested, and one-third is planted in crops or pasture. With proper management, truck crops and peaches can be grown successfully.

Carolina Sandhills National Wildlife Refuge

The Carolina Sandhills National Wildlife Refuge consists of approximately 46,000 acres of land and water in Chesterfield County. Most of the refuge is covered by longleaf pine forests interspersed with scrub oak. The habitat is enhanced by 1,200 acres of open fields and forest clearings, and thirty man-made lakes and ponds. The refuge was purchased in 1939 under the provisions of the Resettlement Act. The land had become badly eroded and very little wildlife was left in the area. The immediate goal of the refuge was to restore the damaged barren land to a rich, healthy environment so native plants and animals could re-establish themselves.

The primary objective of the refuge today is to provide habitat and protection for threatened and endangered species, as well as migratory birds. Some of the animals on these lists include the red-cockaded woodpecker, pine-barrens treefrog, southern bald eagle, and the eastern cougar. The refuge also offers opportunities for environmental education, wildlife oriented recreation, and serves as a demonstration area for land management practices, which help preserve our wildlife heritage and conserve precious natural resources.

The refuge conducts a variety of habitat management programs to increase and maintain habitat diversity for wildlife. Examples include prescribed burning, roller chopping, mowing, and periodic timber harvesting. Also, pond water levels are changed with each season to encourage the growth of desirable aquatic vegetation and control the growth of submerged vegetation which would eventually clog the waters completely. Fields and clearings provide food and cover for many species of wildlife. These areas
are planted with crops favored by deer, turkey, dove, and quail. Open areas are essential to achieve the natural diversity characteristic of the original Sandhills habitat.

Unique Natural Habitats in the Sandhills

The Sandhills Region displays a unique assemblage of vegetation, classified as xerophytic, or adapted to dry conditions. The dryness of the area is related to the extremely rapid drainage through the predominantly sandy soils. Xerophytic vegetation is distinguished by a short broken canopy, a dispersed distribution of plants, and in some cases, wide expanses of bare soil. The predominant forest cover consists of longleaf pine and turkey oak, the latter usually in a stunted form. Over time, large areas have been burned, cleared, and cultivated. Now much of the area is planted in loblolly or slash pine, neither of which is native to the area. A number of shrubs and herbaceous plants, including species of sparkleberry, wild rosemary, gopherweed, and sand myrtle, are distinctive elements of the region’s vegetation. Also, the Sandhills are home to the endangered red-cockaded woodpecker and the gopher tortoise. These animals require special habitat conditions for their continued survival.

Clay Deposits

In the western part of the Sandhills Region, particularly in Aiken County, large deposits of kaolin clay have been mined extensively. Aiken County ranks second nationally in the production of all types of kaolin. This clay is of great economic importance in South Carolina and is used unprocessed in the manufacture of ceramics and refractory materials and in its processed form in such diverse materials as rubber, paint, paper, fertilizer, and pesticides. Many millions of years ago, abundant feldspar mineral grains in exposed granite landscapes were altered to the mineral kaolinite through chemical weathering processes. The loosened grains were transported by water and deposited as thick layers, which were then buried by other sedimentary deposits and turned into rock. Modern erosion has uncovered the clay deposits, providing easy access for today’s mining activities.

The Pottery Industry

In addition to pure kaolin, South Carolina colonists discovered other large deposits of fine clay as they moved west from the coast. These valuable deposits provided the materials necessary to make the pottery vessels which were vital for transporting and storing liquids before glass and plastic became readily available. The best deposits were located near Edgefield, Camden, and Columbia. The Carolina Colony, and later the state of South Carolina, exported tons of the kaolin to England, most notably to the Wedgewood factory in England. However, a large number of South Carolinians, including Francis Pickens, established their own local pottery works.

Edgefield County at one time contained two-thirds of the state's pottery works. The first one of significance, built between 1810 and 1820, had the artisan village of Pottersville develop around it. By 1825, sixteen houses, a few stores, and a newspaper constituted this manufacturing center one and a half miles from the Edgefield County Court House. Later, other pottery works also developed in the Edgefield area.

All of these works utilized African American labor, both slave and free. Although in Africa, women were responsible for making all the pottery, South Carolinians followed the
British tradition, and men alone created the stoneware. One slave, known only as Dave, became the most famous and accomplished potter in the South. Dave, who lived to the ripe old age of eighty-three, made large pots wide in the shoulders, the largest having a capacity of forty gallons. Dave inscribed the necks of many jars that he made with verses such as:

"This jar is made cross / If you don't repent you may be lost."

"The Fourth of July is surely come / to sound the fife and beat the drum."

"I wonder where is all my relation / Friendship to all and every nation."

"Dave belongs to Mr. Miles / Where the oven bakes and the pot biles."

Some historians believe that Dave's verses contained hidden messages that slaves would understand but others would not recognize. Others see these verses as simply clever sayings meant to increase the value of the pots.
The Sandhills of South Carolina preserve the ancient shoreline deposits of the Atlantic Ocean during a time when sea level was much higher than it is today. Some call this part of the state the Midlands, because this area lies both near the center of the state and roughly midway between the current location of the coast to the east and the mountains of the Blue Ridge to the west, but the term Sandhills is more descriptive of the topography and geologic makeup of this narrow band of ancient sand dunes. The unique character of the Sandhills greatly influenced the historical development of this area.

In contrast to the pattern that holds true in most of South Carolina, the Sandhills were not settled primarily by farmers. Due to the inability of Sandhills soils to hold water, only a small percentage of this region is considered good for farmland even with modern practices. In the 1700’s, it was nearly worthless from an agricultural point of view. In fact, George Washington, after passing through the Sandhills from Augusta to Columbia, remarked that the land was probably the poorest that he had ever seen. This region is by no means a desert, but the native plants are adapted for quick use of the abundant but periodic rain water in ways which most agricultural crops are not.

The rapids that occur on the major rivers that cross from the Piedmont, through the Sandhills, to the Coastal Plain below encouraged settlement for two reasons: 1) they formed the upward limit of navigability for boats heading inland from coastal ports, and 2) they served as excellent sites for the production of hydropower for textile mills and other industry. These rapids, along the boundary between the harder rocks of the Piedmont and the generally softer rocks of the Coastal Plain, pinpoint the Fall Line Zone, which extends not only through South Carolina but also as far north as Rhode Island and as far south as Alabama and parts of Mississippi. During the time before rail transportation became available, cargo traveling inland from the coast had to be offloaded, carried around the rapids of the Fall Line Zone, and reloaded on wagons or smaller boats for the trip into the Up Country. A similar task had to be undertaken for cargo moving down toward the coast. All of this activity around the rapids, and all of the people required to do the work (and feed and entertain the workers), led naturally to the growth of towns. When railroads began to supersede river transportation, towns along the Fall Line Zone generally turned toward manufacturing using the locally abundant water power, initially converting it directly into mechanical power but by the late 1800’s turning it first into electricity.

With their roots firmly planted in their long histories of trade and industrial production, cities in the Sandhills have overcome the agricultural shortcomings of the area and continue to grow. Deposits of valuable earth materials, important to industry, such as high-quality sand and some of the largest and purest deposits of kaolin clay in the country continue to support this region. A rich human history is associated with South Carolina’s capital, particularly during the Civil War, and many landmarks of historic significance have been preserved. The natural history of this narrow band of Sandhills is, in many places, still unmarred, showcasing plant and animal communities uniquely adapted to the extremely sandy and consequently often-dry soils.
PLACES TO VISIT

Columbia Canal/Riverfront Park. Downtown Columbia. For information call 803-733-8613 or 803-733-8331.

Columbia Museums of Arts, Corner Main and Hampton Streets, PO Box 2068, Columbia, SC 29202. For information call 803-799-2810.

McKissick Museums. 1403 Richland Street, Columbia, SC. Operated by the University of South Carolina. For information call 803-252-1450.

Peachtree Rock Preserve. For information call the South Carolina Nature Conservancy in Columbia, SC at 803-254-9049.


South Carolina State Museum. Located in the Columbia Mills Building at 301 Gervais Street, Columbia, SC. For information call 803-737-4999, 803-737-4978, or 803-737-4921.

Riverbanks Zoological Park and Botanical Garden. 500 Wildlife Parkway--just off I-26 at Greystone Blvd. For information call 803-779-8717.

Foster-Dixiana Sand Quarries. Located on Hwy. 321 in West Columbia, SC. For information call 803-794-2872.

REFERENCES AND RESOURCES


STUDY AREA 4: SANDHILLS / MIDLANDS OVERVIEW

Activity 4-1: Overview

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<td>6 LAND USE/LAND COVER MAP</td>
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<td>1 1850 Street Map of Columbia</td>
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PERFORMANCE TASKS
(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts =

1. **Trace Sandhills boundaries and characterize topography.**
   Using the STATE BASE MAP #1, SHADED RELIEF, trace with a wipe-off pen the northwestern and southeastern boundaries of the Sandhills/Midlands Region. Name the counties that are included in this region. Why are the boundaries so irregular? How many streams or rivers flow completely across this region? How many streams or rivers begin in this region? Describe the typical Sandhills topography and explain how it differs from the surrounding landscapes.

2. **Characterize Sandhills soils and land use.**
   Use the GENERAL SOIL MAP to determine the major soil types found in the Sandhills Region of the state. What percent of the soil in South Carolina is classified as sandhills type? Are these soil types found anywhere else in South Carolina? Use the LAND USE/LAND COVER MAP to determine the kind of vegetation typically found in the sandhills. What other land uses are common in the Sandhills/Midlands Region?

3. **Locate the center of the state.**
   Several different procedures can be used for determining the center of a geographic region. Most of these involve some form of mathematical calculation. Class groups can try to discover some of these methods on their own, or they may choose one of the two sample methods presented below. If they use the sample methods, students should divide into groups, follow the instructions indicated, and compare results during a class discussion.

   **Group I: Determine Center of Circumference of Circle**
   According to a report issued in 1786 (see paragraph entitled Choosing a Site for the New Capital on page 4-5) the suggested site for the new capital was the center of a circle . . . whose circumference strikes through the high hills of Santee crosses Santee at the confluence of Congaree and Wateree rivers and crosses the Congaree River at the confluence of the Saludy & Broad River[s] . . . . Using the STATE BASE MAP # 1, SHADED RELIEF, draw a circle around the city of Columbia (use Columbia as the center point), with a wipe-off pen, with a diameter of 30 miles (radius of 15
miles). Does this circle match the one described in Senator John Lewis Gervais' bill to relocate the Capital of South Carolina to a central location? Mark on the map the site which would have been the center of the circle described in the 1786 report. How far is this spot from the present-day position of Columbia? Determine if the center of either circle is, in fact, the exact center of the state. How would you determine the center of South Carolina today? Why did the committee members make this statement . . . "such Maps of the State which they could posses themselves of . . ."?

**Group II Determine Center of Mass of State**

Cut out the shape of South Carolina from a piece of stiff cardboard. Try to balance this piece of cardboard on the sharp point of a pencil. Mark the location on the cardboard where balance occurs, then identify the corresponding location on the **STATE BASE MAP #2, WITH HIGHWAYS**. If Columbia is not located precisely at this point, how far is the capital city from the exact center of the state?

4. **Evaluate potential locations for State Capital.**

   On the **STATE BASE MAP #2, WITH HIGHWAYS**, locate the town of Wedgefield in western Sumter County (about 10 miles west of the city of Sumter at the intersection of Highways 763 and 261). Wedgefield is just south of the town of Stateburg (not shown on the map), which was General Thomas Sumter's preference for the new location of the State Capital in 1786. The leading competitor was the Columbia site, where Friday's Ferry crossed the Congaree River at the town of Granby, at the head of navigable water. Sumter argued that the Friday's Ferry location was far from healthy because it had so much nearby swampland; that the barren, worn-out, sandy soil produced only pine, which was not a good building material; that the planters lived more than ten miles apart; and that navigation, so necessary and essential to commerce, was bad on the Congaree. In contrast, the High Hills of the Santee and Stateburg offered higher ground, healthy air, good water, and superior soil. Did Sumter have a valid argument for making Stateburg the capital? Compare Stateburg, Columbia, and the "exact center of the state" as potential sites for a State Capital. Locate each site on the **STATE BASE MAP #2, WITH HIGHWAYS**. List pros and cons for each site, being sure to include references to landforms and landscape features to explain your answers. Which do you think would have been your personal choice for the Capital? Why do you suppose the Assembly chose the Columbia location?

5. **Locate potential site for new county seat.**

   Locate your county on the **STATE BASE MAP #2, WITH HIGHWAYS**, and also locate your county seat (the town where county government offices are located). Why do you think that particular town was originally selected? Suppose that the town residents got tired of having all the government offices in their town and voted to move the county seat to a new location. Where in your county would be the best place for a new county seat? Mark your selection on the map with a wipe-off pen and explain why you chose that spot. Refer to landforms and landscape features as well as population distribution and existing transportation routes. Would you recommend changing the location of your county seat?
6. **Locate towns important to transport of cotton.**

Before the development of railroads, cargo moving from the coast or inland to the coast had to be loaded and unloaded around the rapids of the Fall Line Zone. Located on major rivers, Hamburg, Columbia, Camden, and Cheraw became major towns and grew in importance with the spread of cotton into the upstate. They became major collection centers for cotton which was then shipped by steamboat or railcar to Charleston. Use the **STATE BASE MAP #2, WITH HIGHWAYS**, and a wipe-off pen to locate and mark the positions of Hamburg, Columbia, Camden, and Cheraw. What geographic similarity do they all possess?

7. **Trace route of Alexander Scaife.**

Use the **STATE BASE MAP #2, WITH HIGHWAYS**, and a wipe-off pen to trace the route that Alexander Scaife took to transport cotton on a barge from Chester to Columbia (refer to the story "The Cotton Boat" on page 4-7). If you were transporting goods today from Chester to Columbia on an 18-wheeler truck, which highways would you take? Mr. Scaife said they picked up sugar and coffee in Columbia. Where did these products come from? How did the sugar and coffee get to Columbia? Explain how this type of trade demonstrated the one-crop trading system which characterized South Carolina's economic pattern even in Scaife's time. Which ferries were mentioned in the account? Why were there so many ferries?

8. **Measure length of the Columbia Canal.**

Many canals were built in South Carolina because of the Internal Improvement Act of 1818. The most successful one in the state was the Columbia Canal. Most canals were built to bypass rapids and shoals on rivers. The Columbia Canal, however, has, for a long time, served a different function, as a productive hydroelectric plant generating peak power for Columbia residents. Using the scale bar on the **COLUMBIA TOPOGRAPHIC MAP**, measure the length of the Columbia Canal as it is today. Refer to the **COLUMBIA LITHOGRAPH** and again measure the length of the Columbia Canal using the scale bar. Do your results agree? Which value is the most accurate? Why? The original Columbia Canal was 3 1/8 miles long and extended from Granby in the South to Richland Street just north of the power plant by the South Carolina State Museum. Why do you think the canal was extended northward when power production became the main function of the canal? Most of the original portion of the canal is no longer in use, but can be identified on the lithograph as a narrow treeless pathway with light red tint. Mark this route on the lithograph with a wipe-off pen.

9. **Locate Civil War landmarks and retell stories.**

Use the location descriptions about the Civil War given in the Background Information and associated stories to identify where the following events took place in and around Columbia. Use the **COLUMBIA TOPOGRAPHIC MAP** and Figure 4A-1, "1850 Street Map of Columbia," found in the Brief Site Description for Study Site 4A. Once you have located each landmark, retell the story behind it in your own words.

a. The secession convention (First Baptist Church)
   (Refer to page 4-8, The Secession Convention and the Onset of the Civil War.)

b. Move to Columbia of Confederate Printing Press (Gervais & Huger Streets)
   (Refer to page 4-8, Columbia's Importance to the Confederacy.)
c. Surrender of Columbia by Mayor Goodwyn (trace routes with wipe-off pen)  
   (Refer to page 4-9, The Fall of Columbia.)

d. First Baptist Church saved and Washington Street Methodist Church burned  
   (Refer to page 4-10, "One Account of the Burning of Columbia.")

e. Eyewitness account of fires by Emma LeConte (South Carolina College)  
   (Refer to page 4-11, "Eyewitness Account of the Burning of Columbia.")

f. Hampton-Preston Mansion saved by the Mother Superior (mansion & cemetery)  
   (Refer to paragraph on page 4-12.)

g. Saving of Robert Mills House (Elmwood Avenue and Bull Street)  
   (Refer to paragraph on page 4-12.)

h. Mann-Simons Cottage (Richland Street and Marion Street)  
   (Refer to paragraph on page 4-13.)
i. The Blanding Street House (Blanding Street and Bull Street)  
   (Refer to paragraph on page 4-13.)

10. Locate site where Sherman fired on capitol.  
   Locate on the COLUMBIA TOPOGRAPHIC MAP the site on the west bank of the  
   Congaree River, in West Columbia, where Sherman’s troops fired at the South  
   Carolina State House. Today the site is identified by a historical marker along  
   Highway 378 halfway between Highway 1 (Meeting Street) and Highway 12. Use the  
   map scale to determine the distance that the shells were fired. General Sherman  
   planned to cross the Congaree River and burn the capital city. But the South  
   Carolina troops burned the bridge over the Congaree River as Sherman and his  
   troops approached Columbia. General Sherman elected not to cross the Congaree  
   River because of the depth and the swift current. To enter Columbia, he and his  
   troops decided to find a more accessible route and camped on an island in the  
   Saluda River in close proximity to the site of the Riverbanks Zoo. Locate the islands  
   in the Saluda River where his troops may have encamped before entering Columbia.  
   Why did Sherman choose this site to cross the rivers rather than farther south? Was  
   this a wise decision? Why or why not?

11. Write story about person who is both hero and villain.  
   Some people are viewed both as heroes by one segment of the population and  
   villains by another segment. Two such persons are highlighted in the story on page  
   4-10, titled "One Account of The Burning of Columbia." The unnamed soldier who  
   burned the Church was viewed as a hero by the Yankee army but as a villain by the  
   citizens of Columbia. Likewise, the unnamed custodian who sent the soldiers to burn  
   the 'wrong' church was a hero to Baptist church members, but a villain to the  
   Methodist worshippers. Using this story as a model, put yourself in the place of a  
   citizen of the city of Columbia during the Civil War. Write a story about something  
   you might have done which would appear heroic to one side and villainous to the  
   other. Use the COLUMBIA TOPOGRAPHIC MAP to pinpoint a location for your  
   story. Share stories within your group and select your favorite to tell to the entire  
   class.

12. Trace drainage divide from Augusta to Columbia.  
   Use the STATE BASE MAP #1, SHADED RELIEF, and a wipe-off pen to draw a line  
   as straight as possible, connecting North Augusta, in Aiken County, with West  
   Columbia, in Lexington County. Be sure not to cross any streams. You have just  
   traced the Sandhills drainage divide. Trace the path of all streams north of the divide  
   in red. Trace the path of all streams south of the divide in blue. How can you explain
the fact that the Sandhills in this area are higher in elevation than the Piedmont or the Coastal Plain? How has this drainage divide been used to advantage?

13. **Use coded message to describe landscape.** Sometimes people want to send information about their location to their friends while keeping it secret from others. Select any location in the Sandhills/Midlands Region that is identified on the *STATE BASE MAP #2, WITH HIGHWAYS*, and devise a coded message that will tell a friend your location. Exchange messages with others in your group and try to decode their messages to identify their locations. Use Dave's poetic verses on page 4-16 to give you ideas for coding your message.

**ENRICHMENT**

1. **Research equipment used to build canals.** During the Canal Age, South Carolina appropriated money for the development of canals. Research these canals and locate them on the map in your South Carolina history book. What equipment, that would be considered obsolete today, was used to build the canals? A good resource is Jim Casada's article "Carolina's Grand Canals" in *South Carolina Wildlife*, January-February, 1995, pgs. 36-40.

2. **Ask legislator about transportation budget.** In 1818, South Carolina Assembly committed $1,900,000 towards improving transportation. These internal improvements included building of canals. Ask your legislator how much is budgeted today for internal improvements such as roads and bridges. Compare the equivalent of today's dollar with that of 1818. How does the 1818 dollar amount compare with today's figure?

3. **Interpret Dave's poetic verses.** Many of Dave's poetic verses (see paragraph entitled The Pottery Industry on pages 4-15 and 4-16) may contain cryptic themes and messages. Can you interpret his meanings? What is significant about Dave's verses beyond what he said? Clue: Check the slave codes and read between his lines!
The State
March 23, 1995

Studies indicate pollution could shorten life span

The simple act of breathing could be shortening the lives of people in South Carolina's three largest cities, where a new study says a common form of air pollution is the culprit.

After a ten-year study of cities across the nation, researchers at the Harvard School of Public Health, Brigham Young University, and the American Cancer Society concluded that breathing air with even average sulfate levels can shorten life spans. In Columbia, Greenville and Charleston, sulfate levels are above average. Sulfate pollution comes mostly from coal-burning factories and power plants. Diesel trucks and wood burning also are sources.

Columbia has the state's dirtiest air, with 16 micrograms of sulfate per cubic meter, compared with a national average of 10.5 micrograms. Charleston measured 13.8 micrograms and Greenville, 11.

Researchers said residents of the most polluted cities could lose about two years off their expected life span, while those in areas with average pollution levels could die prematurely by a few months or a year.

RATIONALE

Columbia is in the geographic center of the state, and it was selected as the capital city primarily because it was the junction point of two major rivers, the Broad and Saluda, which made it accessible to a large number of South Carolinians. The Columbia study site is unique, as it is geographically situated on three different geological regions, the Piedmont, the Sandhills, and the Coastal Plain. The Piedmont band of rolling topography runs in the northeast-southwest direction and is bounded by the Sandhills Region. Today, Columbia, like other urban and suburban metropolitan cities in South Carolina, needs services and resources to support its large population and busy economy. Water, electricity and natural gas are needed for both industrial and residential use. Transportation facilities such as airports, highways, and railroads are needed to link the people and resources. Space and land are needed for housing, businesses, factories, shopping centers, and utility corridors in urban areas. Specifically, Columbia is fully supported by the surrounding landscape, including forest land for timber, agricultural land for row crops and dairy products, and mining sites for building materials. Careful attention must be paid to the possibility of over-stressing the available resources of these areas.
Introduction

One important factor that has shaped the Columbia metropolitan area is the river system. The confluence of the Broad and Saluda rivers, flowing out of hilly terrain west and north of Columbia to form the meandering Congaree River, located in a flat terrain, is part of the expansive Santee River basin that drains central South Carolina. This river system provided Columbia with an important link with Charleston and made the area accessible for transportation of farm products. Ultimately, it made the Carolina Midlands the state's center for trade, transportation, governmental affairs, cultural enhancement, manufacturing, and the home office of many businesses.

The village of Granby grew up beside Friday's Ferry about 1760. At the time of the Revolutionary War it was the most populous place on the Congaree River and one of the key points in the British defense. A strong house on high ground above the village was built and named Fort Granby. The capture of Fort Granby by the patriot General Lee made the British position in central South Carolina untenable and hastened the British evacuation. After the Revolutionary War, the town of Granby grew into a trading center for the present counties of Lexington, Newberry, and Saluda. It was the only important town between Camden and Augusta, and after 1800 it was also the terminus of the Santee Canal water transportation route. By 1796, three bridges had been built across the Congaree at Granby, and in 1796, it became the county seat of Lexington County.

When President George Washington visited the Columbia area, he was most favorably impressed by Granby and its citizens. He predicted that a great future lay ahead for the town of Granby, though he was not favorably impressed by Columbia itself. However, as the Capital City grew, merchants of Granby established businesses there. Columbia was free from the danger of floods and was less subject to disease and fevers. Eventually, the court house was moved, and the old town sank into decay. Buildings were demolished or moved while others burned or rotted. Granby slowly disappeared. Several cemeteries and the Granby Monument are all that remain today.

Naming the Streets of Columbia

Columbia was probably one of the first planned towns in the United States. The Commissioners designed the new capital to be two miles square with two principle streets 150 feet wide. All the rest of the streets were 100 feet wide spaced ten streets per mile. These provisions called for 400 square blocks, each approximately four acres in size, to be divided into eight rectangular one-half acre lots. The State House was built at the intersection of the two principle streets, which were named Assembly and Senate in honor of the legislative bodies. All the north-south streets were actually laid out slightly northwest--southeast so they could run parallel to the Congaree River.

The remaining streets were named as follows: North-south streets east of Assembly Street were named for South Carolina Revolutionary War Generals: Richard Richardson, Thomas Sumter, Francis Marion, William Bull, Andrew Pickens, Richard Henderson, John Barnwell, Richard Winn, and Henry Laurens. Harden Street was the east boundary. Richardson Street was re-named Main Street, with the Capitol Complex now carrying the name Richardson Square, and Winn Street was changed to Gregg Street honoring Maxcy Gregg the Civil War hero. Going westward, toward the Congaree River
parallel to Assembly, the streets were named for Continental Generals who fought in South Carolina: Horatio Gates, Benjamin Lincoln, Christopher Gadsden, Anthony Wayne, and Casimir Pulaski. The remaining north-south streets were named for Isaac Huger, Ortho Williams, Mordecai Gist, Thomas Pinckney, and Owen Roberts. Gates Street subsequently was renamed Park Street. Pinckney and Roberts streets for the most part no longer exist, because of encroachment by the waterworks and other public buildings.

The east-west streets lying north of Senate were named for statesmen and heroes. Gervais was named for John Lewis Gervais the statesman, and Lady and Washington were named for General George Washington and his "lady," Martha Washington. Plain was named for the Taylor plantation "The Plain." Later it was changed to Hampton Street honoring General Wade Hampton, the Civil War commander. Taylor was named after Thomas and James Taylor, the original owners of the Columbia property. Walnut and Laurel carried tree names after the most commonly used native

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**Figure 4A-1: 1850 Street Map of Columbia**

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Modified from Jones (1985) South Carolina One of Fifty States

**CITY OF COLUMBIA - 1850**
Figure 4A-2: 1995 Street Map of Columbia

The east-west streets lying south of Senate Street were named as follows: Pendleton for Judge Henry Pendleton; Medium, Green and Devine were named for citizens of the newly formed town. Later, Medium was changed to College Street honoring the South Carolina College, and is now part of the University of South Carolina campus. In recent years Green street has been changed to Greene, honoring Nathanael Greene, the Revolutionary War hero. Devine was misspelled for years as D-i-v-i-n-e. Many thought that it was named for the cotton bloom considered 'divine' because of its
critical importance to the early S.C. economy. The remaining east-west streets were named for well-known commodities. Blossom was named for the cotton bloom honoring the developing cotton industry. Wheat, Rice, Tobacco and Indigo were named for important crops of that time. Today, Rice is taken up by railroad tracks. Indigo was changed to Catawba Street named after a native tree. Later, Indigo was renamed Whaley in honor of W. B. Smith Whaley, the industrialist who owned a number of cotton mills in the area. Lower Street was so named because it was the lower boundary of the town. It now carries the name Heyward in honor of Duncan Heyward, a former South Carolina Governor.

Cotton Mills and Expansion of the City

During the early 19th century, many South Carolinians thought the state should be manufacturing more of its own cloth rather than selling so much of its cotton harvest to the New England states and Europe. But even by 1860, there were only three operating cotton mills in the state; only one of these was in Columbia. After the Civil War, entrepreneurs from the North, and from Europe, built many textile mills throughout the state, along with neighboring mill houses, stores, and schools.

The Olympia Mills section of Columbia, located just south of the historic district along the Congaree River, is an excellent example of a neighborhood that was almost completely dependent on the local mill for its economic livelihood. Mill sites were usually chosen based on proximity to a power source, whether water power or electricity, and access to transportation, primarily railroads. Mill villages often consisted of small lots with small houses crowded together, because the builders wanted to insure that everyone had quick and easy access to the mill, the school and churches, and the company store.

Mill villages as well as other local communities tended to retain their identity over the years even as the city of Columbia expanded around them. Because many people in mill villages were related to each other and knew their neighbors very well, these neighborhoods tended to remain as tight-knit communities with their own local flavor and customs. In recent years, the city limits of Columbia have expanded greatly and the metropolitan region now covers a large part of two counties, Richland and Lexington. As with most metropolitan areas, Columbia today is a composite of many different neighborhoods and customs, providing a diversity that enriches the city as a whole.

Elmwood Cemetery Once Thought to Be Haunted

Elmwood Cemetery is bounded on the south side by Elmwood Avenue (Highways 126 & 76) and on the west side by the Columbia Canal. The original plot of ground now occupied by Elmwood Cemetery (once called Tickleberry) was thought to be haunted. It was not converted to a cemetery until 1852, when a child of a professor at the South Carolina College (now the University of South Carolina) became the first occupant. The cemetery filled up rapidly, as many bodies were transferred from other depositories.
Street Railroad Changes Columbia

The introduction of streetcars changed the face of Columbia. In 1886, the Columbia Street Railway Company, with a capital stock of $50,000, purchased six cars, and twenty-five to thirty horses. The first lines established began at the railroad station on Gervais Street. The total rail line extending from this point measured only four miles. A double track extended up Main Street to Laurel Street, where one track continued up Main Street to Elmwood then turned to go by the old Fairgrounds and the cemetery. The second track went out Laurel Street to Barnwell, then to Blanding, and then east to the Charlotte, Columbia and Augusta railroad depot. A branch from Laurel Street ran up Pickens Street to the state hospital. By 1888, only two years after the first cars ran, eight hundred passengers were using the street railroad every day.

Five years later, electric streetcars were introduced to the city. The line was extended from Blanding to Gregg and south to Taylor, then east to Heidt and south on Heidt to Gervais. The Gervais Street Branch was extended in 1895 to the Shandon Pavilion, near present-day Martin Luther King, Jr. Park. In addition, a new line ran off Elmwood south on Gadsden to Richland, where it turned east until it reached Main Street. One year later, the line from Shandon was extended northward on Harden to Gervais, then west along Gervais to Main, forming what became known as the "belt line." Riding along the belt line became a popular form of recreation, especially for children. Whenever the cars broke down, the superintendent of transportation took a horse and buggy along the route collecting the children and returning them to their homes.

Over the next sixteen years, two important rail line stems were constructed extending off the belt line. A line from Scott's Alley (one block north of Elmwood) on Main ran to Hyatt's Park and by 1912 all the way to College Park. The other major stem ran from the Shandon Pavilion out Devine Street, then to Garners Ferry Road and finally to Camp Jackson in 1917. Although the electric streetcar lines produced significant changes to city life, by 1920 the street railway ceased to be a major means of transportation in the city as automobiles made their debut.

The Mall Culture

The shopping mall is an important center of affairs for residents of urban areas. If modern cities are not yet the space-age domes envisioned by the science fiction writers of the past, the large shopping malls found in the urban and suburban communities of today certainly approach the ideals of self-contained living that those writers suggested. Services available in these huge, climate-controlled centers rise so far above simply buying and selling that, despite the fact that shopping is the economic reason for their existence, people no longer even call them shopping malls. Mall is the more normal and inclusive term, better because it is more general.

In addition to making retail purchases of all sorts, ranging from Afghan sweaters to Zebra fish, mall patrons can have an eye examination, consult a chiropractor, get a hair cut, mail packages, see a movie, play video games, work out at a gym, sign up for community college, buy life insurance, rent a tuxedo, enter a contest to win fabulous prizes, stroll through an automobile showroom, and enjoy a meal ranging from exotic cuisine from countries they may have never heard of to corn dogs and mustard on a paper plate. The list goes on. Even if this array of activities were all a mall offered, it might still live up to its potential as a clean, comfortable, safe city. But there is yet another sort of service.
Whether as a result of conscious planning on the part of mall administrators or as a spontaneous shift in usage by visitors, malls now perform many of the less-obvious community functions of a society. Young people meet there, whether just to hang out or to date. Kids visit Santa Claus before Christmas and look for Easter eggs among the usually real, and frequently beautiful, foliage of indoor plants. They trick-or-treat with their parents from store to store at Halloween time. Large numbers of folks regularly walk in the mall for exercise; in fact, special mall-walking shoes are available. Business meetings occur there. Charitable contributions are taken up. Clubs gather. Writers scribble at small tables. Old men read newspapers on indoor park benches. Families show off new babies. And the malls themselves are often visually inspiring, probably the biggest and perhaps the most beautiful buildings that many of the patrons have ever seen. The park, the social club, the art gallery, the playground, the street corner, the backyard—these and many other elements of a functioning urban community can all be found at the local mall, where they have all moved indoors.

Excerpt from the Diary of Martha Merritt, April 10th
By Jody Tinsley

I went to the Mall today, of all places, and I was just one of the five-hundred or so kids there. My parents decided I need “stimulation.” Daddy said, “Martha, I think you ought to go to the Mall today and be with some of the other kids.” Mother agreed, so they dumped me off this afternoon on their way to play golf. I just stood in the shade of the entranceway, staring after their car in the glare of the parking lot.

Being left at the door of the Mall by yourself doesn’t make you look forward to the experience, but my parents weren’t coming back for me until 5, so I had hours to kill. I pulled open the big, glass door and a stream of cold air rushed out by me. I was swallowed up inside.

It didn’t take me long to realize that at the Mall, too, most of the kids are “ins” but some are “outs.” As usual, I was an out. Just because I’d rather read than watch TV, half of the kids already think I’m nuts. If they knew I kept a diary they’d probably quit talking to me. I did run into some girls I know from gym class. We get along there so I said “hi,” and they seemed glad to see me. We went to the music store, but Brooke Belmont was there with some of her friends. You should have seen how quick “my” so-called friends went over to hang around her. I just didn’t want to, so I left the store while they were laughing at something.

Johnny Carr was there, in black jeans and a blue T-shirt, just coming out of the video arcade. He walked right over to me, and I thought, “I can’t believe he’s coming to talk with me.” He wasn’t. He just said “hi” and kept walking, going up to the phones behind me. I sat down on a bench and tried to listen, but the noise from the arcade was too loud. I was just sitting and watching an old man in a gray suit and hat reading a newspaper when a voice right beside me said, “He’s always here. I call him The Ringmaster.”

It was a boy I’d seen at school, but I couldn’t remember his name.

“I’m David,” he said. “You’re Martha, from French class last year. Fermez la port,” he said, pointing off into space just the way Madame Wilson had at the start of every class.

“Oh yeah,” I laughed. “But what do you mean by The Ringmaster?”

“You know,” he replied, “at a circus, the man who’s always dressed up and shouting ‘Ladies and Gentlemen!’ Just watch.”
In a few minutes a couple of old ladies walked near the old man’s chair. He looked up from his paper and said something—we saw his mouth move—and he actually raised his hat. David swore the man had said “Ladies,” but I don’t know.

David said, “To me, this whole place is a circus, and I’m the only spectator.”

“What are you talking about, David?” I asked.

“Come on,” he said, “I’ll show you.”

And he did.

We went to the toy store and looked at the stuffed animals. An 18-foot snake curled in the rafters, and life-sized (almost) lions and bears wrestled in bins in the back. At the outdoor supply store, acrobats with ropes and chalked hands performed on the climbing wall. There was a fat lady buying frozen yogurt in the food court and lots of strongmen and women buying stuff in the health food store. The arcade noise sounded more like a calliope to me then.

We got popcorn from one of the concession stands and sat down to watch the parade of clowns fooling around under the Big Top of the Mall solarium.

I couldn’t believe how fast 5 o’clock came. Maybe I need to write down more of what I saw before I forget it. Of course, I plan to go back before too long. David says he’s usually there on weekends.
Activity 4A-1: Landforms of Metropolitan Columbia

**Materials**

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<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<tr>
<td>LAND USE/LAND COVER MAP</td>
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<td>GENERAL SOIL MAP</td>
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<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<td>COLUMBIA LITHOGRAPH</td>
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<td>State Map of Major Drainage Basins</td>
<td>Figure 1-2</td>
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<td>1850 Street Map of Columbia</td>
<td>Figure 4A-1</td>
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<td>1995 Street Map of Columbia</td>
<td>Figure 4A-2</td>
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<td>Wipe-off Pens</td>
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**PERFORMANCE TASKS**

(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts =

1. **Locate the study site.**
   Locate the Columbia Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP, by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Locate physical features and place names.**
   Using both the COLUMBIA LITHOGRAPH and the COLUMBIA TOPOGRAPHIC MAP, name the rivers flowing through Columbia. In which direction are these rivers flowing? Notice that the Broad River has more sediment (water appears lighter) than the Saluda River. This pattern continues after the rivers join to form the Congaree River. Locate the rapids along the Broad and Saluda rivers that identify the Fall Line Zone. Locate the Columbia Canal and the dam on its lower end. Identify and name the bridges and highways connecting Columbia with West Columbia. What landscape features do you think were influential in encouraging early settlement in this area?

   Locate and identify several famous Columbia landmarks such as the Williams Brice Stadium, the State Fairgrounds, Longstreet Theatre, rock quarries, the South Carolina State Museum, the University of South Carolina campus, Riverbanks Zoo, the South Carolina State Hospital complex on Bull Street, the Elmwood Cemetery, and the South Carolina State House and Capitol complex. Identify which downtown streets are named after Revolutionary War generals, Continental Army generals, prominent citizens, influential legislators, and important agricultural products.

   Use Figure 4A-1, "1850 Street Map of Columbia," to document the carefully planned nature of the original city of Columbia. Then review the topographic map to compare...
and contrast the street layout of the Columbia historic district (planned in detail in 1786) with the layout found in the newer communities which grew up around it.

Identify on both the map and the lithograph the major interstate highways skirting around Columbia. What features help in determining that these are interstate highways? Locate Highway 12 in West Columbia and Highway 227 in the upper right hand corner of the topographic map. Are these considered interstate highways? How can you tell what similarities and differences exist between these roads and interstate highways like I-20? Determine the amount of land area (in acres) used for the cloverleaf at the junction of I-26 and I-20 as seen on the topographic map. What types of businesses and industries would be attracted to locating near interstate highways? Why? Also locate the major power line right-of-ways servicing the Columbia area. Follow these lines across the Saluda and Broad rivers.

3. **Compare Piedmont and Coastal Plain.**

   Using the COLUMBIA TOPOGRAPHIC MAP, identify examples of two Piedmont and two Coastal Plain landforms by contrasting patterns and spacing of contour lines. Use a wipe-off pen to trace the boundary between these two regions. Make a comparative list of the differences in landscape characteristics such as drainage, topography, elevation, soil types, land usage, and vegetation types. In which landform region do you find most of the residential areas? Agricultural areas? Industrial areas? Is this just by chance? Give some reasons for your answers.

As the Broad River and Saluda River flow across the Fall Line Zone into the Coastal Plain, the configuration of the topography and drainage pattern abruptly changes. Describe how the banks of the Congaree River would appear if you were riding down the river in a boat. How does the Congaree River differ from the Saluda and Broad rivers in appearance and velocity of the water? What topographic and floodplain differences are obvious? Locate the levee or dike on the east bank of the Congaree River. Follow the river route. Note the large, flat, cleared areas east of the levees. Why were these dikes built?

Use the information gathered from Part I and Part II to fill in the chart that follows. Once your chart is completed, summarize the differences in average elevation, relief, and average slope (river gradient) between the Piedmont and Coastal Plain. Why is the Sandhills Region completely missing along the Broad and Congaree River System through Columbia?

**Part I  Piedmont Landscapes**

Use information on the COLUMBIA TOPOGRAPHIC MAP to describe the landscape of the Piedmont portion of Columbia. Is it flat, hilly, or mountainous? Find the highest and lowest elevation points in the area of Piedmont topography and enter your data on the chart provided. What is the difference in the elevation of the Broad River at the top of the map and at the Gervais Street Bridge in downtown Columbia where it merges with the Saluda River to form the Congaree River? Enter this data on your chart also. Determine the elevation of any five of the following landmarks in the Piedmont Region of Columbia, then calculate from that data an average Piedmont elevation value. Enter this average on the chart provided.

* Capitol building on Gervais Street
* Richland Memorial Hospital on Highway 227 near Harden
* The Governor’s Mansion on the corner of Gadsden and Richland Streets
* Elmwood Cemetery on Elmwood Avenue
* Columbia Bible College on routes 21/321 in northeast Columbia
* The South Carolina State Hospital on Bull Street
* Benedict College at the corner of Harden and Taylors Streets
* St. Andrew’s School off route 176 just south of the interchange with I-20

**Part II Coastal Plain Landscapes**

Use information on the COLUMBIA TOPOGRAPHIC MAP to describe the landscape of the Coastal Plain portion of Columbia. Is it flat, hilly, or mountainous? Find the highest and lowest elevation points in the area of Coastal Plain topography and enter this data on the chart provided. Then calculate the difference in elevation of the Congaree River from the Gervais Street Bridge in downtown Columbia to the bottom edge of the topographic map. Now determine the approximate elevation of any five of the following landmarks in the Coastal Plain region of Columbia, and then calculate from that data an average coastal plain elevation value. Enter this data on the chart provided.

* Sewage disposal plant in lower right hand corner of map
* Community of Granby along the west bank of the Congaree River
* The State Fairgrounds near the Community of Olympia
* Railroad bridge over Congaree Creek west of the Congaree River
* Williams Brice Football Stadium near community of Olympia
* Cemetery in community of Arthurtown
* The Gaging station on Highway 21/176/321 near the bottom of the map

<table>
<thead>
<tr>
<th>CHARACTERISTIC</th>
<th>PIEDMONT Part I</th>
<th>COASTAL PLAIN Part II</th>
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<td>Lowest Elevation</td>
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<td>Average Elevation</td>
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<td>Change in River Elevation</td>
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<td>River Gradient</td>
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4. **Compare topographic profiles of Coastal Plain and Piedmont.**

   Construct topographic profiles along the two base lines described below. Fold a piece of graph paper lengthwise and place the fold along the base line drawn on the map. Mark on your graph paper the spot where each index contour (the dark contour lines) intersects your fold line. Write the elevation represented by each index contour line next to your mark for that line. Also label the relative positions of creeks and other landmarks. These marks along the fold line will serve as place holders along the horizontal axis of your diagram and will have the same horizontal scale as the topographic map. Now unfold your graph paper and draw a line along the crease to represent your horizontal axis. Next, draw in your vertical axis. Be sure you place your vertical axis at least one inch from the left side of your paper. The vertical scale should be approximately 5 centimeters = 100 feet (depending on the grid size of your graph paper). Plot each point on the graph paper, using the elevation value as the vertical coordinate, and the position mark on the horizontal axis as the horizontal coordinate. Draw a smooth line through these points on your graph paper to complete the topographic profile. Use the profile information to compare and contrast Piedmont and Coastal Plain topography.

   **Group I  Piedmont Topography**

   Draw a straight line, using a wipe-off pen and a ruler, between Roosevelt Village School (on the east bank of the Broad River near the northern end of the Columbia Canal) and Alcorn Jr. High School (just off Fairfield Road near the top of the map on the right hand side). Use this as your base line for drawing a topographic profile.

   **Group II  Coastal Plain Topography**

   Draw a straight line, using a wipe-off pen and a ruler, between Williams Brice Football Stadium (between the communities of Olympia and Arthurtown along Highway 48) and the water tower (labeled "WT" on the map on Taylor Road just west of the power lines and the Seaboard Coast Line Railroad in the town of Cayce). Use this as your base line for drawing a topographic profile. Use non-index contour lines if need be to get additional information.

5. **Interpret land use characteristics of study site.**

   With a wipe-off pen, draw a horizontal and a vertical center line on the COLUMBIA TOPOGRAPHIC MAP, so that you have divided the map into four identical segments or quadrants. Select one or more of the following map quadrants to analyze connections between topography and land use in the Columbia area. Also locate these features on the COLUMBIA LITHOGRAPH. Refer to the map symbols chart in your portfolio. Share your group’s analysis with the rest of the class and, as a class, try to summarize the major concepts and concerns associated with city planning.

   **Group I  Examine Northeast Quadrant**

   Describe the topography of this area. What streams are responsible for draining the land area? What is the direction of water flow in the creeks? What is the highest and lowest elevation in this quadrant? Determine the elevation drop, in feet, of Smith Branch Creek. Locate Crescent Hill Cemetery along Two Notch Road (US Hwy. 1) near Perry Junior High School (now W.A. Perry Middle School). What is the elevation of the cemetery? What is the elevation of Smith Branch Creek nearest to the cemetery? What is the elevation difference? Using the scale bar in the map legend, determine the distance in feet from the cemetery to the closest point on the creek. Why do you think cemeteries are built on high ground?
Group II  Examine Southeast Quadrant
Describe the topography. Locate the railroad tracks along both sides of the Congaree River. What two companies own these tracks according to map information (both companies have since merged with other railroads—their new names are Norfolk Southern and CSX)? Why do these railroads tend to parallel the Congaree River? Locate the quarries on both sides of the Congaree River. Why are they located here? Why are so many ponds around the quarries? Are the ponds higher or lower in elevation than the Congaree River? Locate the sewage disposal plants in the lower right hand corner of the map on either side of the Congaree River. Why are sewage treatment plants located here?

Group III  Examine Southwest Quadrant
Describe the topography. Locate Sixmile Creek and note the extent of its floodplain. Why are there so few houses or buildings located in these areas? If one were to build in this area, what events would pose a danger to the dwellings and their people? Why might Sixmile Creek flood quickly? Determine the elevations of several of the small ponds at the headwaters of Sixmile Creek. Are these natural or man-made? What purpose do they serve? Many of the smaller tributaries are represented by dashed and dotted lines. What type of tributaries are these? How do they differ from the solid blue line symbol representing Sixmile Creek? Locate the Columbia Metropolitan Airport in the lower left hand corner of the map. Why was the airport located here? Give several reasons.

Group IV  Examine Northwest Quadrant
Describe the topography. Locate the Diversion Dam on the Broad River. The dam structure was intended to divert water into a man-made canal running adjacent to the river on its east bank. Why was the diversion dam built here instead of farther north or south? Locate the Zoological Park (Riverbanks Zoo) on the north bank of the Saluda River just west of its junction with the Broad River. Why is this a good location for a zoo? With a wipe-off pen, trace the streets in the red shaded areas between the Broad River and the Saluda River. How does this pattern differ from the street patterns in the pink shaded area of Columbia or West Columbia? Why is there such a different pattern? Does it relate to different land use? Consult the COLUMBIA LITHOGRAPH for additional information. How does land use differ in the pink, purple, white, and green shaded regions of this quadrant? Calculate the elevation of several schools in this area. Are schools usually built on high ground, or low ground, or is there no pattern? Explain your answer.

6. Locate sand and gravel mining sites.
On the COLUMBIA TOPOGRAPHIC MAP, locate the gravel pit just south and west of Interchange 113 on Interstate Hwy. 26 (southwest quadrant). What is the connection between the occurrence of gravel types and the Sandhills landform region? What historical geological event was responsible for the formation of these particular economic deposits? List four possible uses of this commodity in the Columbia area. What modes of transportation are used to get this product to market? Why are there no gravel pits closer to downtown Columbia?
ENRICHMENT

1. **Research long term impact of human use of urban rivers.** Identify as many uses of the rivers in the Columbia Metropolitan area as possible. What are the positive and negative impacts associated with each current use? How do other uses affect the recreational uses of the river? What concerns would you expect the community to develop regarding extended use of the rivers?
Activity 4A-2: Urbanization of the City of Columbia

**Materials**

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<td>6</td>
<td>1850 Street Map of Columbia</td>
<td>Figure 4A-1</td>
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<td>1</td>
<td>1995 Street Map of Columbia</td>
<td>Figure 4A-2</td>
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<td>Transparent Grid Overlay</td>
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**PERFORMANCE TASKS**

(Icon Key) Overview = ⚢; Science = ☀; Math = ☐; History = ☦; Language Arts = ✒

1. **Analyze the newspaper article. ☒ ☀**
   Read the newspaper article on page 4A-1, "Studies indicate pollution could shorten life span." Explain how the study relates to the Sandhills/Midlands Landform Region. Identify on the COLUMBIA TOPOGRAPHIC MAP (refer to the COLUMBIA LITHOGRAPH if needed) some locations in the city where the worst sulfate air pollution might be found. Explain why you selected those locations. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same references and setting, write another newspaper article related to this same situation, but date it far enough in either the future or the past so that you have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

2. **Analyze land use changes through time. ☀**
   Look in the margins of the COLUMBIA TOPOGRAPHIC MAP and the COLUMBIA LITHOGRAPH to determine the year the map was printed and the year the aerial photograph was taken. Examine both cartographic products carefully to identify any changes which have occurred during the interval. How many of these changes are man-made? How many have occurred naturally?

3. **Analyze General Assembly's system for naming capital city streets. ☦ ☒**
   Outline with a wipe-off pen Columbia’s Historic District on both Figure 4A-1 “1850 Street Map of Columbia” and the COLUMBIA TOPOGRAPHIC MAP. Explain the system for naming the streets of Columbia. Does this system seem like a good way to name streets? Explain. Compare the original names given to Columbia’s streets by the General Assembly with today’s names. Refer to Figure 4A-2 “1995 Street Map of Columbia.” List the discrepancy between the original name and today’s street names. Use the information on Naming the Streets of Columbia on pages 4A-2 through 4A-5 to determine why these name changes were made. The two main streets and boundary streets were designed to be 150 feet wide with all the other streets 100 feet wide. Why do you think the streets were laid out so wide? Were any of the Columbia Historic streets named for women? How are streets in your town or city named? Do any of the streets in your area carry these same names? In recent years, have any of your streets been renamed or named for distinguished people in your community? If so, name one of these streets and tell why the person was honored in this way.
4. **Trace city streetcar routes.**

**Group I  Original Streetcar Routes**
Refer to the street railroad information on page 4A-6. Then trace, with a wipe-off pen, the original streetcar route on the COLUMBIA TOPOGRAPHIC MAP. Transfer this route onto the COLUMBIA LITHOGRAPH. Identify at least six landmarks that were connected by the streetcars. Is the original streetcar route contained within the two mile grid laid out by the 1786 Act of the General Assembly? How were the first cars powered? What circumstances allowed the street railroad to convert to electricity? Why were streetcar routes eventually abandoned?

**Group II  Expanded Streetcar Routes**
Refer to the street railroad information on page 4A-6 and the COLUMBIA TOPOGRAPHIC MAP. Trace, with a wipe-off pen, the expanded streetcar routes around Columbia as they formed the first belt line. Waverly became the first suburb of Columbia outside the original two square miles. Why did the streetcar routes extend to the north and southeast rather than follow the original grid pattern for streets as Columbia moved outward? Study the topographic map before you come to a conclusion. Notice that lots in the Waverly area are smaller than those in the original grid. Why would lot and street sizes have changed? What part did the streetcars play in the expansion of Columbia? Why were the streetcar routes eventually abandoned?

**Group III  Identify Belt Lines**
Refer to the street railroad information on page 4A-6. Since early colonial days, Columbia has developed three transportation belt lines that provided transportation circuits around the city. Thus, Columbia residents and visitors have been provided with easy access to urban areas in and surrounding the city. On the COLUMBIA TOPOGRAPHIC MAP, identify the original two-mile-square belt line that accommodated several means of transportation in the 19th century. Next, locate highways on the map, which formed a partial belt line connecting suburban areas around Columbia during the 1900's. Finally, identify the interstates and limited access highway connectors that form the modern day belt line around Columbia.

5. **Locate granite mines and calculate depth.**
On the COLUMBIA TOPOGRAPHIC MAP, note the active rock quarries located on both sides of the Congaree River near the community of Olympia. Granite is mined from these quarries. What historical geological processes occurred to make this area suitable for this type of mining? Describe how this commodity would most likely be transported. Name four potential uses for granite. How deep are the granite quarries? (If you were at the top of one of these quarries looking down, how many feet would it be to the bottom?) Which one is the deepest? Locate these same features on the COLUMBIA LITHOGRAPH. What keeps the Congaree River from flooding the quarries?

6. **Determine set of ordered pairs to locate Columbia landmarks.**
Place the transparent grid overlay on top of the COLUMBIA TOPOGRAPHIC MAP. When the streets of Columbia were laid out, Senate and Assembly, named for the two bodies of the legislature, were the widest streets. Using their intersection as the origin point, locate the following places on the topographic map and determine their coordinates using ordered pairs. Also, locate as many schools as possible. Determine coordinates for three schools of your choice.
<table>
<thead>
<tr>
<th>COLUMBIA LANDMARKS</th>
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<tbody>
<tr>
<td>South Carolina State Capitol (House)</td>
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<tr>
<td>Governor's Mansion</td>
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<tr>
<td>Robert Mills Historic House (State Hospital)</td>
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<td>State Museum</td>
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<tr>
<td>Woodrow Wilson's Boyhood Home</td>
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<td>Mann-Sims Cottage</td>
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<td>University of South Carolina Coliseum</td>
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<tr>
<td>University of South Carolina Stadium</td>
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<tr>
<td>Intersection I-20 &amp; I-26, four leaf clover</td>
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<tr>
<td>Location of School #1</td>
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<tr>
<td>Location of School #2</td>
<td></td>
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<tr>
<td>Location of School #3</td>
<td></td>
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</tbody>
</table>

7. **Estimate time of day air photo was taken.**

   Use the **COLUMBIA LITHOGRAPH** to estimate the time of day that the infrared aerial photograph was taken, based on the angle indicated by shadows cast by various city buildings. You will actually be using the building like a huge sundial and reading the angle the shadow makes with the direction of true north. At noontime, the shadow should point directly north. Determine which way the shadow should point in the morning, and which way it should point in the afternoon. Look at several shadows on the lithograph and estimate as closely as you can the time of day that the aerial photograph was taken.

8. **Locate malls and/or shopping centers and determine reason for location.**

   Malls are places where many people gather at the same time. Look over both the **COLUMBIA LITHOGRAPH** and the **COLUMBIA TOPOGRAPHIC MAP** to try to identify buildings or groups of buildings which would qualify as a mall. What features on the map and/or photo led you to believe it was a mall? What other possible uses could these buildings have? Mark the location of the mall on the topographic map with a wipe-off pen. Why is this mall located where it is? What modifications of the landscape had to be accomplished before this mall was built? How would you get to this mall from the State Capitol Building? Mark your route on the topographic map with a wipe-off pen. Do you think the street system near the mall is adequate to handle all the mall traffic? Explain your answer. Pick a spot on the map where you would recommend a new mall be constructed. Mark that spot with a wipe-off pen. Consider factors such as the slope of the land, the effects of construction on surrounding woodlands or waterways, the reaction of local businesses and homeowners, traffic congestion, and land prices. Explain why you picked that spot.
9. Locate places people congregate; ask why; write story about a trip.

Name several other kinds of places where people congregate. Find these places on the COLUMBIA TOPOGRAPHIC MAP and/or COLUMBIA LITHOGRAPH. In terms of location, road size and layout, parking, etc., how are these places similar to a mall? How are they different? Write about a trip you have taken to a mall, a shopping center, or other public building. In addition to sharing your own experiences, include information about the location of the building(s), the date of your visit, and some indication about the size of the place you visited. You may find it interesting to write as Martha Merritt did in her diary entry beginning on page 4A-7.

10. Compare modern day Historic Columbia to 1786 specifications.

Prove that Historic Columbia is a two-mile square plot with two main streets running perpendicular, and that there are ten streets in each quadrant. Using a wipe-off pen, outline Columbia's Historic District on the COLUMBIA TOPOGRAPHIC MAP by marking Elmwood, Harden, and Heyward streets. Next, mark this same area on the COLUMBIA LITHOGRAPH. Use the scale bar located on the topographic map or lithograph to verify the dimensions of Columbia's Historic District. Next, mark Assembly and Senate streets and count the blocks in each of the resulting quadrants on the lithograph. What is the total number of blocks in Columbia's Historic District? How do you account for the discrepancy with the number of blocks (400) originally intended by the founders? How closely does the Historic Columbia District conform to the 1786 Legislative specifications outlined by the city fathers?

11. Locate mill villages in Columbia.

The Olympia Mill village and mill buildings (labeled "Olympia") are clearly visible on the COLUMBIA TOPOGRAPHIC MAP near the southwestern corner of the historic district and also on the COLUMBIA LITHOGRAPH. Locate the two large mill buildings on the south side of Heyward Street. Select the easternmost of these two mill buildings and measure its perimeter and calculate its area. Also calculate the area of the State Capitol (southeast corner of Assembly and Gervais Streets). What is the straight line distance (as the crow flies) from the mill to the statehouse? What is the actual driving distance (following streets) from the mill to the statehouse? Why does a textile mill need to be so much larger than a government building like the statehouse when both have about the same number of employees?

Describe the landscape in and around the Olympia Mill village. What are the major land uses in the areas bordering this community? Why are there so many railroad tracks in and around Olympia? How is the layout of Olympia (street patterns etc.) different from many of the newer residential areas of Columbia?

12. Compare street patterns along Columbia riverfront.

Refer to Figure 4A-1, "1850 Street Map of Columbia." Notice that north of the Gervais Street Bridge all of the streets reach the river banks. South of the bridge, only one of the streets goes all the way to the river. Use the COLUMBIA TOPOGRAPHIC MAP and the COLUMBIA LITHOGRAPH to try and determine a reason for this particular street pattern.
ENRICHMENT

1. **Explain why there were no paved streets in Columbia until 1908.**
   
   Columbia had no paved streets until 1908. Access libraries to find books about Columbia; find out why the city and Richland County (or other cities and counties in the state) did not begin seriously paving streets until the 1920's. In conjunction with paving of roads, determine what happened in the 1920's that caused the eventual demise of street railways. Research the role the South Carolina Good Roads Association had in improving the road systems in the state.

2. **Contrast life in Columbia in 1900 with life today.**
   
   Find photographs and drawings of early 20th century Columbia. From your findings, construct a chart contrasting life in Columbia around the turn of the century (1900's) to life in the city today. Use your research to develop a story to tell to your friend describing the sights you saw on a trip around the belt line. Be sure to include being picked up by a horse and buggy when the street car breaks down.

3. **Estimate time of day aerial photograph was taken using trigonometry.**
   
   The sun is approximately 5 degrees north of the celestial equator in April when these infrared aerial photographs were taken. Columbia is situated at about 34 degrees north latitude. At midday the sun would therefore appear to be 60 degrees above the horizon, and building shadows would be at their minimum length. Research the height in feet of your favorite Columbia landmark and use this information, along with the trigonometric data, to calculate the length of the shadow at noontime.

   Then compare the predicted shadow length with the actual shadow length and estimate the time of day the photograph was actually taken.

   Note: Use the tangent of 60 degrees and a diagram showing similar triangles to visually outline your trigonometric procedures.

   \[ \text{height of building} = \text{Tangent } 60^\circ \times \text{length of shadow} \]

4. **Relate accomplishments of people to Columbia's street names.**
   
   Use the information on Naming the Streets of Columbia on pages 4A-2 through 4A-5 to identify first names of the people who were recognized by having a street named in their honor. Next research at least six of these people to learn more about their part in the early development of South Carolina. Why were they honored by having streets named after them?
The News and Piedmont

June 17, 1984

Graniteville: A company town no more

by Paul Martin

It's 4 p.m. on a hot summer afternoon and the shift is changing at Graniteville Company. But workers and residents of this meandering textile town soon will experience more permanent and profound changes--changes that may mark the end of a lifestyle and the end of an era.

Graniteville is the quintessential mill town--truly a place where the mill is the town and the town is the mill.

In 1845, wealthy silversmith William Gregg of Virginia founded both, spending $300,000 to build a cotton mill and "a village of comfortable cottages" for workers. A powerful father figure, Gregg shepherded his employees, forbidding the use of liquor while prohibiting child labor and making school attendance compulsory.

He built and owned the homes where the workers lived, the churches where they prayed, and the parks where their children played. Gregg and his legacy, the Graniteville Co., provided the town's street lights, water, garbage collection, and sewage removal.

But when Miami financier Victor Posner completed a takeover in July 1983, residents braced themselves. The first change came in mid-1983 when the Graniteville Co. posted its first profit in several years. The second change will come July 1, 1984, when the area's 13 man Police Department is disbanded. The company is pulling out of the law enforcement business after generations of providing protection, and "the responsibility of law protection for these people will fall on the shoulders of the sheriff," said Aiken County Council chairman Carrol Warner.

Warner said company-funded police protection is the first service to go, "They are going to phase out all the services they had provided."

Tom Taylor, life-long resident, said changes were more or less expected when the company was sold. "The town has benefited over the years from the generosity of the Graniteville Co., and I don't think we could expect another company to do the same," he said. "I just feel fortunate that we had it all these years."

RATIONAL

The Graniteville Study Site highlights a typical mill town along the boundary between the Sandhills and the Piedmont regions of South Carolina. The textile mills which developed in and near Graniteville relied on water power for running the machinery and required both the damming up of streams to create small reservoirs and the construction of a canal system for delivering water to the factory site. Ponds were also constructed to handle wastewater from the plants. Often this water was polluted with a variety of hazardous wastes. The Langley Pond Superfund Site in Graniteville is a prime example of the types of environmental problems which can result from improper disposal of industrial waste. Public access areas are located along the reservoir north of town and along Langley Pond south of the old mill site. Kaolin mining is also a major industry in the Graniteville area. Some of the abandoned mines are now used for landfills, and site restoration is a major concern.
Brief Site Description

Introduction

The Graniteville area is situated just below the boundary between the Piedmont and Sandhills regions. The lower elevation land along Flat Rock Pond just north of town sits on a highly weathered granite rock, best exposed in the spillway from the Pond into Horse Creek. This granite is the source of the name of the town, Graniteville. The high potassium feldspar mineral content of the rock produces exceptionally pure kaolinite clay when weathered. This clay, weathered from the granite over millions of years, is thought to be the major source of the kaolin clay deposits found in and around Graniteville. The higher elevations around town are Coastal Plain sedimentary rocks which cover and hide the underlying granite rock in most areas. Langley Pond has been designated as a Superfund Cleanup Site by the U.S. Environmental Protection Agency. Years of chemical wastes from textile manufacturing have contaminated the lake water and especially the sediment.

William Gregg and Manufacturing

William Gregg is considered to be the father of large-scale cotton manufacturing in the South. While South Carolina's antebellum economy was dominated by agriculture, Gregg was the most vocal advocate for "Domestic Industry" and saw it as a means of aiding poor whites by diversifying the state's economy.

At age four, after the death of his mother, William was sent to Alexandria, Virginia to live with his uncle, who was skilled at manufacturing watches and textile spinning machines. As a young man, Gregg was sent to Kentucky to become an apprentice to a master watchmaker and silversmith. In 1824, he came to Columbia, opened a business, and married Maria Jones, daughter of a wealthy landowner and store proprietor living in the Edgefield District. After a New Jersey businessman opened a small cotton and woollen mill near Graniteville that used the falling water of Horse Creek as power, Gregg became interested in the operation, but was appalled at the poor management he observed. Sensing an opportunity, William and his father-in-law purchased the mill and within a year Gregg doubled the profits. He soon became convinced that the cotton and slavery-based agrarian southern economy was not allowing the region to compete economically with the north. His views were published in the Charleston Courier and soon became widely known at a time when such issues were being discussed and debated throughout the state. His views indicate that he was an advocate for employing poor whites whom otherwise could barely eke out a living in the worn-out soils of the Sandhills and Piedmont Regions.

In 1845, the General Assembly officially chartered the Graniteville Manufacturing Company. By 1849, the company's weaving equipment consisted of 9,245 spindles and 300 looms and was the largest cotton manufacturing mill in the state. Gregg insisted that his mill use local workers, local capital, and local building materials. The mill and dams were built of blue granite that was quarried from beside a stream that ran near the factory site. Gregg also built a complete mill village for his workers and attempted to enforce high moral standards. He prohibited liquor, required school attendance for the children, and allowed no child below the age of 12 (school age) to work in his mill. To house his employees, he built gothic style cottages with steep roofs, peaked dormers and eaves finished with scroll-cut woodwork giving the appearance of gingerbread houses. He
rented these houses for $16 to $25 per year even though it cost him $400 to build each house. Obviously these houses were not built to make money, but to provide better living conditions and to serve as an incentive for workers. Most of his employees were women and their male children over the age of fourteen. Their husbands became tenant farmers on land he leased to them. Men working at the mill were paid $4 to $5 per week, women were paid $3 to $4 per week and children between the ages of twelve and fourteen were paid $1 to $2 per week. Slaves were not employed at the mill.

Children under the age of twelve were required to attend Gregg's school from 8:30 AM to 4:30 PM each day for nine months. He provided transportation to and from his Graniteville Academy each day, and he often served as the truant officer by policing local swimming and fishing holes and leading students back to class by the ear or at the point of his buggy-whip. Gregg is credited with establishing the first free, compulsory public education system in South Carolina and one of the first in the nation. He also looked after the spiritual well being of his mill families by building two churches, St. John's Methodist and St. Paul's Episcopal. Legend suggests that St. John's Church served as a station on the Underground Railroad taking slaves to freedom in the days before the Civil War.

In what is often considered the last Confederate victory of the Civil War, General Sherman sent a detachment of northern troops to destroy the Graniteville Mill and presumably the rest of Graniteville as well. Confederate General Joseph Wheeler's men defeated Union General Judson Kilpatrick's cavalry regiment at the Battle of Aiken on February 11 and 12, 1865. This victory saved not only Graniteville, but also the towns of Aiken and Warrenville from the ravages of Sherman's march through South Carolina. Even though his mill furnished cloth and yarn for the Confederate government during the Civil War, Gregg resented the practice of forcing Southern mills to furnish cloth and yarn at cost, to be exchanged by the government for agricultural products that the farmers were unwilling to sell for Confederate money. He also opposed the draft, which had resulted in a decrease in the number of available workers, and other Confederate policies which greatly increased the price of supplies. After the war, Gregg attempted to modernize his mill but died in 1867 after working in waist-deep water to repair a mill dam.

Mill Town Legends

Like most mill villages and other small towns, Graniteville has accumulated its own unique set of homegrown stories and legends. The closeness of the community, both physically and culturally, tends to promote this type of sharing of events through storytelling. Also, in such a community it is very difficult to keep secrets for very long. When people have very few facts about an event, they tend to let their imagination fill in the blanks for them, and before long a legend is born. Generally such legends are built around actual events and real people and places, but there is usually a mystery or strange, unexplainable occurrence associated with the event. The story, "The Little Boy's Grave" on page 4B-4, is a good example of how a legend can start.
The Little Boy's Grave
Adapted by Christy Clonts from Elinor Fogle's William Gregg and the One Hundred Twenty Six Years of the Graniteville Company.

Legend has it that in 1855 a little boy, too young and too sick to travel, was put off the train in Graniteville. He was cared for by the proprietor of the local hotel until his death. No one ever knew his name or where he came from.

The people of Graniteville "nickled - up" to have a coffin made and a tombstone put on his grave. It can be found in the local cemetery with "Little Boy 1855" on it. Flowers have mysteriously been kept on his grave ever since.

Kaolin Mining and Environmental Restoration

All of the kaolin mining in South Carolina is surface, or open-pit, mining. This type of mining is very economical for the industry, but often leaves large holes in the ground which are unsightly and can be dangerous as well. South Carolina law requires that such areas be reclaimed to become farm lands, woods, lakes, or pasture land. Often, industry representatives and civic leaders can come up with innovative ways to use abandoned kaolin mines. In the Graniteville area, several examples of such innovation can be seen on the infrared image. The large mine west of the golf course and north of Langley Pond is currently being used as a landfill for construction waste such as scrap wood and wallboard, roofing materials, cinderblock, and brick. As material is added to the pit, it is covered periodically with dirt. Eventually the pit will be filled in completely and planted in grass or trees.

Another abandoned kaolin mine, just visible along the southern boundary of the lithograph, is being used as a sanitary landfill for household trash and garbage. This material is covered with dirt daily and planted with grass. The older part of this landfill has been outfitted with wells and pipes to collect methane gas generated from the decaying waste. The existing field has a total of twenty-two wells and a newly covered adjacent field contains an additional four wells. The methane gas is collected, piped across the highway, and used by an operating kaolin processing plant to heat the ovens which dry the kaolin clay for industrial use. This landfill will be producing methane gas for many years even after the it has been completely filled, covered and landscaped.
Activity 4B-1: Impact of Mining

Materials

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<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<td>LAND USE/LAND COVER MAP</td>
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<tr>
<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<tr>
<td>GENERAL SOIL MAP</td>
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<tr>
<td>State Map of Major Drainage Basins</td>
<td>Figure 1-2</td>
</tr>
<tr>
<td>The Geologic Time Scale and South Carolina</td>
<td>Figure 1-6</td>
</tr>
<tr>
<td>Wipe-off Pens</td>
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</tbody>
</table>

PERFORMANCE TASKS

(Icon Key)  Overview =  ; Science =  ; Math =  ; History =  ; Language Arts =  

1. **Locate the study site.  [ ]**
   
   Locate the Graniteville Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Determine elevation of clay pits to assess rock structure.  [ ]**
   
   The GRANITEVILLE TOPOGRAPHIC MAP shows the location of many mines which have been dug into the sandhills topography. All these claypits or strip mines are taking material from the same rock formation which is very rich in kaolin clay. Use contour line information to determine the approximate elevation of the clay deposit at each of the following mines. Use that information to describe the rock structure in this area. (Are the rocks horizontal, tilted, vertical, or folded?) Explain your answer to the class.

   **location of claypits:**
   1. Large mine northwest of Langley Pond elevation =  
   2. Small claypit near I-20 interchange in Northwest quadrant of map elevation =  
   3. Claypit northeast of Richardsons Lake, Southeast quadrant of map elevation =  
   4. Small claypit near three unnamed lakes, northeast quadrant of map elevation =  

3. **Explain why there are no claypits around Langley Pond.  [ ]**
   
   Why is the clay found mostly at higher elevations and not around Langley Pond? Is it more likely that the clay never formed there, or that it formed and was later removed by erosion? Explain your answer. Where would you look to find new locations for claypits?
4. **Interpret the white areas on Graniteville Lithograph.**

On the GRANITEVILLE LITHOGRAPH, there are several large white regions scattered around the area. What do these white areas represent? Refer to the topographic map to get some clues. What are the blue regions within the white areas? What purpose do they serve? Explain why infrared aerial photographs show these particular colors on the lithograph.

5. **Analyze why clay pits are not distinguishable by contour lines.**

Look at several kaolin mines on the GRANITEVILLE TOPOGRAPHIC MAP. The claypit symbols are simply placed on top of the pre-existing contour lines. Why are the clay pit depressions not shown by contour lines? What are the advantages and disadvantages of not showing the contour lines of the open pit mines?

6. **Evaluate and characterize reclaimed mine areas.**

Locate the very large kaolin mine along the lower edge of the GRANITEVILLE LITHOGRAPH. About one-fifth of that clay pit has been filled in and reclaimed. How can you identify the reclaimed area on the lithograph? What features are visible which indicate this land area is different from its surroundings? Why does it appear that way in the infrared image? How would the reclaimed area look to a ground observer?

**ENRICHMENT**

1. **Research construction materials made from clay.**

Clay is also important in producing materials used in building construction. What construction materials are produced from clay? Locate the major manufacturers of brick and clay pipe in South Carolina. Where are they concentrated? Why is this so?

2. **Describe successful reclamation methods.**

Contact one of the four kaolin mining companies operating in the Graniteville area: Cyprus Industrial Minerals, Dixie Clay, J.M. Huber, or W.R. Grace. Ask for information on how they are reclaiming old clay pits. Which reclamation methods are most successful in the Graniteville area?
Activity 4B-2: Textile Mill Town

Materials

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PERFORMANCE TASKS

(Icon Key) Overview = ⚪; Science = ⚫; Math = □; History = ▪; Language Arts = ⚫

1. **Analyze the newspaper article.**
   
   Read the newspaper article on page 4B-1, "Graniteville: A company town no more." Explain how the story relates to the Sandhills/Midlands Landform Region. Identify on the GRANITEVILLE TOPOGRAPHIC MAP (refer to the GRANITEVILLE LITHOGRAPH if needed) where the places and events named in the story might be located. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same references and setting, write another newspaper article related to this same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

2. **Analyze land use changes through time.**
   
   Look in the margins of the GRANITEVILLE TOPOGRAPHIC MAP and the GRANITEVILLE LITHOGRAPH to determine the year the map was printed and the year the aerial photography was flown. Examine each cartographic product carefully to identify any changes which have occurred during that time interval. How many of these changes are man-made? How many have occurred naturally?

3. **Trace the path of Horse Creek.**
   
   Using the GRANITEVILLE TOPOGRAPHIC MAP and a wipe-off pen, trace the path of Horse Creek from Vaucluse Pond to beyond Langley Pond. Note that Horse Creek continues from the spillway at Flat Rock Pond and not Bridge Creek Pond. What happens to the elevation of the land area from Vaucluse to beyond Langley Pond? How large is this elevation change, and why does it happen? Note the change in the size of the creek and its floodplain from Vaucluse to beyond Langley Pond. What happens to the creek size and why does it happen? Why did the mills first locate along Horse Creek? Why was Vaucluse Pond constructed? Why were Flat Rock Pond and Bridge Creek Ponds constructed? Why was Langley Pond constructed?

4. **Explain use of Graniteville canal.**
   
   On the GRANITEVILLE TOPOGRAPHIC MAP locate the canal just south of Bridge Creek Pond. How was it formed? What might it be used for? Look at the end of the canal. Where does the water in the canal go? What changes might occur to this water from the time it leaves Bridge Creek Pond until it arrives in Langley Pond?
5. Evaluate site for Leavelle McCampbell Middle School. Locate the school just east of the canal mentioned in Performance Task #4 on page 4B-7, on the GRANITEVILLE TOPOGRAPHIC MAP. Note that although no name is given on the map, this is Leavelle McCampbell Middle School, built in the 1920's. The main building of the school is marked with the flag symbol on the map. The gym, cafeteria, and music rooms are just east of the main building. The large gray patterned areas on the west side of the canal are part of the original mill buildings. Is there an elevation difference between the two buildings of the Middle School? How can you tell? Describe and name the feature located in between the two school buildings. Why was the school located here? Note that the houses around the school are rather large old houses while the mill workers' houses are mostly on the west side of the mill buildings.

6. Locate Cemetery for "The Little Boy's Grave" story. Refer to the story, "The Little Boy's Grave" on page 4B-4. The boy was buried in the cemetery located east of the Leavelle McCampbell school, called the Graniteville Cemetery. Locate this cemetery on the GRANITEVILLE TOPOGRAPHIC MAP. What is the elevation of the cemetery? Locate other cemeteries on the map. Are cemeteries usually located in populated areas? Why are cemeteries usually located on hills?

7. Explain why the old mills are located near water. The original textile mill buildings were located on the west side of the canal. New modern textile mills have since been built about a mile west-northwest of the original buildings. Locate these new buildings on the GRANITEVILLE TOPOGRAPHIC MAP. Why did the old mills need to be located by water, but not the new mills? Note that each new mill has a water tower. Locate these on the GRANITEVILLE LITHOGRAPH. How do the mills get water into these water towers?

8. Identify changes associated with new high school. The new Midland Valley High School was built in 1980. The GRANITEVILLE LITHOGRAPH shows this school but the GRANITEVILLE TOPOGRAPHIC MAP does not. Locate the school on the far west boundary of the lithograph just west of Langley Pond. Why is the school not shown on the topographic map? What changes have occurred to this parcel of land as a result of the school being built? What changes in the streets and highways were made to accommodate the new facility? Compare the building size to the size of the Leavelle McCampbell Middle School mentioned in Performance Task #5 on page 4B-8. Which school would you rather attend? Why?

9. Explain color change in Langley Pond. Locate Langley Pond on the GRANITEVILLE TOPOGRAPHIC MAP and the GRANITEVILLE LITHOGRAPH. Why does the color of the water on the lithograph change from one part of the pond to the other? Trace the drainage into this pond. How many mills drain into this pond? What is the linear feature which almost cuts Langley Pond in half? Why was it originally constructed? What function does it serve today?
10. **Investigate features associated with a golf course.**

Locate the Midland Valley Golf Course in the upper center of the GRANITEVILLE LITHOGRAPH and the left center of the GRANITEVILLE TOPOGRAPHIC MAP. What features allow you to easily identify a golf course? Does the pond in the course contain much sediment? How can you tell? Calculate the par values for each hole on the golf course. To do this you must use the scale bar to determine the length of each fairway on the course. Any distance less than 300 yards should be counted as Par 3. Any distance between 300 and 400 yards should be counted as Par 4, and any distance over 400 yards should be counted as Par 5. Add up your answers to calculate the total par value for the course.

11. **Brainstorm questions about the boy in "The Little Boy's Grave" story.**

The story, "The Little Boy's Grave" on page 4B-4, leaves one with more questions than answers. Brainstorm a list of all the questions that come to mind after reading this story. Use information from the GRANITEVILLE TOPOGRAPHIC MAP and the GRANITEVILLE LITHOGRAPH to try to find answers to your questions. Weave your answers into different types of written documents from that time in history. Examples: birth certificates, marriage licenses, newspaper articles, journals, letters, health records, etc. When you have an entire file of documents, review them for inconsistencies or contradictions and revise them as necessary. Can you tell the story of this little boy's life from your file? Or his mother's life? Or the hotel proprietor's life?

12. **Explain relative decline in importance of Graniteville.**

In the 1800's, Graniteville was considered to be one of the most important cities in South Carolina because of the economic impact of its textile mills and kaolin mines. During the late 20th century, however, Graniteville increasingly has been overshadowed by the rapid growth of neighboring cities such as Aiken and North Augusta until it has lost much of its earlier importance. Examine the Graniteville - Aiken - Augusta area on the STATE BASE MAP #2, WITH HIGHWAYS and speculate about some causes for Graniteville's decline and the corresponding expansion of Aiken and North Augusta.
ENRICHMENT

1. **Research how your school got its name.**
   The Leavelle McCampbell Middle School was named after an early community leader. Research your school's name and write a short article about it. Submit the article to your school newsletter.

2. **Compile list of idioms commonly used in your community.**
   The term "nickel-up" is used in the story, "The Little Boy's Grave" on page 4B-4, to mean they took up a collection. Begin compiling a list of idioms (the language peculiar to a community, people, or class) that are commonly used in your community or family. Try to determine how each idiom began. Do you use these idioms? In what types of writing or conversation are idioms used most often?

3. **Write your Congressman about Superfund Clean-up Program.**
   Langley Pond has been designated as one of the Federal Superfund Clean-up Sites. Write your Congressman to find out how this program works and whether continuing the clean-up is favored.
The State
November 9, 1996
To the Hounds

by Sammy Fretwell and Pat Robertson

The H. Cooper Black Field Trial grounds lie deep in the pines of South Carolina's largest state-owned forest. On this land of rolling sand hills and thick brush, sportsmen have big plans to chase foxes with hounds. They want to use the property like bird hunters do: to see how well their dogs search for prey.

But fox hunters also want to erect a huge metal fence at Sand Hills State Forest to contain hounds and foxes. And that's where they've got some explaining to do. The fence would stand 5 feet 5 inches tall and with a 16 inch overhang at the top. It also would include a one-foot extension underground to keep animals from digging beneath it. It would cover 15 percent of the state forest and would be the first of its kind on publicly owned lands in South Carolina. By some accounts, the fox hunting grounds would be the largest in the country.

Fox hunters say there's no reason for alarm. They won't kill foxes and only want a place to see how their dogs compare with others. Still, environmentalists say it's dead-wrong to build a fence on public woodlands. State and federal agencies are also nervous about the unusual proposal. Not only could the fence keep deer, wild turkeys and other wildlife from passing easily through the forest, it's bad policy to cordon off state recreational lands - especially for private use, some critics say. In a recent letter to the state Forestry Commission, the S.C. Wildlife Federation said it is "very disturbed" about the proposal.

Fox hunters contend the fence will cover so much acreage it would have little measurable impact on wildlife or public use of the state forest. Moreover, the Cooper Black property will become a prime spot for national fox-hunting competitions that could bolster the sagging economy of eastern South Carolina. It's up to the Forestry Commission to decide if the plan should include a fence, specifically to accommodate the fox hunters. It's preparing to hold public hearings later this month to let people voice their opinions.

RATIONALE

The Sugarloaf Mountain Study Site includes portions of both the Carolina Sandhills National Wildlife Refuge and the Sandhills State Forest. It depicts the characteristic landforms, soils, rocks, and vegetation typical of most sandhills localities. Xerophytic vegetation, stunted forests, and wide expanses of bare soil are evident. The cartographic products also illustrate the effects of a series of habitat management programs, such as placement of firebreaks, periodic timber harvesting, fluctuating water level in ponds, and maintenance of open fields. Such open areas are essential for preserving the natural diversity of the original sandhills habitat and protecting several threatened and endangered species. Sugarloaf Mountain is actually more of a hill than a mountain. This feature is a unique outcropping of iron-cemented sandstone which is more resistant to erosion than the surrounding rocks. A trail leading to the top of the mountain offers a panoramic view of the sandhills forest.
Brief Site Description

Introduction

The Sugarloaf Mountain Study Site includes portions of the Sandhills State Forest and the Carolina Sandhills National Wildlife Refuge. The area lies along the Fall Line Zone and is characterized by deep sandy soils that support an extensive longleaf pine forest and associated ecosystem. Scattered scrub oaks also are abundant and the dominant ground cover is wiregrass. The elevation of the area ranges from 250 feet to more than 500 feet above sea level. A patchwork of bottomland hardwood forests, cultivated and fallow fields, man-made ponds and lakes, and dry uplands makes this region one of the most diverse habitat areas in the state.

Sugarloaf Mountain

By most standards, Sugarloaf Mountain should really be named Sugarloaf Hill. The peak itself rises only about 160 feet above the surrounding plain, and the diameter of the hill is only about 500 feet. Across the road to the south is a similar, but smaller, peak named Horseshoe Mountain. A short trail leads to the top of Sugarloaf Mountain where a spectacular view stretches well into North Carolina. A fenced-in area at the top serves to confine visitors to the bare rock exposure and protect the vegetation on the steep slopes of the hillside from erosion.

The rock that makes up Sugarloaf and Horseshoe Mountains is an iron-cemented sandstone. The sand grains are very similar in size and shape to the sand grains found in the soil nearby. The iron cement most likely precipitated from ground water at a time when the sandhills were buried under other sediments and the groundwater table was much higher in elevation. Changes in pH (groundwater acidity) commonly occur around the groundwater table and can cause dissolved iron ions to come out of solution and precipitate as insoluble iron compounds. Only rarely does enough iron precipitate to produce a well-cemented rock that is sufficiently resistant to erosion to influence the topography, which explains why Sugarloaf Mountain is such a unique location.

Wildlife Habitat

When the Carolina Sandhills Refuge was established in 1939, this part of the sandhills region was heavily eroded and essentially barren. Wildlife was almost non-existent. The top priority was to restore damaged habitat so that native plant and animal populations could be re-established. Today, the Refuge serves as a demonstration site for a variety of land management practices designed to preserve and enhance the once dominant longleaf pine / wiregrass ecosystem and provide for the needs of migratory waterfowl. The Refuge normally supports over 190 species of birds, 42 species of mammals, 41 species of reptiles, and 25 species of amphibians.

Water levels in several ponds are lowered seasonally to encourage the growth of beneficial vegetation and to kill off unwanted underwater vegetation. Similar techniques are used on land, where some areas are planted in food crops for waterfowl, dove, turkey, and deer, while other areas are planted in drought tolerant legumes and grasses to enrich and stabilize the soil. Forested areas are clearcut and/or burned periodically to insure a balance between old and new growth timber. Firebreaks are long, narrow,
cleared areas that separate stands of trees and help control prescribed burns. Most all reforested regions will appear to have an unnatural boundary shape, and will display straight lines on aerial photographs which represent the planting of pine trees in straight rows. Some stands have been thinned to make it easier to harvest pine straw.

The Red Cockaded Woodpecker

The Carolina Sandhills National Wildlife Refuge is home to several endangered species, the most important of which is the red cockaded woodpecker. These woodpeckers prefer to nest in cavities of living longleaf pines, although loblolly and pitch pines are occasionally used as well. There are more than 1,000 cavity trees on the Refuge, all of which must be protected during the prescribed burns which are scheduled every three years. This restriction can cause major problems because the cavity trees are more susceptible to fire than are other pines. This site has one of the largest populations of the red cockaded woodpecker found anywhere in the world. Year-old birds are sometimes captured for relocation, to expand the population into other areas of the country where habitat is favorable.

A cluster or family group of red cockaded woodpeckers includes a mated pair and several helpers, which are young males. Each group of woodpeckers needs as average of two-hundred acres of pine forest, within a one-third mile radius of the cavity tree, to serve as a forage area. Wildlife biologists monitor the activity of clusters through the use of peeper scopes, which can peer into a tree cavity as high as 40 feet while the viewer remains on the ground.

Multiple Land Use

Most state and federal wildlife preserves adopt a multiple use land management philosophy. Not surprisingly, there is occasional disagreement over what uses should be allowed in which parts of the managed area. The Carolina Sandhills National Wildlife Refuge, for example, closes most of its property to the public and allows only day use by visitors. The Sand Hills State Forest, on the other hand, opens almost its entire property to hikers, mountain bikes, horse riding, and camping. Some lakes are managed primarily as habitat for migratory aquatic birds; others are managed primarily for recreation.

<table>
<thead>
<tr>
<th>Sand Hills State Forest Recreation Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excerpted from a brochure available from the South Carolina Forestry Commission</td>
</tr>
<tr>
<td>- No swimming allowed on the Forest</td>
</tr>
<tr>
<td>- Tree felling is not allowed. Only wood already on the ground may be collected and burned as firewood.</td>
</tr>
<tr>
<td>- All fires must be secured in designated fire sites. Fires must not be left unattended and must be fully extinguished before departure from fire site.</td>
</tr>
<tr>
<td>- Unlicensed vehicles are not permitted on any roads.</td>
</tr>
<tr>
<td>- Steps must be used when climbing Sugarloaf or Horseshoe Mountain.</td>
</tr>
<tr>
<td>- Bikes or cars with loud mufflers are not allowed on the Forest.</td>
</tr>
<tr>
<td>- Electric trolling motors allowed in all ponds.</td>
</tr>
</tbody>
</table>
Some of the cleared areas around Mays Lake (in the Wildlife Refuge along Long Branch) were managed as cooperative farms, meaning that the land was leased to local farmers to grow crops with the restriction that 25% of the crop had to be left in the field, unharvested, as food for wildlife. Mays Lake is named for a former property owner, Mr. May Johnson. Nearby Martin Lake is managed for migratory aquatic birds. The water is kept low most of the year, and is gradually filled for the fall migration season. In several places, cleared strips of land are maintained as food plots for wildlife. The Forestry Commission used to place leftover limbs and trash from clearcut areas in long, parallel windrows, but this practice has been discontinued.

The Old Wire Road

The Old Wire Road is a remnant of an early stage coach route that had one of South Carolina's first telegraph wires strung alongside of it. The road is not paved, and in certain segments within the Wildlife Refuge it is closed to vehicular traffic. In most places, Old Wire Road follows the top of a sand ridge to avoid problems with stream crossings. This is said to be the route followed by General Sherman's army during the Civil War when they marched from Columbia into North Carolina. Old breastworks can be found in the woods along Old Wire Road near its intersection with State Highway 102. A grave marker for a confederate soldier is located on Scotch Road near the turnoff for the Sugarloaf Mountain Recreation Area.

The Bombing of Patrick

An unusual clearing in the Carolina Sandhills National Wildlife Refuge, just south of Rogers Branch and east of State Highway 145, holds a special historical significance. During World War II, this part of the Refuge was used as an Air Force bombing range where pilots could practice their skills. The cleared area was mowed in such a way as to generate a large "X" shaped feature that pilots could use as their target. The "X" was lit up at night so pilots could practice after dark. On one occasion, a plane accidentally bombed the nearby town of Patrick, mistaking street lighting at the town crossroads for the intended target. Fortunately, the practice bombs contained flour instead of gunpowder, and no damage was done.

Today, the old bombing field still displays the "X" shaped pattern, but the lights have been removed. The north and east quarters are planted to wildlife food crops, while the south and west quarters are planted to grass. Special dove hunts occasionally take place on the site. Local citizens tell numerous stories of live ammunition and unexploded ordinance being found near this area. A few of these encounters caused serious injury to the teenagers who discovered them.

Agriculture in the Sandhills

Once outside the boundaries of the Wildlife Refuge and the State Forest, a variety of agricultural land uses dominate the countryside. Most of the soils in the area are low in fertility and have a low available water content (water available to plants). Orchards have always been successful in this part of the Sandhills due to the well-drained nature of the soil. Much of the commercial operation is situated on the Alpin soil type which is regarded as poor soil because it consists of pure sand throughout the root zone. Most
Agricultural operations today use irrigation. The orchard near the town of McBee uses wind power to distribute water through a sub-surface irrigation system. They fertilize the trees by dissolving the precise amount of nutrients they require in the irrigation water. Pecan trees have also been grown commercially. Several vinyards can still be found in the area. The largest of these is located north of the community of Bay Springs just east of Black Creek. This vinyard once supplied grapes to a nearby winery (across the road from the west end of the landing strip) which went out of business around 1996. The landing strip, although poorly maintained, is still in use, and the nearby rows of muscadine grapes still produce fruit.

In the 1960s, there was an effort to plant slash pine from the Low Country of Georgia into the Sand Hills State Forest because it grows more quickly, at least in its early stages, than the native pine tree species. Foresters discovered, however, that after a number of years, native stands surpassed the imported species in productivity. The Forest Service now has begun an effort to eliminate these stands of slash pine and replant those areas with the native longleaf pine.

Sand Hills Soils

The characteristics of the soils of the Sugarloaf Mountain Study Area are strongly associated with their landscape positions (see Five Factors of Soil Formation, p. 1-39). The soils of the broad ridge tops are dominated by the Alpin, Ailey, and Candor series. All of these have thick surface horizons composed of sand. Much of the original parent material was sand, but these upland soils may also have received aeolian (carried by wind) material over the years.

The Alpin series is almost entirely sand. The Candor series has a loamy subsoil that can hold some water for use by plants. The Ailey series has a partially cemented subsoil which impedes the downward movement of water, forming a perched water table. Because of their excessively drained sandy surface horizons, it is often difficult for seedlings and young plants to get started on these soils. Once roots have extended to deeper horizons that can hold more water, they are likely to survive.

Sideslopes are dominated by Ailey and Vaucluse series soils. Vaucluse series has thin, sandy surface horizons that overlie a dense compacted subsoil that severely reduces rooting depth of plants. It is highly erodible because of the steep slopes, and the shallow rooted nature of the plants that grow on it.

Bibb and Johnston series are two soils that dominate the floodplains in much of the Sand Hills region. Unlike the Piedmont region, most of the floodplain soils of the Sand Hills are wetlands. The Bibb series is found along the larger Sand Hills creeks and rivers, and is composed of layers of sandy loam and sand. Additional material is often deposited during floods. The Johnston series is characteristically found along the floodplains of the smaller creeks and streams, but is sometimes also found in the back swamps of larger waterways. It has a thick, black surface horizon that is high in organic matter (a common feature of wet soils).

Ogeechee series is a wetland soil that is usually found in low spots in the uplands, where water drained from the surrounding soils tends to collect. It is not associated with the floodplains.
Pelion and, to a lesser extent, Emporia series soils can be found on gently sloping footslopes and benches above the floodplain of Black creek. Pelion soils have sandy surface horizons and a dense subsoil that impedes root growth and water movement. It has a shallow perched water table at the top of the subsoil. Emporia soils are sometimes found on broad ridge tops as well as benches above the creek. It has a better water holding capacity than most upland soils in this area, and is therefore better suited to agricultural crops.

Hillside seeps and springs often form in the Sand Hills when a stream or gully erodes down through a perched water table. More reliable seeps were often used as household water sources for small farms and sharecroppers.

**Figure 4C-1: Sandhills Soils Characteristics**

<table>
<thead>
<tr>
<th>Soil Series</th>
<th>Description</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpin</td>
<td>sand</td>
<td>Ridge tops</td>
</tr>
<tr>
<td>Candor</td>
<td>sand and loamy subsoil</td>
<td>Ridge tops</td>
</tr>
<tr>
<td>Ailey</td>
<td>sand and partly cemented soil</td>
<td>Ridge tops and side slopes</td>
</tr>
<tr>
<td>Vaucluse</td>
<td>thin sand with dense compacted subsoil</td>
<td>steep slopes</td>
</tr>
<tr>
<td>Bibb</td>
<td>sandy loam and sand</td>
<td>floodplains</td>
</tr>
<tr>
<td>Johnston</td>
<td>high in organic matter</td>
<td>floodplains</td>
</tr>
<tr>
<td>Ogeechee</td>
<td>poorly drained</td>
<td>wetlands in uplands</td>
</tr>
<tr>
<td>Pelion</td>
<td>sandy surface and dense subsoil</td>
<td>gently sloping footslopes</td>
</tr>
<tr>
<td>Emporia</td>
<td>sandy</td>
<td>broad ridge tops</td>
</tr>
</tbody>
</table>
Activity 4C-1: Sandhills Topography

Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
<td>1: 500,000</td>
</tr>
<tr>
<td>LAND USE/LAND COVER MAP</td>
<td>1: 500,000</td>
</tr>
<tr>
<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
<td>1: 1,000,000</td>
</tr>
<tr>
<td>GENERAL SOIL MAP</td>
<td>1: 594,000</td>
</tr>
<tr>
<td>SUGARLOAF MOUNTAIN LITHOGRAPH</td>
<td>1: 14,400</td>
</tr>
<tr>
<td>SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP</td>
<td>1: 24,000</td>
</tr>
<tr>
<td>State Map of Major Drainage Basins</td>
<td>Figure 1-2</td>
</tr>
<tr>
<td>The Geologic Time Scale and South Carolina</td>
<td>Figure 1-6</td>
</tr>
<tr>
<td>Sandhills Soils Characteristics</td>
<td>Figure 4C-1</td>
</tr>
</tbody>
</table>

PERFORMANCE TASKS

1. **Locate the study site.**
   Locate the Sugarloaf Mountain Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Locate and describe Sugarloaf Mountain.**
   Locate Sugarloaf Mountain on the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP (upper center of map). What is the elevation at the top of this mountain? Calculate the contour interval of this map. What does this contour interval tell you about the typical land slopes in this part of the state? How much higher is the Sugarloaf Mountain than the recreation area directly to the west? What is the elevation of Horseshoe Mountain just across the road to the south? What is the elevation of the highest point anywhere on the map (look in the upper left hand corner). Why is this particular hill not named, even though it is higher than Sugarloaf Mountain?

   Use your map information to locate Sugarloaf Mountain on the SUGARLOAF MOUNTAIN LITHOGRAPH. You can pick out the top of the mountain by locating the triangular feature which represents the log fence enclosing the bare rock exposure. How wide do you think the rock exposure must be to show up on the lithograph? Explain your answer. Next examine the lithograph colors around Sugarloaf Mountain and speculate about the type of forest found there. How would you interpret the large white area just northeast of the mountain?

3. **Correlate soil map patterns to lithograph colors.**
   The SUGARLOAF AREA SOIL MAP inset included on the SUGARLOAF MOUNTAIN LITHOGRAPH shows soil classifications for a portion of Black Creek near the Bay Springs Community. The scale of the soil map is the same as the scale of the
SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP. With a wipe-off pen, outline on the topographic map the approximate boundary of the coverage of the soil map. Which category of soil type is associated with the Black Creek bottomlands? Which soil type is associated with the larger tributary streams entering Black Creek? Why do you think no slope classes are provided for these bottomland soils? Which soil type is associated with the grape vineyards north of Bay Springs?

Now use a wipe-off pen to draw the outline of the coverage of the soil map onto the SUGARLOAF MOUNTAIN LITHOGRAPH. Note that the scale is different, so the coverage boundary you draw will look larger on the lithograph. What color on the lithograph corresponds closely to the geographic distribution of the bottomland soil types? Use this information to speculate about the type of vegetation and land cover that would be found in this area. Refer to Figure 4C-1, "Sandhills Soils Characteristics" as needed.

4. Compare routes of Old Wire Road, railroad, and Highway 1. 
Locate the Old Wire Road, the Seaboard Coast Line railroad, and U.S. Highway 1 on the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP. Fill out the table below and infer what was the most important factor in constructing each of these transportation routes. Use the entire route from one side of the map to the other. List one advantage and one disadvantage for each route, based on the topography of the Sandhills Region. Why do you think the builders of the railroad and the new main highway did not just build along the exact same route as Old Wire Road?

<table>
<thead>
<tr>
<th>ROUTE</th>
<th># OF STREAMS CROSSED</th>
<th># OF INDEX CONTOURS CROSSED</th>
<th>HIGHEST ELEVATION ON ROUTE</th>
<th>LOWEST ELEVATION ON ROUTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLD WIRE RD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAILROAD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIGHWAY 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Analyze reasons for different names for same feature. 
Locate McLean Pond and Mount Lake, in the upper center of the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP. Speculate about possible reasons why one body of water is called a "pond" and the other a "lake." Likewise, locate Rogers Branch and Little Alligator Creek, on the left hand side of the map. Speculate about possible reasons why one stream is called a "creek" and the other a "branch." Also, the words "draw" and "run" can name streams in other geographic regions. What language arts term is used to refer to different words that mean the same thing? Why do you think the English language has so many words that can be used interchangeably? What advantage does this give a speaker or writer?

Locate the landing strip near Bay Springs in the upper portion of the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP. Also locate this feature on the SUGARLOAF MOUNTAIN LITHOGRAPH. Refer to lithograph colors and map symbols, especially contour lines, to devise an explanation for why this site was chosen for an airstrip. Analyze the land use patterns in this area and speculate about who might have used such an airstrip, apparently situated out in the middle of nowhere. Note the color
differences between some of the nearby paved and unpaved roads to infer whether the landing strip itself is paved or unpaved. What difference would it make (paved or unpaved) if you were trying to land a small plane on this airstrip?

7. **Describe the layout of the town of Patrick.**

Many towns in South Carolina use a circle to establish their community boundary line. Locate the town of Patrick on the center right part of the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP. Trace the circular community boundary with a wipe-off pen. With another color wipe-off pen, trace the two main highways which intersect in the center of town. Measure the radius of the boundary circle. Calculate the area of the town using the formula for the area of a circle \( a = \pi r^2 \). Next, count the number of buildings within the town limits - but do not count the churches. Most of these buildings are houses. Try to calculate the population of the town of Patrick by estimating the average number of people living in one house and multiplying that number by the total number of houses. Discuss in your group how accurate you think your number really is. Divide the number of residents by the area of the town to calculate the population density of the community. Estimate the population density of your own community and compare it to the population density of the town of Patrick.

Compare the layout of the town of Patrick with the clearing that was used as a practice bombing target during World War II. Locate this clearing on both the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP (upper-left) and the SUGARLOAF MOUNTAIN LITHOGRAPH (left-center). Refer to the description in the background information on page 4C-4 for help in recognizing this feature. Explain how a pilot could have mistaken the crossroads of the town of Patrick for the "X" pattern in this field. How far is the field with the "X" from the center of the town of Patrick? How long would it take to fly from the bombing strip to the town (assuming a typical airspeed of 200 mph)? Speculate on the effect this time interval might have had in causing the pilot's error.

**ENRICHMENT**

1. **Research significance of railroad location markers.**

Trace the route of the Seaboard Coast Line railroad on the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP. Notice the placement of numerous triangular symbols along the railroad that have been given names like "Mid A" (for Middendorf location A) and "Mid B" (for Middendorf location B). Measure how far apart such reference points were from each other on average. Contact a railroad company to find out why these reference points were originally needed and if they are still used.

2. **Research Sandhills soils.**

The SUGARLOAF AREA SOIL MAP inset included on the SUGARLOAF MOUNTAIN LITHOGRAPH gives the names of several common Sandhills soil types. Select one of the ten soil categories, outline its distribution on the lithograph, and use library or internet resources to find out as much as you can about how that soil was formed.
Activity 4C-2: Wildlife Habitat Management

**Materials**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent Grid Overlay</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>SUGARLOAF MOUNTAIN LITHOGRAPH</td>
<td>6</td>
<td>1: 14,400</td>
</tr>
<tr>
<td>SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP</td>
<td>6</td>
<td>1: 24,000</td>
</tr>
<tr>
<td>Wipe-off Pens</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

**PERFORMANCE TASKS**

(Icon Key) Overview = ₿; Science = ⚪; Math = ⬇; History = ⬇; Language Arts = ❖

1. **Compare land use inside and outside of preserves.**
   Trace, with a wipe-off pen, on the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP, the boundary of the Carolina Sandhills National Wildlife Refuge. Also trace, with a different color wipe-off pen, the boundary of the Sand Hills State Forest. Transfer both boundaries onto the SUGARLOAF MOUNTAIN LITHOGRAPH by drawing them in with different color wipe-off pens. Remember that the map and the lithograph are printed at different scales so you will be able to transfer only a portion of each boundary line onto the lithograph. Compare and contrast land use inside and outside of both the Refuge boundary and the State Forest boundary. What kind of land use information can you get from the lithograph? What kind of land use information can you get from the topographic map? Why do you think both boundaries are so irregular in shape?

2. **Analyze land use changes through time.**
   The SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP was printed in 1968 (the date is not shown on the map). Look in the margins of the SUGARLOAF MOUNTAIN LITHOGRAPH to determine the year the aerial photography was flown. Examine each cartographic product carefully to identify any changes which have occurred during that time interval. How many of these changes are man-made? How many have occurred naturally?

3. **Analyze the newspaper article.**
   Read the newspaper article on page 4C-1, "To the Hounds." Explain how the story relates to the Sandhills/Midlands Landform Region. Identify on the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP (refer to the SUGARLOAF MOUNTAIN LITHOGRAPH if needed) where the places and events named in the story might be located. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same references and setting, write another newspaper article related to this same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

4. **Express political opinion advocating your position.**
   Controversial issues usually generate heated debate among both proponents and opponents. Sometimes this debate is verbal, sometimes it is written down in the form of an editorial, sometimes it is expressed in pictures or with slogans. This type of communication is referred to as advocacy, and its purpose is to convince others that they should support the author's position on the issue. Use the issue of Fox Hunting
in the Sandhills State Forest (see Newspaper Article on page 4C-1) as your topic. Refer to the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP and SUGARLOAF MOUNTAIN LITHOGRAPH to get additional data to support your position. Set up a class debate on this issue by preparing a position statement as described below. You should try to be as persuasive as possible. To this end, you may exaggerate for effect, use humor, or stretch the truth a little bit, but do not include statements that are obviously untrue or that attack opponents personally.

Group 1 Favor fox hunting in State Forest - prepare 3 minute oral presentation
Group 2 Favor fox hunting in State Forest - write 100 word editorial
Group 3 Favor fox hunting in State Forest - make poster with captions (slogans)
Group 4 Oppose fox hunting in State Forest - prepare 3 minute oral presentation
Group 5 Oppose fox hunting in State Forest - write 100 word editorial
Group 6 Oppose fox hunting in State Forest - make poster with captions

5. Rank relative ages of clearcut areas. Infrared aerial photographs give detailed information about the type of vegetation in an area. Such images are particularly valuable to foresters who use the information to determine the age and health of wooded areas. Note the various shades of red coloration on the SUGARLOAF MOUNTAIN LITHOGRAPH. Remember that this photograph was taken in winter, so evergreen trees, like pine, will show up in red and deciduous trees, like oak, will not. Most of the Wildlife Refuge property is planted in pine trees, but there is one significant area of hardwoods. Where are the hardwoods located? Refer to the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP to reference locations as needed. What color represents open fields on the lithograph? Explain why there is no red coloration in a winter infrared photograph for these grassy areas.

Areas that have been clearcut will show no red coloration, because there are no live trees left. When these areas are first re-planted, there may be a small amount of red associated with the seedlings. As the trees grow larger, the amount of red color in the area increases. So the older clearcuts will appear redder than the younger ones. Another indicator of relative age is the appearance of windrows. Clearcut areas often will have dead tree limbs and brush piled into long parallel rows which are easily visible in aerial photographs. In recent clearcuts, the windrows are distinct and easily recognized. As the new trees grow larger, they tend to obscure the windrows. By the time the forest is fully grown, the windrows have largely decayed and can no longer be seen under the large tree canopy. Locate on the lithograph four different clearcut areas and mark them with a wipe-off pen. Use the following legend.

Area 1 = freshly clearcut field with no windrows
Area 2 = recently clearcut field with distinct windrows
Area 3 = fairly old clearcut field with new trees and indistinct windrows
Area 4 = very old clearcut field with full grown trees and no windrows visible

Compare your answers with answers from other groups in your class.
6. **Analyze Mays Lake Reservoir.**
   Locate on the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP the area where Clay Fork Branch and Long Branch flow into Black Creek (left center section of map). Now locate this same area on the SUGARLOAF MOUNTAIN LITHOGRAPH. The large black area there is called Mays Lake Reservoir. Why does the water appear black on the infrared photograph? Look carefully at the margins of the lake. Some segments are blue-gray and others are white. What information do these colors give you about the habitat along the lake shore? Trace, with a wipe-off pen, the outline of Mays Lake Reservoir onto the topographic map. Use the contour line information to explain why this reservoir was constructed in this particular spot.

7. **Analyze percentage distribution of soil types.**
   It is useful to know not only the classification of soil types, but also the percentage distribution of those categories. That information is needed to make reasonable generalizations about the soil characteristics of an area. Look at the SUGARLOAF AREA SOIL MAP inset included on the SUGARLOAF MOUNTAIN LITHOGRAPH. Notice that there are ten different soil categories listed, as well as a color code for water. Place the transparent grid overlay (small squares) on top of the soil map. For each small square on the grid, determine the predominant soil category in that area (the soil type that fills the largest portion of that single grid square). Keep a tally sheet so that you can mark the number of grid squares associated with each soil type. When you finish your count, examine your tally sheet carefully. Which soil type is most abundant in this area? Which soil type is least abundant? If you had to write a general description of soil types for the Wildlife Refuge, what would it be? Do not mention more than three soil types in your generalization.

8. **Correlate location of firebreaks with contour lines.**
   Locate as many firebreaks (thin white strips labeled "firebreaks") as you can on the left half of the SUGAR LOAF MOUNTAIN TOPOGRAPHIC MAP. Approximately how wide is a firebreak? Use the map scale to calculate this value. The length of the firebreaks varies widely. Speculate about why firebreaks might come in different lengths. Try to correlate the orientation of the firebreaks with the contour line pattern on the map. What is one advantage of a firebreak that follows a contour line? What is one advantage of a firebreak that cuts across contour lines? Locate a few firebreaks on the SUGARLOAF MOUNTAIN LITHOGRAPH. How can you recognize a firebreak on the lithograph?

9. **Critique list of rules and regulations.**
   Read through the "Sand Hills State Forest Recreation Rules" on page 4C-3. Locate on the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP, and mark with a wipe-off pen, all of the landform features mentioned in this list. It is important for the Forest Service to convey this type of information to visitors in a clear and concise fashion. Analyze each of the rules and comment on its clarity and its conciseness. Suggest wording changes to any of the rules that need improvement and explain how your changes would better express the intent of the recreation managers.
ENRICHMENT

1. **Find examples of habitat managed for endangered species.**
   Contact the Carolina Sandhills National Wildlife Refuge to get information about the endangered species that are found on their property. Select one of these rare plants or animals and research the land management practices that have been set up to provide habitat protection for it. Locate places on the SANDHILLS TOPOGRAPHIC MAP and the SANDHILLS LITHOGRAPH that exhibit such habitat management.

2. **Document changes in timber cutting practices.**
   Forestry practices have changed significantly over time. Research the history of logging as an industry and document the changes in timber cutting practices that have occurred in the eastern pine forests, such as are found in the Sandhills of South Carolina. Be able to summarize the principal scientific rationale for each of these logging methods and cite pros and cons for its use in the Sandhills. Use the SUGARLOAF MOUNTAIN TOPOGRAPHIC MAP and the SUGARLOAF MOUNTAIN LITHOGRAPH, to locate examples of as many types of logging strategies as possible.
SECTION 5
COASTAL PLAIN REGION / OVERVIEW

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SECTION 5
COASTAL PLAIN REGION / OVERVIEW

POWER THINKING ACTIVITY -"Reservoir Referendum"

Lake Marion and Lake Moultrie are two large, shallow Coastal Plain reservoirs which are both filling up slowly with sediment. The Governor is concerned that anglers and others who use these lakes for recreation will become upset when their nice lakes have turned into large mud flats. Even though this will not happen for many years to come, the Governor likes to plan ahead and has asked your consulting group to propose the construction of a new reservoir somewhere in the Coastal Plain. Where exactly would you place the dam? What factors would you have to consider? What areas of the coastline would this new reservoir affect, and how would they be affected? Outline the land areas which would be put under water. How would the reservoir affect the local area, both environmentally and socially? What groups of local people would favor a dam and reservoir there? What groups would oppose such construction? Make a list of pros and cons. Use either one of the state base maps for reference.

PERFORMANCE OBJECTIVES

1. Recognize Coastal Plain landforms by analyzing structural features, geometric shapes, characteristic drainage patterns, and other topographic indicators on maps and lithographs.
2. Analyze different vegetation and land use patterns based on elevation data and other topographic parameters.
3. Identify and trace sequences of military campaigns in the Coastal Plain and link specific skirmishes to particular war heroes.
4. Develop a repertoire of folk tales, wise sayings, and legends characteristic of the Coastal Plain Region.
5. Develop an awareness of the early pioneering efforts made by South Carolinians in railroad transportation.
6. Construct, interpret, and evaluate content in railroad time tables (schedules).
7. Assess agricultural and social problems related to a one-crop economic system.
8. Analyze how constructing reservoirs can have both a positive and negative effect on local environments and on land resources.
9. Interrelate soil types, rock units, and land use in the Coastal Plain.
BACKGROUND INFORMATION

Description of Landforms, Drainage Patterns, and Geologic Processes

Characteristic Landforms of the Coastal Plain

Looking at it in overview, the Coastal Plain seems to form a single homogeneous region, covering close to one half of the area of South Carolina. And if one includes the geologically related Coastal Zone and Sandhills regions, the total coverage exceeds 60% of the state. Most texts, however, break the Coastal Plain down into sub-regions based on differences in vegetation, land use, or topographic relief. Several of these sub-regions will be emphasized in other sections of this manual, but the overriding dividing factor, with the most influence on land use patterns, is the one based on elevation above sea level.

A clear distinction can be made between the higher elevation Upper (or Inner) Coastal Plain and the lower elevation Lower (or Outer) Coastal Plain. A partially eroded terrace ridge, in places called the Orangeburg Scarp (Citronelle Escarpment), runs across the state and marks the approximate boundary between the two divisions. The Upper Coastal Plain resembles in many ways parts of the Piedmont and Sandhills, as the topography is rather hilly in places, and the landscape is heavily dissected by stream erosion. Elevations vary from 300 feet near the Sandhills to about 125 feet at the Orangeburg Scarp. The width of this sub-region varies from 10 to 40 miles. Local topographic relief is usually measured in tens of feet, and slopes range from gentle in the southeastern border area to moderate along the Sandhills boundary.

The much flatter and almost featureless Lower Coastal Plain slopes gradually towards the ocean in a series of at least seven steps or terraces, separated by escarpments which reflect temporary sea level positions throughout relatively recent (Pliocene and Pleistocene) geologic time. An additional escarpment is currently forming along the present-day sea level position. Elevations range from 125 feet to near sea level, and local topographic relief is seldom more than 20 feet. The nearly level modern plain is characterized by a large number of meandering streams and rivers with broad floodplains.

A surprisingly wide variety of landscape features can be found in the Coastal Plain Region, an area not usually given much credit for spectacular scenery. Many of these diverse landforms are only visible up close as they tend to blend in with the predominately flat terrain and dense vegetation characteristic of most of the region. Most of these landforms have features which reveal the particular environment in which they were formed. For example, wide, level plains mark former sandy ocean bottom shelf deposits; low, linear hills and adjacent depressions imply ancient barrier island deposits and adjacent marshes; gravel deposits on top of low hills mark locations of former river beds; and rapid drops in elevation (escarpments) indicate positions of former shorelines where wave scour eroded into older terraces. These boundaries are particularly easy to recognize, as they outline broad, nearly flat depositional surfaces which tilt slightly towards the Atlantic Ocean and create a series of landform belts roughly parallel to the present coastline.
Geographic Features of Special Interest

The most notable Coastal Plain geographic features, visible on any statewide map, are the two large lakes, Marion and Moultrie, located almost in the center of the region. Both of these lakes are actually reservoirs which were constructed in the 1930's. These lakes have had a profound influence on the type of land use, especially tourism, found in the surrounding areas. Remnants of the Old Santee Canal are visible in several places near Lake Moultrie, but they are best seen at Old Santee Canal State Park, near Monck's Corner. Another large reservoir, Par Pond, on the Savannah River Site in Barnwell County, is closed to tourism because of concerns about industrial pollution. Several other hazardous waste sites have been located in the Coastal Plain Region, creating major environmental concerns about potential groundwater and surface water contamination. More localized sites with characteristic landforms or specific natural features are covered in more detail in other sections of this manual.

Coastal Plain Once an Ocean Floor

All parts of the Coastal Plain are underlain by nearly horizontal sedimentary rock layers, primarily of marine origin, that were formed from underwater deposits of mud, silt, and limestone which were buried and later experienced both compaction and cementation. Although much of the area is now above sea level, allowing a limited amount of erosion to take place, the large percentage of land occupied by floodplains of both major and minor rivers characterizes the region as primarily a depositional area.

All Coastal Plain sediments, other than modern floodplain material, were originally deposited when sea level was much higher than its present position. But the Coastal Plain has also experienced several periods of much lower sea level when significant stream erosion took place throughout the region. Geologic evidence from wells and surface exposures indicates that sea level has fluctuated through many such cycles during the Cenozoic Era of geologic time. The greatest flooding episode probably occurred during the Eocene Epoch, about 40 million years ago, when the Santee Limestone was deposited in a marine continental shelf environment far from the shoreline. At that time, the shoreline was located well north of Columbia and perhaps reached as far as the Blue Ridge Region. During the succeeding Oligocene and Miocene Epochs, sea level fell dramatically as ice caps began to form in Antarctica and Greenland, and the Appalachian Mountains began to rise higher. The shoreline location at that time was probably situated many miles seaward of the present coastline.

Most of the marine sediments were deposited on top of an older surface of igneous and metamorphic rocks identical to that exposed in the Piedmont. Closer to the source, these sedimentary layers took on a more terrestrial depositional pattern, showing characteristics more common to river and floodplain deposits. Because the land surface slopes gradually seaward, both now and in the past, the Coastal Plain sediments are much thicker near the coast (averaging about 3,000 feet thick), than they are near the Fall Line Zone, where they thin to practically nothing. Deeper water sediments are found closer to the present coastline, while more shallow water and terrestrial types of deposition are found near the Fall Line Zone. Even along the coast, sediment thicknesses vary. Tectonic uplift near the North Carolina state line, along what is called the Cape Fear Arch, has allowed only about 400 feet of Coastal Plain sediment to
accumulate on top of the Piedmont crystalline rocks near Myrtle Beach. In comparison, Hilton Head Island, near the Georgia border, where subsidence continued uninterrupted, has sediment thicknesses exceeding 4,000 feet.

The Quaternary Period ice ages caused several more sea level fluctuations during the last million years of geologic time, producing many of the terraces found on the Lower Coastal Plain. Although the ice sheets did not reach as far south as South Carolina, expansion and retreat of continental glaciers alternately lowered and raised sea level as ice formed on the continents and then melted. Some of the terraces and associated escarpments near the present coast represent interglacial ages of higher sea level when features such as marshes, deltas, beaches, and barrier islands formed somewhat inland from the modern ocean. Although erosion has modified these features, sometimes considerably, they can often be recognized by their distinctive soil types. Several river paths in South Carolina appear to have been diverted by such old terrace features. Examples of these include the Lynches, Black, and Edisto rivers. Modern deposition, because of a relatively stable sea level, is essentially limited to floodplain sediments, alluvial deposits, and the filling in of marsh areas closer to the coastline.

**Soils of the Coastal Plain**

Coastal Plain soils develop primarily on sandy and clayey coastal sediments which have a tendency to be strongly acidic. The resulting chemical weathering and leaching processes tend to dissolve ions from soil minerals readily and contribute to the rapid development of clearly defined soil profiles. Many of these ions accumulate in the 'B' soil horizon layer and impart a distinctive color to the subsoil. The geographic origin of many of these sediments was the Piedmont Region so the mineralogy of Coastal Plain soils is often similar to that found in the crystalline source rocks. Some soils form on floodplain deposits composed of alluvial sediment. These transported soils have very different properties from the residual soils. The abundant moisture and thick vegetative cover common in the Coastal Plain provide a source of replenishment of soil minerals lost to weathering so the quality of the 'A' soil horizon layer can be maintained.

Soil wetness varies from well drained to very poorly drained, partly due to differences in the original sediment layers and partly due to the elevation of the soil above the ground water table. The best drained soils are found on elevated sandy marine and fluvial deposits in the Upper Coastal Plain. The most poorly drained soils are found near the coast where broad expanses of muddy marsh and floodplain deposits are barely above the water table. Many of these soils with high water tables develop a mottled clay-like layer called a gley layer.
Influence of Topography on Historical Events and Cultural Trends

Native Americans

When Europeans first came to the South Carolina area in the 1500's, beginning with the Spanish under Lucas Vasquez de Ayllon in 1521, they met a variety of Native Americans (the term that has come to replace the word "Indian" which was in use from first contact until the 1970's). The earliest pattern of trade relations between the two groups centered around deerskins and European goods like firearms, pots, pans and other metalware. This earliest interaction was characterized by wariness on the part of both parties: it brought great profit to the Europeans and terrible epidemics (smallpox, measles) to the Native Americans.

The Native Americans were described as a people at a stone age technological level, lacking knowledge of metallurgy, the wheel, pack animals, sails and husbandry but possessing instead agricultural skills and relatively sophisticated political and social organizations and customs that emphasized voluntary rather than coerced behavior. Most of the nations lived in semi-permanent villages surrounded by fields of corn, beans, squash, pumpkins and melons. Nations held land in permanent use, rather than ownership but otherwise quickly adapted to European trade patterns. In recent years, it has become fashionable to view the native people as environmental purists. Reality demands a more balanced perspective. The truth is that they quickly exploited and depleted the deer of the Carolina woods for trading purposes, with more than 40,000 skins going through Charles Towne's harbor in 1690. This number reached a maximum of 150,000 a year during the 18th century. For Native Americans, participation in the white man's economy required finding a tradable commodity -- deerskins. Participation in that economy, however, could not protect them from the land hunger which was exhibited by the Europeans moving out slowly along the coast and up the rivers. However important the trade in deerskins may have been to Europeans, it was always secondary to the desire for more land. In the hands of the Europeans, trade was a useful club that forced various nations into alliances with the Europeans. As a result, Native Americans often fought other Native Americans on behalf of their trading partners; in 1712-13, Yemassees versus Tuscaroras; and in 1715, Cherokees versus Yemassees and then Creeks. The result of such behavior was that a small number of whites, only 1500 men in 1715, managed to force all Native Americans out of the Coastal Plains by 1730. After that date, only the Cherokees and Catabaws remained a major factor in South Carolina's development.

Revolutionary War Campaigns in the Coastal Plain

In addition to the "Indian Wars," the Coastal Plain was the locale of several important battles during the Revolutionary War. Many of these battles involved one of South Carolina's most famous military heroes, General Francis Marion. He became a popular folk hero because of the unconventional tactics he used to win battles. Many of those tactics are similar to what we would call guerrilla warfare today, and were very different from what the British army expected to face.

While most of the fighting in 1780 was in the Piedmont Region, by 1781, most of the action had shifted to Coastal Plain battlefields. On May 11, 1781, Patriot General Thomas Sumter was defeated at Orangeburg by British Lieutenant Colonel Lord Francis
Rawdon. On September 8, 1781, Patriot Major General Nathanael Greene and Francis Marion lost the Battle of Eutaw Springs, the final Revolutionary War battle in South Carolina, to Lord Rawdon, but in the process the British army was so depleted that they were forced to withdraw to Charles Town a short time afterwards. After the end of the war, on December 14, 1782, the British army left Charles Town for the last time, along with close to 4,000 South Carolina loyalists and 5,000 slaves.

**Origin of South Carolina's State Flag**

South Carolina soldiers have marched under many different flags since colonial times, but only one of them has received official endorsement as the designated state flag. The official flag has a long and colorful history behind it. It was designed by Colonel William Moultrie who was asked by the Revolutionary Council of Safety to design a flag for the state's troops in the fall of 1775. Armies had to fly flags so that friendly forces would recognize their allies and not attack. At that time there was no other efficient way of communicating from a distance between armies. The original flag was a navy blue color with a silver crescent in the upper left hand corner. Moultrie got his ideas for this flag from the uniforms of the South Carolina troops. These troops wore dark blue jackets and had hats with a silver crescent attached.

![Figure 5-1: South Carolina State Flag](image)

Colonel Moultrie was commanding the unfinished palmetto log fort built on Sullivan's Island when a British fleet attacked on June 28, 1776. Throughout the heavy bombardment, the spongy palmetto logs absorbed many of the British shells and protected the South Carolina troops. During the battle, Sergeant William Jasper became a hero by retrieving the flag when it was shot down. The British were unable to force the fort to surrender and had to withdraw. The fort was re-named Moultrie in honor of its victorious commander. Later, a grateful state added the palmetto tree to Moultrie's flag.
Partly as a result of its role in this battle, the palmetto tree was named as the state's official tree. However, it was not until January 28, 1861, that the state legislature adopted Moultrie's flag as the official state flag of South Carolina.

Compromise of 1808

During the period when the growing of rice and indigo provided much of the base for South Carolina's prosperity (pre-1790), the geographical requirements of those two crops favored the development of plantations, slavery, genteel living and aristocracy in the area near the coast. This was in stark contrast to the subsistence agriculture practiced by yeoman farmers and the rough life style characterizing the Back Country. The Low Country aristocrats feared being overwhelmed and out-voted by anti-slavery, anti-aristocracy forces from the Back Country and therefore kept the control of South Carolina's state government in their own hands. But the advent of the cotton gin and the subsequent spread of the cotton culture throughout the state lessened those fears. Slaves, plantations, aristocrats and genteel living now began to dominate the Piedmont as they had the coastal plains, convincing Low Country leaders that the perceived threats to their comfortable way of life had vanished. Representation in the legislature was now determined on a proportional basis, meaning that the more densely populated areas above the Coastal Plain now became equal participants in the governmental process. This acceptance by all sections of the state of this power-sharing arrangement signaled an end to many of the fundamental regional political differences within the state and is called the Compromise of 1808.

Early Railroads

The transportation system through South Carolina in the early 1800's was in need of great improvement. Charleston was the center of trade, but most crops were grown elsewhere. It was thought that canals would make the rivers more accessible to the farmers for commerce, but the canal system ultimately proved to be impractical and unprofitable. It was easier for the average person to travel from Philadelphia to Charleston than to go from Greenville to Charleston. Farmers in the Up Country needed a means of transportation in order to get their products to Charleston, and the merchants needed more trade to compete with other port cities. A prospective solution was to build a railroad that would provide easy transportation to the port city.

In response to these concerns, private investors in Charleston built the first railroad in South Carolina, extending 136 miles from Charleston to Hamburg, which is located on the Savannah River near the present-day city of North Augusta. At the time, this track was the longest railroad in the world. Their goal was to provide a convenient transportation link between the western counties of South Carolina and the Charleston port in order to siphon off a lot of the growing trade which had been using the Savannah River to reach the Georgia port in the city of Savannah.

The inaugural run of its first train, The Best Friend of Charleston, took place on Christmas Day, 1830, following three years of planning and construction by the South Carolina Canal and Railroad Company. At that time, one passenger described the inaugural trip with these words: "On the wings of the wind at the speed of fifteen to twenty-five miles an hour annihilating time and space and leaving all the world behind" (taken from the Resource and reference guide: American spirit and South Carolina history, by Pipes et. al.). The steam engine used for The Best Friend of Charleston was
the first locomotive built in America for use in regular passenger service. It was constructed at West Point, New York, and then shipped to Charleston.

Only six months after its inaugural run, an explosion on board the Best Friend blew out the boiler and destroyed the engine. Apparently, a railroad worker was annoyed by the hissing of steam escaping from the boiler's safety valve and proceeded to stop the noise by holding down the valve, an action which allowed steam pressure to build up within the boiler until it finally exploded. The unfortunate worker did not understand the scientific principles which governed the workings of the steam engine and as a result was killed in the accident. A new locomotive, named the Phoenix was brought in to replace the Best Friend. The Southern Railway Company built a scale model of the Best Friend in 1928 to celebrate the hundredth anniversary of the South Carolina Canal and Railroad Company. Today, a replica of The Best Friend of Charleston is permanently housed at the South Carolina State Museum.

As railroad lines were added to crisscross South Carolina, many towns sprang up at junction points. One of the earliest of these towns was Branchville, in Orangeburg County, where a separate track to Columbia and Camden "branched off" the main railroad line. This location was selected because it was halfway between Charleston and Aiken. Even now, every September, a "Railroad Daze" festival is held in Branchville. These early railroads provided an important transportation link for farmers to market their products, miners to ship fertilizer made from phosphate, and loggers to transport harvested timber. An advertisement that appeared in Miller's Almanac describes arrival and departure times, charges, freight rates, and regulations for both the passengers and the freight carried aboard The Best Friend of Charleston. It is interesting to compare these items with current day transportation regulations in South Carolina.
### SOUTH-CAROLINA RAILROAD,

*Between Charleston and Hamburg, S. C. opposite Augusta (Geo.)*


#### Rates of Passage

<table>
<thead>
<tr>
<th>From</th>
<th>$</th>
<th>Cts.</th>
<th>To</th>
<th>$</th>
<th>Cts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charleston</td>
<td>--</td>
<td>15</td>
<td>50</td>
<td>Woodstock,</td>
<td>--</td>
</tr>
<tr>
<td>Aiken,</td>
<td>--</td>
<td>16</td>
<td>75</td>
<td>Summerville,</td>
<td>--</td>
</tr>
<tr>
<td>Blackville,</td>
<td>--</td>
<td>46</td>
<td>2 25</td>
<td>Inabnet's,</td>
<td>--</td>
</tr>
<tr>
<td>Midway,</td>
<td>--</td>
<td>64</td>
<td>3 25</td>
<td>Branchville,</td>
<td>--</td>
</tr>
<tr>
<td>Branchville,</td>
<td>--</td>
<td>74</td>
<td>3 75</td>
<td>Inabnet's,</td>
<td>--</td>
</tr>
<tr>
<td>Blackville,</td>
<td>--</td>
<td>90</td>
<td>4 50</td>
<td>Summerville,</td>
<td>--</td>
</tr>
<tr>
<td>Aiken,</td>
<td>--</td>
<td>120</td>
<td>6 00</td>
<td>Woodstock,</td>
<td>--</td>
</tr>
<tr>
<td>Hamburg,</td>
<td>--</td>
<td>136</td>
<td>6 75</td>
<td>Charleston,</td>
<td>--</td>
</tr>
</tbody>
</table>

And from one intermediate Station to another, Five Cents per Mile. Children under 12 years and Coloured persons, half price.

#### Regulations for the Passenger Carriage

1st. All baggage at owner's risk—75 lbs. allowed. 2d. Servants not admitted, unless having the care of children, without the consent of all the Passengers. 3d. Passengers not allowed to stand on the outside platform. 4th. Smoking prohibited. 5th. No Gun or Fowling Piece shall be permitted to enter the Car unless examined by the Conductor. 6th. The feet not to be put on the Cushions, nor the cars to be soiled, defaced or injured in any way. 7th. Dogs not admitted into the Passenger Cars. 8th. At the ringing of the Bell, passengers will be allowed one minute to take their places. 9th. Seats must be engaged and paid for fifteen minutes previous to the hour of departure. As a general direction, the conductors of the Carriages are instructed not to permit any conduct that is inconsistent with good order, or the comfort and safety of the Passengers: for which especial end these Rules have been established, and are required to be enforced with civility but strictly.

#### Hours of Departure and Arrival

**Upward Passage**

**Leave Charleston**, at 6 A.M.

To Woodstock, running time and stoppages 1h. 5m.  
*Not to arrive before 5m. past 7 A. M.*

**Leave Woodstock**, at halfpast 7 A. M.

To Branchville, running time and stoppages 3h. 30m.  
*Not to arrive before 5/4 past 10 A. M.*

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5-9
Figure 5-3: Bill of Fare for The Best Friend of Charleston (Back)

<table>
<thead>
<tr>
<th>LEAVE BRANCHVILLE, 11 A. M.</th>
<th>To Blackville, running time and stoppages, 2h. 20m.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>Not to arrive before 1/4 past 1 P. M.</em>—For Dinner 25 minutes.</td>
</tr>
<tr>
<td>LEAVE BLACKVILLE, at quarter before 2 P. M.</td>
<td>To Aiken, running time and stoppages 2h. 15m.</td>
</tr>
<tr>
<td></td>
<td><em>Not to arrive before 1/2 past 5 P.M.</em>—20m. for Plane &amp; starting</td>
</tr>
<tr>
<td>DOWNWARD PASSAGE</td>
<td></td>
</tr>
<tr>
<td>LEAVE HAMBURG, at 6 A. M.</td>
<td>To foot of Plain, running time and stoppages 1h.10m.</td>
</tr>
<tr>
<td></td>
<td><em>Not to arrive before 7 A. M.</em>—Up the Plain 20 m.—Breakfast 20m.</td>
</tr>
<tr>
<td>LEAVE Aiken, at 8 A.M.</td>
<td>To Blackville, running time and stoppages 2h. 15m.</td>
</tr>
<tr>
<td></td>
<td><em>Not to arrive before 10 A. M.</em></td>
</tr>
<tr>
<td>LEAVE BLACKVILLE, quarter past 10 A. M.</td>
<td>To Branchville, running time and stoppages 2h.15m.</td>
</tr>
<tr>
<td></td>
<td><em>Not to arrive before 1/4 past 12 M.</em></td>
</tr>
<tr>
<td>LEAVE BRANCHVILLE, at half past 11 M.</td>
<td>To Summerville, running time and stoppages 3h.</td>
</tr>
<tr>
<td></td>
<td><em>Not to arrive before 1/2 past 3 P. M.</em>—dinner 25 minutes.</td>
</tr>
<tr>
<td>LEAVE SUMMERVILLE, at 4 P. M.</td>
<td>To Charleston, running time and stoppages 1h. 80m.</td>
</tr>
<tr>
<td></td>
<td><em>Not to arrive before 1/2 past 5 P. M.</em></td>
</tr>
</tbody>
</table>

RATES OF FREIGHT.

<table>
<thead>
<tr>
<th>Per foot</th>
<th>Per 100 lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>To Branchville,</td>
<td>7 cents 25 cents</td>
</tr>
<tr>
<td>Midway,</td>
<td>8 &quot; 28 &quot;</td>
</tr>
<tr>
<td>Blackville,</td>
<td>10 &quot; 25 &quot;</td>
</tr>
<tr>
<td>To Aiken,</td>
<td>23 &quot; 45 &quot;</td>
</tr>
<tr>
<td>Hamburg,</td>
<td>14 &quot; 50 &quot;</td>
</tr>
</tbody>
</table>

The above embraces *all* charges, (including Insurance from Fire while traveling) and one week's *Storage*.

CHARGES

For labour and storage (not exceeding one week) 3\(\frac{1}{2}\) cents per hundred pounds, or 1 cent per cubic foot. After which storage to be charged at Charleston rates.

N. B.—Hollow Ware not taken loose. Demijons, Jugs, and every description of Glass or Earthen Ware, not securely packed, to be at the owner's risk.

REGULATIONS

1st. Freight will be forwarded agreeably to the order of time it is received. That intended for the morning trip must be at the Depository by two o'clock the day previous, *in good order, and marked the name of the station on the line it is to be left at, or it will not be received.*

2d. Freight for Jerico and the other stations up to, and including Reeves', is payable at the Charleston Depository, and to be left at the place directed, at the risk of the owner.

3d. All freight must be paid for at the respective Depositories on its *delivery.*

4th. No package of any description, for any of the stations, entered on the freight list for less than 12\(\frac{1}{2}\) cents, and no receipt given for a less amount of freight than 50 cents.

5th. GUNPOWDER prohibited.
Slavery

Slavery is a system of labor in which certain people are owned by other people as property, deprived of their rights and forced to work for their owners. Slavery was brought to South Carolina by the first white settlers in 1670 and quickly became an essential part of the agriculture of South Carolina, continuing until emancipation in 1865. In South Carolina, as in the rest of the Western Hemisphere, slavery took on a racial dimension. Only descendants of Africans were enslaved, and the presumption for almost 200 years was that everyone with brown or black skin hues was a slave. The labor of generations of slaves made possible the prosperity of South Carolina in the years before the Civil War.

Traditionally, historians have viewed slaves and slave life from the point of view of individuals who were treated as dehumanized creatures subject to the will of their owners and white society. In recent years, historians have begun to emphasize social development and community building in their discussions of slavery. Some argue that in spite of the oppressiveness of slave life, slaves were still able to create a life and a society for themselves independent of their masters. Building that community structure enabled slaves to be supported psychologically and to survive some of the difficulties of slavery. The typical slave community was founded on distinct customs and strong religious experiences. These values helped to balance, somewhat, the typically poor treatment slaves received and ensure that a population of more than 400,000 would be around to welcome freedom in 1865.

King Cotton

Cotton cultivation did not take over South Carolina agriculture and life until the 1790's when, with the invention of the cotton gin, the age-old problem of finding a labor-effective way to separate the seeds from the fibers was solved. Previous to that time, rice and indigo were the only staple crops for South Carolina farmers. By 1810, cotton had expanded until it was grown in every section of the state. At that time over 50% of the cotton grown in the country came from South Carolina, and total acreage put into cotton continued to expand. In 1920, cotton production peaked in the state with a total of 1.6 million bales produced. The growing, processing, selling, transporting, and thinking about cotton by so many people created a type of "cotton culture" that dominated the lives of South Carolinians until the 1960's. Growing cotton always meant more than just making money from the crop, for as Ben Roberston said in Red Hills and Cotton, "Cotton with us is almost human...Sometimes I think a Southerner's idea of heaven is a fine cotton-growing country. . . ." Although cotton is no longer King in South Carolina, its legacy remains in the exhausted fields and severely eroded gullies found in many parts of the state. For better or worse, cotton has been an essential part of South Carolina culture and history.
Wise sayings, folk ways, and good luck charms are as old as civilization itself. Different parts of the world and different cultures have many different customs and associated fables, proverbs, and sayings. In the United States, because it is made up of so many different cultures, we have a wide variety of sources of sayings and folk ways. In South Carolina, you will even find significant differences between beliefs held in the Up Country and beliefs held in the Low Country.

Often there is an element of “truth” or common sense in these sayings, many of which are still prevalent today. For example, local farmers still say that the best time to plant a spring vegetable garden is on Good Friday, the Friday before Easter. We’ve all heard the story about the groundhog coming out on February 2nd. If he sees his shadow, then the backbone of winter will not be broken, and cold weather will continue for another six weeks. Or, "a cold winter is followed by a long, hot summer," and "when large drops of rain fall, it will not rain for long."

There are, of course, lots of good luck and bad luck sayings. We have all heard of, and probably used, lucky charms. The old folks say that to have the best kind of luck a person should always have about him the left hind foot of a rabbit that has been killed at midnight in a graveyard in the dark of the moon. Folks even made a living selling luck charms in the old days. Rebecca Godbold, a nineteen year old girl, used to peddle her good luck charms in Marion to make extra money. For 50 cents you could buy "Lucky Perfume Drops," "Courtin’ Powder," "Follow Me Boys," or "Follow Me Girls." And if those worked too well, you could also buy "Get Away Powder"! The two super duper deluxe one-dollar charms were "Lucky Bags" and "Sure Luck Oil." Both of these were supposed to keep you “in the money.”

Wise sayings, folk ways, and luck charms are interesting to collect and research. More often than not, there’s a story behind that saying or charm. Just ask! You’ll find out! Here are some other examples of what folks living in South Carolina in the late 1800’s were saying. Who knows how many generations back they might have been saying these very same things. Someone that you know might have even said one of these phrases to you lately.

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**Wise Sayings and Good Luck Charms**  
By Lyn Zalusky Mueller

* Small children sweeping will bring visitors.
* Company is sure to come if a rooster crows on the doorstep.
* If the palm of your hand itches, scratch it by rubbing it on wood, and you will get money.
* A dream told before breakfast will come true.
* Throw a kiss at a redbird, and you will see your sweetheart within an hour.
* When you have killed a snake, hang it with its belly to the sun, if you need rain, and you will get what you need.
* To avert the bad luck of a rabbit crossing your path, turn your hat around.
Strange Stories and Legends

Most rural areas have a host of legends and folk tales about both real and imaginary people who have had an impact on a small town or a local neighborhood. Like stories about UFO’s (unidentified flying objects), most involve some semblance or aspect of a non-scientific occurrence or supernatural event. Often these stories involve reports of strange sightings along dark rural roads or in abandoned houses. They rarely take place in crowded rooms or populated public places. Some of these tales are funny while others are supposed to be scary. But some of the best are the ones local folks claim are true, like this one.

The Vanishing Girl
Retold by Libby W. Carnohan

The road from Charleston to Columbia was especially dark except for the single stream of light from a shadowy moon. The couple drove on eager to get home and go to bed. They had been visiting a sick relative in Charleston. Their conversation was abruptly interrupted when the man driving the car swerved to miss a young girl walking along the edge of the road. She was dressed in pink satin and white lace and carried only a single rose. The sight of her was so unusual that at first the wary travelers thought that they were mistaken. They slowed, and there in the moonlight the girl stood motioning for them to stop. The couple immediately stopped and asked if the girl needed to be taken somewhere. She replied, "Yes, I must get to the hospital in Columbia. My boyfriend was in an accident, and they took him there. I have to see him." The couple explained that they were going to Columbia and would be glad to help. The wife leaned forward to allow the young girl to get in the back seat. The couple tried, but couldn't get the girl to answer any of their questions. All they heard from the back was a faint whimpering. Finally, the soft noise stopped and the couple tried again to find out more about the accident. This time when the girl did not respond, they stopped and turned around to see if she was all right. Much to their amazement, the seat was empty. The girl had vanished.

So shaken by the incident, the wife insisted that they go to the hospital in Columbia to check on the condition of the young man. No one at the hospital knew anything about an accident. No young man had been admitted that evening or the evening before. The couple grew more and more frightened. They returned to their car and carefully checked the interior. There under the front passenger's seat, they found a single white rose.

Years later, the couple's grandchildren were visiting with them. The children told them a ghost story they had heard at school. As they told it, there is this young girl who wanders the roads between Charleston and Columbia searching for her boyfriend who was killed in a car accident on the night of their senior prom. Only the truth is, both the young man and the young girl were killed in that accident that night on that lonely road.
Natural Resources, Land Use, and Environmental Concerns

Climate and Water Resources

The climate of the Coastal Plain Region is classified as temperate, with a 200--250 day growing season and an average annual rainfall of 46 inches. As the rivers enter the Coastal Plain from the Piedmont, they begin to meander and to form broad floodplains or bottomlands. These areas are often seasonally flooded and serve as important water storage and aquifer recharge areas. Groundwater is easily and uniformly available from the deep coastal sedimentary rock layers and wells commonly yield up to 200 gallons per minute. Some flowing (artesian) wells also occur, particularly in the Upper Coastal Plain. Although the quantity of water is not a problem, the quality of both ground and surface water is a concern in many areas of the Coastal Plain.

Soils and Land Use

Coastal Plain soils form on top of a variety of sediment types, from coarse sand to fine clay. Most have a loamy to sandy clay subsoil and good surface drainage but possess only moderate to poor internal drainage. The inherent fertility and organic content of these soils are classified as moderate, but where drainage is good, favorable soil texture exists. This makes the Coastal Plain soils some of the best farmland in the state. At lower elevations soils are excellent, as long as sufficient drainage is provided, and this area has become South Carolina's major agricultural belt. In the very lowest areas drainage can become a major problem, making such areas unsuitable for regular agricultural use but very favorable for the growth of floodplain forests.

Agricultural practices have developed somewhat differently in the Upper and Lower Coastal Plain sub-regions. In the higher elevation Upper Coastal Plain, approximately 24% of the land is considered to be prime farmland. About half of this is covered in cropland and about half in forest. The major cash crops are cotton, corn, and soybeans. Farms tend to be large and cover a variety of Coastal Plain landscape features with the exception of river floodplain swamps.

In the lower elevation Lower Coastal Plain, poor drainage makes large acreages of land unsuitable for row crops. This land, however, is very well suited for the bottomland hardwoods and pines which have been planted extensively throughout the region. Farmland is usually restricted to isolated upland regions which act as broad drainage divides between the very wet coastal marshes and floodplain swamps. About 15% of the area is considered to be prime farmland, and approximately half of this total is open land with the remainder being forested.

The Timber Industry of the Coastal Plain

From the beginning of European settlement, South Carolina's great forests of longleaf pine and cypress invited entrepreneurs to turn trees into commodities for sale in the West Indies and the British Isles. From as early as 1680, timber was an important trade item in the state, and a large number of auxiliary enterprises were supported by the lumber industry from 1680 to 1830. During that period, merchants, sawmill operators, teamsters and rivermen all prospered from the cutting of the forests. However, by 1830 much of the forest land had been turned into cotton fields. For decades after, little
interest was shown in re-developing a lumber industry in South Carolina. But as cotton lands wore out and became useless for agriculture, growing trees on that land for commercial use became an attractive alternative. By the 1890's, when professional forestry had become established in the United States, cutting trees had again become a prosperous enterprise in the state. The industry has since expanded greatly so that it now represents a substantial portion of South Carolina's economy. The orderly plantings of long miles of pine trees along Coastal Plain highways testify to this recent economic resurgence.

Agriculture of the Coastal Plain

Although farming as a way of life has declined in importance in many parts of South Carolina over the past fifty years, it is still a very important land use in certain counties. Almost 50 percent of the Coastal Plain Region is used as cropland or pastureland. This area is the largest row crop farming area of the state, with corn, soybeans, melons, peanuts, and cotton being the favored crops. Closer to the coast, where the low elevation of the land has prevented farmers from draining the wet soils, the primary land use is timber and pulpwood production. This area is commonly known as the flatwoods. It includes large expanses of longleaf and loblolly pine forest which support one of the state's most productive and popular deer and turkey hunting areas.

In farmland areas which are no longer profitable, many of the old fields have been allowed to return to native pines or have been planted in loblolly pines by private individuals or timber companies. These practices have resulted in the pine dominated Coastal Plain landscape we see today.

Unique Natural Habitats in the Coastal Plain

When colonists first arrived in South Carolina, millions of acres of pristine bottomland hardwood forest existed within the state. Today, the preserved natural habitat is measured in thousands of acres and even that amount is under increasing pressure from timber and agricultural interests for development. Several parks, preserves, and wildlife refuges in the Coastal Plain region serve to highlight unique environments as well as to protect rare or endangered plant and animal species. In addition to the Congaree Swamp National Monument in Richland County, other protected areas include the Webb Wildlife Center in Hampton County, Savannah National Wildlife Refuge in Jasper County, Wambaw Creek Wilderness Area in Berkeley and Charleston counties, and the Francis Beidler Forest located in Four Holes Swamp, Dorchester County. These last two wilderness areas highlight swamp regions, which are now protected from increasing development pressures, forming a last refuge for a host of endangered plants and animals. All of these areas serve as reminders of the Coastal Plain's greatest natural resources: extensive forests, fertile soil, and abundant wildlife.

Although Coastal Plain forests are dominated by pines, many other kinds of trees contribute to the region's natural landscape. On higher ground in the Upper Coastal Plain, especially on bluffs overlooking rivers, a pine-hardwood forest dominates. This classification consists of primarily loblolly pine, hickory, and various oaks. On lower slopes, the wetter conditions are preferred by white oak, laurel oak, water hickory, overcup oak, cypress, and tupelo gum. True swamps, particularly in the Lower Coastal Plain, are dominated by baldcypress and tupelo gum stands. Swamp trees often have flared bases for support, and cypress knees project above the water or wet soil.
Even though the Coastal Plain is largely forested, there are scattered areas of open grasslands called savannahs, most notably in the Lower Coastal Plain. Dominated by various grasses and sedges, and longleaf pine or pond cypress, savannahs usually are associated with a high water table or ponding of water for considerable periods of time. Forest fires during dry periods are another important factor contributing to savannah formation, because fire destroys competing vegetation and encourages the growth of fire-tolerant species.

**Freshwater Fisheries**

In recent years impoundments within the state, especially lakes Marion and Moultrie, have become the sites of significant recreational fishing. Striped bass, hybrid and large mouth bass, and catfish are important fish for recreational purposes. The rise of fisheries is a reminder that until 1830 the rivers of South Carolina provided a supplementary income to large numbers of people who caught sturgeon, salmon, bass, and shad in great quantities. But overfishing and the large amount of sediment carried by streams eroding topsoil from agricultural fields ended hopes for a significant fishing industry. Only within the past six decades, with careful management practices, has fishing been restored to an important place in South Carolina life.

**Phosphate, Limestone, and Other Rock Resources**

Sand and gravel production is the most common mining activity in all of South Carolina, but it is particularly widespread in the Coastal Plain Region. The primary industrial use of sand and gravel is as an aggregate in concrete and asphalt. Other uses include sandblasting, filtration, glassmaking (pure sand only), and fill material. Clay is also mined extensively in the Coastal Plain. Clays are used in the manufacture of bricks and cement. A particular type of silica-rich clay, opaline claystone, also known as fuller's earth, is found in Sumter County, near Pinewood. Fuller's earth is a highly absorbent form of clay which becomes even more absorbent when heated to very high temperatures. It is marketed as an oil and grease absorbing agent in the rubber, plastics, and cleaning industries, but is perhaps best known as the major absorbing component of kitty litter.

Limestone quarries dot the landscape in the central area of the Coastal Plain surrounding Lakes Marion and Moultrie. This is the region where the Santee Limestone formation is exposed at or near the surface of the land. In 1993, limestone products were the most valuable mineral commodity in the state, with total sales exceeding 100 million dollars. Much of the limestone is actually a mixture of lime and clay, called marl, which is ideal for the production of portland cement. South Carolina produces more portland cement per year than any other Southeastern state. The largest production facility is the Giant Portland Cement plant near Harleyville in Dorchester County.

The phosphate industry was once important in some Coastal Plain counties but has not been active during the past fifty years. In the late 1800's and early 1900's phosphate sands and pebbles were dredged from river basins of several Coastal Plain rivers, primarily the Wando, Cooper, and Ashley. The primary use of this material was for agricultural fertilizer. Although huge amounts of phosphate reserves probably still exist in both onshore and offshore sediments of South Carolina, most beds are only a few inches thick and mining is no longer economically feasible.
A very small peat industry exists in South Carolina, primarily in Colleton County. The peat is extracted from bog and floodplain deposits along coastal rivers. It is marketed as a soil conditioner and can also be used in wastewater treatment as a filter. Uranium-rich sands in Dillon County may be a future economic resource, but no mining operations are currently planned.

Summary

The Coastal Plain landform comprises the largest geographical division in South Carolina. Geologically, 20 to 30 million years ago it was covered by waters of the Atlantic Ocean. During this time, rivers deposited a variety of materials from the Piedmont and Blue Ridge regions, sediments that, after the ocean retreated, formed a diversity of landforms on this generally flat plain. The soils are of excellent quality and support the major agriculture belt of the state. Several river systems draining the state form floodplain swamps which contain abundant hardwood forests and wildlife.

Native Americans found the Coastal Plain to be hospitable to their way of life, but their ways did not sustain them in the conflict with the technologically superior European culture. Other conflicts played themselves out on this large, fertile plain: battles of the Revolutionary War, slavery, the rise of railroads and the demise of canals, cotton as King and its fall, progress and conservation, and the costs and benefits of major developments such as the Santee Cooper Project, which provides electricity and recreation for many residents of South Carolina. Historically, the need to get produce to the markets of Charleston, the flat topography of this region, and the slow-moving, meandering rivers contributed to the pioneering efforts made towards early transportation systems, both canals and railroads.

Now there are concerns that prime farmland is disappearing to developers, timber is being cut at alarming rates, and wildlife habitat is decreasing dramatically. Even with the large number of national and state wildlife preserves, the public must become aware of proper conservation practices so that the ecological balance is not disturbed to the point that future generations can no longer enjoy the unique environments and productive farm land of this region.
PLACES TO VISIT

Webb Wildlife Center. For information and directions call 803-625-3569.

Wambaw Creek Wilderness Area, Francis Marion National Forest. For information call 803-336-3248, 803-825-3387 or 803-887-3311.

Old Santee Canal State Park. Off R.C. Dennis Boulevard in Moncks Corner, at 900 Stony Landing Road. For information call 803-899-5200.

REFERENCES AND RESOURCES


WPA Files, South Carolina:

"Luck Charms." Prepared by Annie Ruth Davis, Marion, December 29, 1936.
"Luck Charms." Prepared by Annie Ruth Davis, Marion, February 2, 1937.
"Folk Ways (Lancaster County)." Prepared by Mrs. B.M. Paul, not dated.
STUDY AREA 5: COASTAL PLAIN OVERVIEW

Activity 5-1: Overview

Materials

<table>
<thead>
<tr>
<th>Item</th>
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<tr>
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<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<tr>
<td>LAND USE/LAND COVER MAP</td>
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<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<td>Revolutionary War Campaigns in South Carolina</td>
<td>Figure 1-10</td>
</tr>
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<td>Map of 1860 Cotton Distribution</td>
<td>Figure 5-4</td>
</tr>
<tr>
<td>Map of 1981 Cotton Distribution</td>
<td>Figure 5-5</td>
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<tr>
<td>Map of Antebellum Railroads - 1860</td>
<td>Figure 1-12</td>
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<td>Bill of Fare for Best Friend of Charleston</td>
<td>Figure 5-2, 5-3</td>
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<td>Wipe-off Pens</td>
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PERFORMANCE TASKS

1. **Describe topography of Coastal Plain.**
   - Using the STATE BASE MAP #1, SHADED RELIEF, trace with a wipe-off pen the boundaries of the Coastal Plain Region. Describe the typical landscape appearance of the Coastal Plain. Name the major reservoirs, watersheds, and urban areas in the Coastal Plain Region. Identify and locate at least two river systems that originate in the Coastal Plain Region of South Carolina. Compare the paths and features associated with these rivers to river systems that originate in the mountains, such as the Santee and the Pee Dee. Trace the paths of all these river systems and record any name changes as they flow seaward. Which category of river system contains the most name changes? Why do some South Carolina rivers change their names so often? Is a good idea to have different names for the same river? Explain.

2. **Examine land use in Coastal Plain.**
   - Trace the Coastal Plain boundaries with a wipe-off pen onto the LAND USE/LAND COVER MAP. What land use/land cover is concentrated around Coastal Plain rivers and streams? Some maps and texts divide the Coastal Plain into an Upper and a Lower region. What evidence would you use to make this division? What land use dominates the Upper Coastal Plain? What land use dominates the Lower Coastal Plain? Trace your best estimate of the Upper / Lower Coastal Plain boundary onto the map with a wipe-off pen.

   Draw in the approximate position of the Orangeburg Scarp (Citronelle Escarpment) with a different color wipe-off pen. You may have to refer to the STATE BASE MAP #1, SHADED RELIEF, to help you locate this feature. The line should go through the towns of Allendale, Orangeburg, Sumter, Hartsville, and Bennettsville. How closely does the Orangeburg Scarp line up with your land use boundary line? Compare your results with those of other groups. Explain any significant differences in the placement of your boundary lines.
3. **Compare drainage patterns of Upper and Lower Coastal Plains.**
   
   Assign each group one of the following drainage patterns to trace with a wipe-off pen on the *STATE BASE MAP #1, SHADED RELIEF*. Compare the map tracings, identify major differences, and explain why such differences exist.

   **Group I  Lower Coastal Plain**
   Locate Williamsburg and Georgetown counties. Trace the drainage pattern of the Black River and its tributaries within these counties. Note the sharp bend in the Black River in Georgetown County. This deflection marks the location of a former marine terrace which has diverted the normal drainage. Using this drainage pattern as your key, locate similar terraces or escarpments in Dorchester and Berkeley counties. How would you describe such a drainage pattern? Why is this drainage pattern more common in the Lower Coastal Plain? Compare your results with other groups. What conclusions can you draw?

   **Group II  Upper Coastal Plain**
   Locate Aiken County. This county is mostly in the Upper Coastal Plain Region and shows a typical Coastal Plain drainage pattern. Trace the stream drainage patterns of the South Fork Edisto River and its tributaries within Aiken County. This resulting dendritic (branching) pattern is typical of flat homogeneous landscapes. Using this drainage pattern as your key, locate similar drainage patterns in Sumter and Darlington counties. Why is the dendritic pattern more common in the Upper Coastal Plain? Compare your results with other groups.

4. **Estimate amount of swampland in Barnwell vs. Marion counties.**
   
   Locate Barnwell and Marion counties on the *STATE BASE MAP #1, SHADED RELIEF*. Note that these two counties are approximately the same size even though they are shaped differently. Use the map symbols to locate the swamp land in each county. Estimate the percentage of swampland in each county. Which county has the most swampland? Which county is in the Upper Coastal Plain? Which county is in the Lower Coastal Plain? Why is there a difference in the amount of swampland?

5. **Compare Coastal Plain soils.**
   
   Using the *GENERAL SOIL MAP*, identify the soils of the Sandhills and the Upper and Lower Coastal Plains. Do soil types cross boundaries? Use the *GEOLOGIC AND MINERAL RESOURCE MAP* to relate each soil type to the underlying geology. Which soil differences can be attributed to geological differences? How can you explain other soil differences? How have soil characteristics affected the vegetation and land use of each region?

6. **Locate major crop belt in South Carolina.**
   
   The Upper Coastal Plain contains the most extensive and most concentrated crop belt in South Carolina. In this region, farming is the major source of income for the majority of the population. On the *GENERAL SOIL MAP* of South Carolina this region is called the Southern Coastal Plain. Make a list of all the counties which contain at least some "Southern Coastal Plain" soil. Next, look at the *LAND USE/LAND COVER MAP* and notice that yellow is assigned to Agricultural/Grassland land use. For each of the Upper Coastal Plain counties on your list, estimate the percentage of the county which is designated yellow on the map. Select the top ten Coastal Plain counties, in terms of agricultural productivity and list them, in order, on a separate piece of paper. Use a wipe-off pen to shade in those ten counties on the *STATE BASE MAP #1, SHADED RELIEF*. What do all these counties have in common?
5-23

common? Are they bunched together geographically or widely separated? Why are these counties good places for agricultural production? Why is the Lower Coastal Plain not as productive for cropland? Relate the crop belt area to the landform regions of South Carolina.

7. Analyze changes in cotton production. ☀
Student groups should complete one of the investigations listed below. Compare results and draw conclusions about cotton production in South Carolina. Use these questions as a guide for group discussion. Explain the meaning of the phrase "King Cotton." When was cotton "King"? Discuss advantages and disadvantages of South Carolina's one crop economy system. What are some problems associated with a one crop economy system? In which of the five landform regions was cotton grown in the 1860's? In 1981?

**Group I  Which counties produced cotton in 1860?**
Carefully examine Figure 5-4, "Map of 1860 Cotton Distribution." On this map the data were collected based on bales per capita and divided into five categories. On the STATE BASE MAP #2, WITH HIGHWAYS, use different colored wipe-off pens to indicate which counties were included in each of the five categories. Make a list of your data. Why did the map makers select five categories instead of seven or eight or two or three? Is your school located in the old cotton belt of South Carolina (.60 bales per capita or greater)?

**Group II  Which counties produced cotton in 1981?**
Carefully examine Figure 5-5, "Map of 1981 Cotton Distribution." The data on this map are reported as harvested acres as percent of land. The four categories are indicated by the intensity of shading. On the STATE BASE MAP # 2, WITH HIGHWAYS, use different colored wipe-off pens to indicate which counties were included in each of the four categories. Make a list of your data. Why did the map maker select four categories instead of five or six or two or three? Is your school located in the 1981 cotton belt of South Carolina (equal to or greater than .5% harvested acreage)?

8. Trace route of The Best Friend of Charleston. ☀
South Carolina's first railroad locomotive, The Best Friend of Charleston, began running in 1830 from Charleston to the town of Hamburg, which is located on the Savannah River near the present-day site of North Augusta. Trace with a wipe-off pen the Charleston-Hamburg railroad track on the STATE BASE MAP #1, SHADED RELIEF, using the data from Figure 1-12, "Map of Antebellum Railroads--1860," Locate as many station stops as possible, listed on Figures 5-2 and 5-3, the "Bill of Fare for The Best Friend of Charleston." Estimate the percentage of stations not listed on the map. A second line was soon added at Branchville, connecting Columbia and Camden with Charleston. Use a wipe-off pen to trace this railroad line. Identify the rivers and swamps that had to be crossed. Is there a railroad running along the same route today?
9. Make time table for railroad using the Bill of Fare.

Look at the list of stations shown on Figures 5-2 and 5-3, the "Bill of Fare for The Best Friend of Charleston." How many of these places are listed on the State Base Map # 2, with highways? Why are some of these stations not shown on the map? Calculate the average distance between stops. What factors determine how far apart stations should be and how many total stations there should be? How much was a one-way fare from Charleston to Hamburg? How have passenger and freight regulations changed since 1833? What do you think a "Demijon" might be? Why would gunpowder be prohibited on the train? Fill in the time chart below using the information contained on the Bill of Fare. Determine the average speed of The Best Friend of Charleston. Notice that freight rates on the Bill of Fare were quoted per cubic foot or per 100 lbs. Customers paid the higher of the two computed amounts. In 1835, what would it have cost for you to travel to Hamburg with a box weighing 50 pounds and measuring 12" by 18" by 24"? Would you receive a receipt for this package? Where do you think boxes were placed while you traveled?

TIME TABLE FOR THE BEST FRIEND OF CHARLESTON

<table>
<thead>
<tr>
<th>STATION</th>
<th>MILES</th>
<th>FARE (CENTS)</th>
<th>DEPARTURE TIME</th>
<th>RUNNING TIME</th>
<th>ARRIVAL TIME</th>
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<tbody>
<tr>
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<td>0</td>
<td>0</td>
<td>6:00 AM</td>
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<td>Woodstock</td>
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<td>Inabnet</td>
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<td>Branchville</td>
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<td>Midway</td>
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<td>Blackville</td>
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<td>Aiken</td>
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<tr>
<td>Hamburg</td>
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</table>

10. Distinguish between out of date terms and printing errors.

The "Bill of Fare for The Best Friend of Charleston," Figures 5-2 and 5-3, contains several apparent mistakes according to modern English usage. Some of these are old phrases, spellings, and terms which were in common usage in 1835 but are no longer in use today. Others are actually mistakes. Read through the Bill of Fare carefully and find at least one example of a printing error and at least three examples of out of date spellings or phrases. How can you distinguish between mistakes and former usage?

11. Make up a strange tale or legend like "The Vanishing Girl."

Divide into groups. Read aloud the story of the "The Vanishing Girl," on page 5-14. Use your own school setting to make up a similar story using characters and landmarks familiar to students in your group. Take turns sharing your story with other groups.
12. **Design flags for your county and state.**

Explain the historical reasons for including certain symbols on the official South Carolina state flag. Then, using your South Carolina history textbook as a resource, design a new modern flag for South Carolina that would represent a variety of events or objects which have made a significant impact on the state's history and diverse cultures. Prepare a statement explaining the symbols you selected and the way items represented by these icons have played a part in the state's development.

Share your ideas and flag with your classmates. Also design a County Flag or a School Flag for your local area. Again, explain your use of symbols. How many of your symbols are specifically related to landforms or natural features?

13. **Make list of wise sayings and folk ways.**

Read through the list of "Wise Sayings and Goodluck Charms" on page 5-13. Brainstorm in small groups for ten minutes, with one student serving as scribe for each group, to see how many additional wise sayings or folk ways you can list. If you can remember the source of the wise saying, have the scribe make a note of that. Review the lists across groups to come up with a complete class list. How many of these wise sayings are common in your neighborhood or local area? Invent additional wise sayings or proverbs and create short tales to accompany them. Write the list of new wise sayings on the board. Divide into new teams. Have each team member tell a tale and see if his or her teammates can guess the corresponding wise saying from the list on the board.

14. **Locate Marion's military engagement.**

Using a wipe-off pen, locate on the STATE BASE MAP #2, WITH HIGHWAYS, the site of Francis Marion's Revolutionary War engagement at Eutaw Springs. What were Francis Marion's contributions to the Revolutionary War? Why is he remembered as the Swamp Fox? How did you think specific landforms and landscape features might have affected the planning of his military strategy in South Carolina?

15. **List places using Francis Marion's name or nickname.**

Make a list of all the places, cities, streets, and companies in South Carolina that use Francis Marion's name or "Swamp Fox" as their nickname or mascot. Refer to the STATE BASE MAP #2, WITH HIGHWAYS, and any other cartographic products or other resources you may have available. What other famous persons have been memorialized in South Carolina place names, either locally or state wide?

16. **Explain why Coastal Plain houses do not have basements.**

In contrast with buildings in other regions, houses in the Coastal Plain Region almost never have basements. Based on the geology and topography of the area, explain why basements are not usually desirable or possible for most Coastal Plain houses.
ENRICHMENT

1. **Research Eli Whitney and George Washington Carver.**
   Find out how Eli Whitney’s invention of the cotton gin provided South Carolina with a new staple crop, cotton, and why the cotton culture would not have been able to thrive without it. Cotton, as one of our main fabrics, can be used in a variety of ways. Research the many uses of cotton. What are the contributions that George Washington Carver made towards finding major uses for cotton by-products? Explain his impact on the cotton industry.

2. **Research list of unique natural areas in Coastal Plain.**
   Locate the following natural sites and explain how each area represents a unique resource of the Coastal Plain.

   - Webb Wildlife Center, Hampton Co.; Savannah National Wildlife Refuge, Jasper Co.; Wambaw Creek Wilderness Area, Berkeley and Charleston counties; Francis Beidler Forest (Four Holes Swamp), Dorchester Co.; Cathedral Bay Heritage Preserve, Bamberg Co.; Santee National Wildlife Refuge, Clarendon Co.

3. **Collect song versions of "The Vanishing Girl" and similar legends.**
   Strange tales like "The Vanishing Girl" on page 5-14 are common in cultures all around the world. Collect as many different versions of such tales as you can find and identify similarities and differences in characters and settings. Such stories sometimes end up as popular songs. Locate recordings of "Bringing Mary Home" (by The Country Gentleman), (Phantom 309 (by Dave Dudley), and "The Ride" (by David Allen Coe). Try writing your own short song about a "The Vanishing Girl."

4. **Visit county agent to discuss cash crops.**
   Telephone or visit the County Agent's Office to find out the total dollar value of all cash crops sold in South Carolina last year. Among tobacco, cotton, corn, and soybeans, which is the largest cash crop? What other cash crops are significant? How are each of these crops used? If cotton is grown in your county, determine how much cotton is currently planted in your area. How has local cotton production changed over the last twenty years? How does the cotton allotment system work? What part did the boll weevil play in the growing of cotton? Explain the boll weevil eradication program. How effective has this program been? Where is most of the cotton grown today in the United States?

5. **Interview family members and list wise sayings.**
   Create a community list of wise sayings and proverbs and publish it in the local or school newspaper. Ask readers to add comments about your list so that you can continue to expand it. Interview family members to compile a list of folk ways, proverbs and good luck charms. Publish it and give it to relatives as a holiday gift.

6. **Plan class presentation on The Best Friend of Charleston.**
   Visit the State Museum in Columbia and make a video or slides of the replica of South Carolina's first train, The Best Friend of Charleston. Research the history of this train and give an audio-visual presentation to the rest of the class.
The State
May 8, 1991
SRS Cleanup Could Harm Ecosystem, Scientist Said

An environmental expert at the Savannah River Site opposes cleaning up part of the facility because it might cause more damage than the radiation. "Somewhere, we need to decide when to draw the line at cleanup. You can't clean up everything that has been contaminated," said Ward Whicker, a researcher at Savannah River Ecology Lab, operated by the University of Georgia.

"I would argue, even though there are measurable levels of radioactivity, they are not high enough to produce an unacceptable risk to plants or people," he said. Even so, Whicker said he opposes opening the area to the public "because of the potential for lawsuits from people saying they got sick." "On the other hand, I am very much opposed to cleaning it up," he said. "Cleaning it would destroy the ecosystem. A bulldozer would do far more damage than the radiation." Whicker bases his conclusions in part on research at Pond B, a reactor cooling reservoir system abandoned about 25 years ago. The pond has fish and plant life, as well as some radioactive materials.

"I agree with the notion that there are a number of sites at SRS that are not presenting immediate problems," said Brian Costner, director of the SRS watchdog group, Energy Research Foundation. "But the question is long-term use."

Whicker said much of the concern over cleaning up the nation's nuclear defense complex--estimated at more than $200 billion--is based partly on ignorance of what radiation can do. He said not all such sites are dangerous.

Costner said not enough is known about radioactive contamination to make cleanup decisions.
The Savannah River Site is the nation's only source of tritium, a radioactive gas that enhances the explosive power of nuclear weapons.

RATIONAL

The Savannah River Site is a 300 square mile region of restricted access in the Coastal Plain of South Carolina that was chosen by the U.S. Atomic Energy Commission in the early 1950’s to be the primary manufacturing site for the government’s atomic weapons program. The original facilities produced plutonium-239 and tritium for the nation’s defense needs. As a result of this highly unusual and unique land use, a variety of hazardous materials, including radionuclides, volatile organic compounds, and trace metals, have been stored or disposed of on site. Over the last decade, under direction from the U.S. Department of Energy, the primary role of this facility has shifted from nuclear materials production to waste management and environmental restoration. Groundwater contamination is a continuing concern in this area due to the porous nature of some of the Coastal Plain geologic formations and the presence of buried faults. Areas of restored habitat are important test sites for demonstrating the use of advanced technology to clean up pollution.
**Brief Site Description**

**Introduction**

The U.S. Department of Energy’s Savannah River Site (SRS) encompasses approximately 300 square miles of formerly private forest and farmlands in portions of three South Carolina counties. The largest portions lie in Aiken and Barnwell counties, with a much smaller section in Allendale County. The Savannah River, marking the boundary between Georgia and South Carolina, lies along the western edge of this large, nearly circular region that has been designated as a restricted area with limited public access because of the sensitive and dangerous nature of the work performed there. Visitors to the Savannah River Site must check in at a visitor center and receive a temporary entry permit which must be returned upon departure. They must also remain in the presence of an official escort the entire time they are on site. Away from the river floodplain, the remainder of the Site consists of fairly typical landforms of the upper or western edge of the Coastal Plain in South Carolina. The area is well drained by four major stream systems, plus the Savannah River. Many of the streams are unusually clear and straight, similar to Piedmont streams, because of the relatively high relief in this region.

Most of the Savannah River Site is currently covered by forests, with less than ten percent of the area actually used for buildings and facilities, such as the reactor areas and waste management operations. Forests of mixed types provide shelter and food for numerous animals, including some endangered species such as Rafinesques’ big-eared bat, found in habitats ranging from well-drained uplands to swamps. Timber operations throughout the site have had an important impact on habitat distribution. In 1972, the U.S. Department of Energy named the SRS an Environmental Research Park, and forestry and wildlife research took on a more important role in site management plans. Even with the presence of extensive forest tracts, over twenty percent of the area is actually classified as wetland. This designation includes streams, artificial reservoirs used to cool reactors, bottomland hardwood swamps, and Carolina Bays. Both wetlands and forests harbor a rich assortment of plants and animals.

Born out of the global tensions of the Cold War in the 1950’s, the Savannah River Site was originally conceived as a facility to manufacture nuclear weapons to support the nation’s defense effort. The secretive nature of this work, as well as the potential safety hazards, required that access to site facilities be heavily restricted and that people then living within the site boundaries be relocated. The original facilities produced plutonium-239 and tritium using high-capacity nuclear production reactors moderated and cooled by heavy water. Other functions of SRS have included chemical separation and purification of reactor products, storage and processing of nuclear wastes, environmental restoration activities, and development and transfer of experimental waste disposal technologies. The original private sector partner at SRS was Du Pont, although Westinghouse has managed operations since 1988. Major processing facilities consist of five nuclear materials production reactors (all of which were shut down at the time of printing - 1997), two separation areas capable of processing irradiated materials, a closed heavy water extraction plant, and a fuel and target fabrication facility.
Old Ellenton and New Ellenton

Locating the Savannah River Site in this part of South Carolina was a purposeful decision by the management of the DuPont Company. This area had a very large and dependable flow of water, a relatively flat terrain that would permit quick construction, good transportation facilities, and a relatively small number of people who would have to be relocated. Only about 1,500 families lived on the property that was destined to become the Savannah River Plant (as it was first named). The town of Ellenton contained the largest population, 739 people, followed by Dunbarton with 231 people and a few even smaller communities. Most of the people were farmers, although there was one small industry, a banana crate factory, in the village of Leigh. A brand new town, New Ellenton, was established just north of the SRS boundary and displaced families were encouraged to move there. Some moved their houses intact to the new location, while others used the money they received for their property to build completely new homes there. The old school building at Ellenton was used for several years by the DuPont Company to train employees and develop specialized equipment, but most other buildings on the site were torn down. However, house foundations, street curbing, and sidewalks can still be seen in the former town areas. Flowering shrubs and other landscaping still provide clues to the location of the old home sites.

The initial allocation of 260 million dollars and the need for workers led to the belief that the construction and operation of the facility would bring many much-needed jobs to the region. Many of these people were disappointed when it became clear that everyone living on the site would be required to move. The uprooting of families from their land created some hard feelings, but most residents accepted their loss as a necessary contribution to the defense of their country. Some news media of the time took a sympathetic view of their position. “There’s a lot of bitterness in Ellenton and the people don’t mind letting you know it,” wrote Manuel J. Rogers in The News (Dec. 2, 1950). “Their lives are deeply rooted in the sandy soils of the section and they are unhappy at being uprooted and moved like crumbs brushed from a table.” Of course the people were paid fair value for their land and assistance was provided to those families unable to relocate themselves. Although many local residents were offered employment on site, the majority of skilled labor positions, especially during the construction phase, went to outsiders with prior work experience in technical fields.

On November 28, 1952, a little after 12 noon, a radio announcement sealed the fate of the town of Ellenton, South Carolina.

"The United States Atomic Energy Commission today announced that its new production plants to be designed, built, and operated by the E.I. du Pont de Nemours Company of Wilmington, Delaware, will be located in Aiken and Barnwell counties, South Carolina, near the Savannah River. About 250,000 acres will be acquired for the site. Exact boundaries remain to be determined. The new site will be known as the Savannah River Plant. . . . To make way for the plants and the surrounding security and safety zone, it will be necessary for about 1,500 families to relocate in the next 18 months."
In her book, *The Unexpected Exodus* (1971), Louise Cassels, an elementary school teacher in Ellenton, remembers asking her sister, “Do you feel like someone in the family has just died?” Her sister, Mamie, replied “Yes, I do; and doom is certainly upon every home in Ellenton.” Later Ms. Cassels was asked about the move by a photographer, she responded, “We're heartsick at being displaced; but if it's for the good of the country, we'll co-operate 100 per cent.”

When the country heard the news, people from all over came running to see the doomed town of Ellenton. William Stephen Harley described some of the events that followed.

"I'll tell you this, the very first Sunday after the news broke, you could see a tag from just about every state in the Union coming down there to look. . . . when du Pont told us that, "We are going to take ya'll over," they had a meeting in the gym. They had the meeting to kind of cool our nerves, you know. There was a du Pont official there telling us how good they were going to be to us and how much money they were going to pay us for our land and everything. We were just going to have heaven right here on earth! We had heaven already. We just didn’t know it, but I knew it."

The government agreed to buy the houses and property at fair market value as determined by appraisers. Once paid, the owners had to leave Ellenton. They could, however, buy their homes back at salvage prices, well below market value, with the difference in moneys being some compensation for moving. Some of the Ellentoians moved their reacquired homes north of the site to a new town called New Ellenton.

Phyllis Tisdale Boyd, a young child at the time of the move, reminisces about an early memory of home in the pages of Browder’s book.

"The only thing I remember about Old Ellenton is being put in the back of a Chevrolet we had, an old black Chevrolet. I had to watch the procession . . . from there, because they were afraid I’d get run over. . . But I wanted to watch it. I can even see it now, see these huge houses moving down the road. It was just amazing, a whole big chunk of houses moving."

March 1, 1952 was designated as evacuation day, but not all the moves went smoothly. The Cassels were unable to move into their new home in Aiken by the evacuation deadline because their new home was not completed. They notified a government official that they could not leave. He replied, “Lock up your house just as it is, and get a boarding place.” Mamie Cassels responded, “You know as well as we do, there’d be nothing left in the house or on the premises by April. We’re not leaving.” They stayed until their home was completed, and Ellenton was finally vacated completely within the next month or two.

Louise Cassels concludes her book with an expression of lingering sadness mixed with pride and patriotism:

“Today, our little town of Ellenton is just a beautiful memory, one I'll keep forever; no human agent can take that away from me. The sacrifice required was heartbreaking, but in no way is it comparable to the lives that have been given on battlefields for our Country. So we small town folk are proud to have played a part in helping to preserve and protect our United States of America.”
The Sign at Ellenton
by Jody Tinsley

A newspaper article in The Columbia Record on November 28th, 1950, announced in its large headline “GIANT ATOMIC PROJECT TO RISE NEAR AIKEN.” Smaller headlines continued, saying that “H-Bomb” material would be made at the plant and that 1,500 families would have to move. Additionally, the article stated that the United States Congress had appropriated $260,000,000 for the construction of the site. All of these facts mixed to form an uncertain or ambiguous attitude about the plant. Patriotic pride at being selected, the money and jobs brought by the huge construction project, the awe and wonder of the atomic age, and the sadness at being forced to move from old home sites and old home ways—these are all expressed beautifully in a photograph taken in Ellenton (on the SRS) a short time later.

This black and white photograph is of the Ellenton town limit sign. No houses or buildings of any kind are seen in the background, just empty fields and a two-lane road, equally empty except for an old man walking in the distance with a cane in one hand and a parcel of some sort in the other. Hand-painted signs on scraps of wood have been added above and below the town limit sign so that the whole sign reads as follows:

It is hard to understand why our town must be destroyed to make a bomb that will destroy someone else’s town that they love as much as we love ours, but we feel that they picked not just the best spot in the U.S. but in the world. ELLENTON; INCORPORATED. We love these dear hearts and gentle people who live in our home town.

These 64 words (if you count U.S. as 1) speak volumes, a 64 word poem about loss, but colored with hope and determination.
Figure 5A-1: Topographic Map of Old Ellenton
Geology and Potential for Pollution

The Coastal Plain sediments beneath the Savannah River Site consist of Tertiary and Upper Cretaceous age gravels, sands, and clays, with small amounts of limestone. These layers form a wedge of sediments that thickens from the Fall Line toward the Atlantic coast. The depositional environments of these units have been interpreted as marine and near-marine conditions at a period of geologic time when the shoreline was thought to be positioned near the present day Sand Hills region along the Fall Line. Erosion by the Savannah River and its tributaries has exposed most of the thin sedimentary layers in the SRS area so that contacts between units can be mapped easily. Several of the sand and gravel units are highly porous and transmit significant quantities of water so they are referred to as aquifers. These aquifers may be susceptible to many types of pollution from operations at the SRS and are the focus of numerous ongoing studies to determine the possible presence and movement of contaminants.

One way that groundwater pollution spreads in the subsurface is through faults. Several faults have been discovered beneath the SRS which could possibly provide conduits for groundwater flow and permit the spread of pollution to uncontaminated aquifers that are not directly connected. Several of the major faults discovered at SRS are associated with the Dunbarton Basin, a previously downfaulted block of the earth's crust that has preserved terrestrial sediments deposited during the Triassic Period of geologic time. Most of those original deposits were stream and lake sediments which accumulated in a rift basin (an elongated trough bounded by faults) formed by extensional tectonic forces related to the opening of the Atlantic Ocean and the beginning of continental drift between North America and Africa.

The previously downfaulted Triassic sedimentary rocks are wedged in between crystalline rocks of the Piedmont. Both the Dunbarton Basin and the adjacent crystalline rocks are overlain and buried by the typical Cretaceous and Tertiary sedimentary layers found throughout the SRS. The Pen Branch fault, which forms the northwestern boundary of the Dunbarton Basin, has been reactivated in a reverse sense due to compressional stresses after the initial normal faulting associated with extension. This reactivation occurred after the Triassic normal faulting but does not affect the Martin fault. The Martin fault, which forms the southeastern boundary of the Dunbarton Basin, has apparently not been reactivated but conclusive data concerning this fault has not been found. Some Cretaceous and Tertiary age northeast-trending faults, that indicate tectonic compression, have also been discovered on site. Only a small number of the faults have been located at the surface, but their position underground has been confirmed through test drilling of cores and by seismic-reflection profiling technology which uses sound waves to view the subsurface. This method works by bouncing sound waves off rock boundaries and picking them up at specified distances from the sound source. The sound waves are created at regular intervals and are recorded at regular intervals away from the source and then analyzed. The analysis of the seismic data leads to the production of a seismic section which is very similar to a geologic cross section.
Figure 5A-3: Geologic Cross Section of SRS

Figure 5A-4: Map View of SRS Showing Location of Faults
Environmental Restoration Efforts

Over the past 40 years, researchers at the Savannah River Site have greatly advanced the study of waste disposal technologies and their impact on the environment. Radioactive wastes require a unique set of processing and storage methods. In recent years, the facility’s expanded roles of nuclear waste management, environmental cleanup, and environmental technology transfer have actually become more important than its original purpose of producing nuclear material. This research has also identified instances of localized contamination of soil and water at some of the site’s previous disposal facilities. Even though existing regulations were followed during the construction and operation of the site, both nuclear and non-nuclear contamination occurred. In addition, even though no nuclear reactors are currently in operation, nuclear material from other states and countries is still being sent to SRS for safe storage and protection. The current policy seeks to prevent accidental mishandling or intentional misuse of these potentially dangerous nuclear wastes by stockpiling these materials at SRS. Although accepting nuclear waste from outside the state has an economic benefit, some South Carolinians have questioned the use of their state as the “dumping ground for the world.” The courts have been forced to deal with the issue of nuclear waste shipments bound for the SRS on an individual basis, trying to balance the often conflicting wants and needs of state and federal agencies, business and environmental groups, and the local community.

The U.S. Department of Energy uses the term “environmental restoration” to refer to the assessment and cleanup of inactive waste sites. “Cleanup” means actions taken to deal with release or potential release of hazardous substances. This may mean complete removal of the substance; it also may mean stabilizing, containing, or otherwise treating the substance so that it does not affect human health or the environment. Determining the most environmentally sound method of cleaning up each waste unit is a major component of the site’s environmental restoration program. Over 400 inactive waste and groundwater units are included in the SRS restoration program. Sites range in size from several yards to tens of acres and include basins, pits, piles, burial grounds, landfills, tanks and groundwater contamination. Waste types include liquid and solid radioactive, hazardous, and mixed wastes. An example of novel waste disposal techniques is the attempt to immobilize high level radioactive waste within beads of borosilicate glass, a tough, impermeable and insoluble substance that can solidify radioactive waste. Examples of remediation methods range from traditional “pump-and-treat” systems where groundwater is pumped out of the ground, treated, and then reinjected into the ground, to more exotic technologies like bioremediation, which uses soil microorganisms that can actually digest some pollutants as a food source. In the past few years, the SRS has successfully remediated and closed six waste units, among the largest closures in the world totaling over 80 acres.

An example of a recently completed project is the M-Area Settling Basin, which received a combination of wastewater and organic degreasing solvents. It was closed with a clay cap blanketed with geosynthetic material, covered with a gravel/sand drainage layer and topped with soil and grass. The surrounding Lost Lake wetlands area is now being restored to its natural habitat. Another example is Par Pond, which was built in the late 1950’s as a cooling reservoir for P and R reactors. These were two of the original five production reactors used to make materials for atomic weapons. Scientists have found low levels of gaseous tritium in pondwater as well as radioactive cesium in the pond sediment. In 1991, Par Pond was discovered to be leaking through breaks in its...
earthen dam. SRS engineers wanted to lower the lake level by 20 feet so they could repair the dam and guard against the possibility of a catastrophic flood, but others raised concerns about possible fish kills, exposure of cesium-contaminated mud, and release of toxic substances to the environment. To allay some of these fears, when the drawdown was begun, much of the water was pumped to L Lake, another nearby impoundment. Some water was also discharged into other on-site streams that eventually flowed into Lower Three Runs Creek and then the Savannah River. Despite a temporary increase in levels of radioactive cesium reported in streams, the project proceeded without incident and the dam was repaired successfully.
Activity 5A-1: Surface and Subsurface Geology

<table>
<thead>
<tr>
<th>Materials</th>
<th>Scale</th>
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<tbody>
<tr>
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<tr>
<td>6 LAND USE/LAND COVER MAP</td>
<td>1: 500,000</td>
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<tr>
<td>6 GENERAL SOIL MAP</td>
<td>1: 594,000</td>
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<tr>
<td>6 GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<tr>
<td>6 SAVANNAH RIVER SITE TOPOGRAPHIC MAP</td>
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<tr>
<td>6 SAVANNAH RIVER SITE LITHOGRAPH</td>
<td>1: 100,000</td>
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<tr>
<td>1 State Map of Major Drainage Basins Figure 1-2</td>
<td></td>
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<tr>
<td>6 Wipe-off Pens</td>
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</tbody>
</table>

PERFORMANCE TASKS

(Icon Key) Overview = ➔; Science = ★; Math = ☰; History = ☰; Language Arts = ☰

1. **Locate the study site.** ➔ ★
   Locate the Savannah River Site Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2 "State Map of Major Drainage Basins."

2. **Locate features and place names.** ➔
   Locate the following well-known landscape features on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP: Par Pond, L Lake, Savannah River, Lower Three Runs Creek, Upper Three Runs Creek, site of old Ellenton, town of New Ellenton (unlabeled, but just north of Johnson Crossroads on the top border of the map, just left of center), the five reactor sites (C, L, K, P, and R), and the pump stations near the Savannah River. How many of these features can you find on the SAVANNAH RIVER SITE LITHOGRAPH? Explain how you were able to locate each feature. Using the topographic map, determine the elevation of the highest and lowest points shown on the map. Use the scale bar on the map to determine how far the town of New Ellenton (use the location of Johnson Crossroads) is from the town of old Ellenton.

3. **Categorize four types of lakes found on site.** ☰
   Four different types of lakes occur within the boundaries of the Savannah River Site: oxbow lakes, Carolina Bay lakes, artificial reservoirs, and rectangular holding ponds. Using the SAVANNAH RIVER SITE TOPOGRAPHIC MAP, locate twelve bodies of water contained completely within the SRS and categorize each as one of the four types. Each group should calculate the percentage abundance of each type based on their own data. Groups should then combine their data to form a class dataset (being sure to eliminate duplicate lakes) from which percentage abundances can again be calculated. Which calculation, group or entire class, will produce the most reliable conclusion? Explain why.
4. **Examine the Savannah River floodplain.**

Examine the Savannah River floodplain on both the **SAVANNAH RIVER SITE LITHOGRAPH** and the **SAVANNAH RIVER SITE TOPOGRAPHIC MAP**. Note how the state boundary shifts. Which side of the river floodplain has high bluffs? Examine other streams in the area and note on which side bluffs occur. Is there a pattern to the location of bluffs? If so, try to explain it. If not, explain why bluffs occur at all in this area. Locate the town named for the bluffs.

5. **Trace drainage patterns within the Savannah River Site.**

Use a wipe-off pen to trace all drainage paths on the **SAVANNAH RIVER SITE TOPOGRAPHIC MAP** within the SRS boundaries. Into what large river do most of these streams flow? Divide your drainage pattern into individual watersheds for all of the major named streams using the larger tip wipe-off pens. Which stream (other than the Savannah River) has the largest watershed? Which has the smallest? What percentage of the rain falling on the SRS stays within the site boundaries all the way to the Savannah River? Is this answer higher or lower than you expected? Why?

6. **Examine influence of fault lines on topography.**

Refer to Figure 5A-3, "Geologic Cross Section of SRS" and Figure 5A-4 "Map View of SRS Showing Location of Faults." Trace with a wipe-off pen the approximate surface position of the major geologic rock unit contacts (boundaries) and all major fault lines onto the **SAVANNAH RIVER SITE TOPOGRAPHIC MAP** and the **SAVANNAH RIVER SITE LITHOGRAPH**. Is there any evidence that surface landform features are affected by contacts between rock units or by faults? Can you locate a particular rock unit or a fault by looking for characteristic landscape features or other surface evidence? If so, explain how; if not, explain why there is no such evidence.

7. **Determine number of fire towers needed to view all of the SRS.**

You are in charge of fire prevention at the Savannah River Site. This is an important function in an area so heavily forested. As part of your job, you need to construct a series of fire towers so that the entire area (except for Lower Three Runs Creek Corridor) is protected. Fire towers obviously need to be located on high ground so the observer can get a good view. Assume that on an average day, an observer can see 15 miles. Determine how many towers you will need to build to completely cover the land within the SRS. Locate these points on the **SAVANNAH RIVER SITE TOPOGRAPHIC MAP** and use a compass to draw circles, with a 15 mile radius, around each tower. Could you get by with fewer towers if you positioned them differently? Is it absolutely necessary that every square foot of SRS be covered? Discuss within your group and then debate with the rest of the class the question, "How many towers do we really need to build?"

8. **Analyze the circular shape of the Savannah River Site.**

Examine the shape of the Savannah River Site as shown on the **SAVANNAH RIVER SITE TOPOGRAPHIC MAP**, the **SAVANNAH RIVER SITE LITHOGRAPH**, and the **LAND USE/LAND COVER MAP**. Speculate as to why the site appears circular. Determine the area of the Site (ignoring the Lower Three Runs Creek Corridor section) by one of the suggested methods. Compare your answers. Which answer do you think is more precise? Explain. Then calculate the approximate percentage
of South Carolina covered by the Savannah River Site (recall that the total area of the state is 31,000 square miles).

**Group I** - use transparent grid overlay, count squares and convert to square miles

**Group II** - use the formula for area of a circle ($A= \pi r^2$) to calculate square miles

9. **Compare land use inside and outside of the site boundaries.**
   Use the transparent grid overlay and the SAVANNAH RIVER SITE LITHOGRAPH to determine the percentage of the site that is covered by water, the percentage covered by buildings and other artificial facilities, and the percentage covered by forest. Are these percentages similar to what you would find outside of the site boundaries in nearby sections of the Coastal Plain Region?

10. **Plot earthquake danger zone and analyze damage potential.**
    Locate the Pen Branch Fault on Figure 5A-4, "Map View of SRS Showing Location of Faults." With a wipe-off pen, draw this fault as a solid line on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP. Also draw two dashed parallel lines one mile away from the fault on each side. This corridor between the dashed lines represents the major danger zone if an earthquake should occur along this particular fault. How many reactors fall within the danger corridor? What types of damage would you expect here if an earthquake did occur? What other artificial and natural land features might be affected?

11. **Analyze the highway network within the Savannah River Site.**
    Examine the highway system on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP. How are different routes designated on site? Locate the security gates (barricades) at either end of the main highway and along side roads entering the site. Why are there so many gates? Why didn't they just close all of the roads except one or two? Locate the cloverleaf intersection near Reactor B. This was the first cloverleaf intersection ever constructed in South Carolina. Why does the Savannah River Site need a cloverleaf intersection?

**ENRICHMENT**

1. **Research earthquake hazard potential in your local area.**
   Contact the state geological survey or local agencies to find out your local area’s earthquake hazard potential. Consult geologic maps to locate any fault lines or fault zones that pass through your town or county. Consult historical records to determine if earthquakes have ever been recorded in your town. Are there any landforms in the area that resulted from earthquake or fault activity?

2. **Research security procedures at the Savannah River Site.**
   Write to the Savannah River Site to ask about their security procedures and why they need to be so careful about unauthorized people entering the site. Find out the requirements for obtaining a visitor's pass to visit the facility and make a list of buildings and areas open to visitors versus those that are not. Find out whether security measures have increased or decreased over the past ten years and what they expect security levels to be in the next ten years.
Activity 5A-2: Land Use Changes

Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE BASE MAP #2: WITH HIGHWAYS</td>
<td>1: 500,000</td>
</tr>
<tr>
<td>LAND USE/LAND COVER MAP</td>
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</tr>
<tr>
<td>GENERAL SOIL MAP</td>
<td>1: 594,000</td>
</tr>
<tr>
<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
<td>1: 1,000,000</td>
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<tr>
<td>SAVANNAH RIVER SITE TOPOGRAPHIC MAP</td>
<td>1: 48,000</td>
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<tr>
<td>SAVANNAH RIVER SITE LITHOGRAPH</td>
<td>1: 100,000</td>
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<tr>
<td>Wipe-off Pens</td>
<td></td>
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</tbody>
</table>

PERFORMANCE TASKS

(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts =

1. **Correlate land use to topography.**  
   Look carefully at the **SAVANNAH RIVER SITE LITHOGRAPH**. Identify farm fields, small towns or communities, roads, and developed and undeveloped land. See how well you can identify the same features on the **SAVANNAH RIVER SITE TOPOGRAPHIC MAP**. Look at the pattern of agricultural fields in the infrared lithograph. Why are these fields located where they are? Are most fields generally located next to streams or farther away from them? Refer to the **LAND USE/LAND COVER MAP**. How many of the land use categories can be recognized on the state map? Identify sources of non-point source pollution associated with each land use. Look at the **GENERAL SOIL MAP** and determine if the soil categories inside the Savannah River Site are any different from soil categories outside its boundaries.

2. **Analyze land use changes through time.**  
   Compare physical features (man-made) found on the **SAVANNAH RIVER SITE TOPOGRAPHIC MAP** and the **SAVANNAH RIVER SITE LITHOGRAPH**. Some features will appear on the map but not on the satellite image. Other features appear on the satellite image but not on the map. What date was the map printed? What date was the satellite image obtained? Use a wipe-off pen to circle as many features as you can find that are visible on the satellite image but are not shown on the map. Next use a different color wipe-off pen to circle as many features as you can find on the map that are not visible on the satellite image. Select any four of your circled features and explain why you think each change occurred and how that change might have affected the natural environment.

3. **Compare old Ellenton town site with current landscape.**  
   Locate the site of the old town of Ellenton on the **SAVANNAH RIVER SITE TOPOGRAPHIC MAP** and the **SAVANNAH RIVER SITE LITHOGRAPH**. Look at the lithograph inset maps and compare the old black & white photograph with the modern color infrared photograph. Identify any 1951 structures that are still visible in the 1994 photo. Also refer to Figure 5A-1, "Topographic Map of Old Ellenton." How much of the former town is still visible on the lithograph inset? How has the surrounding natural landscape changed during that same time? Do you see any evidence of reforestation? Use a magnifying glass to focus on the color infrared inset of the town. List any evidence of past civilization that you can see. Trace with a wipe-off pen the street pattern of old Ellenton from Figure 5A-1, "Topographic Map of Old Ellenton," onto the color infrared lithograph inset. Use the pond and the railroad tracks as guides for tracing. Which streets still exist? Which
ones were abandoned? What happened to the structures (buildings, etc.)? What determined which structures would be moved and which would simply be abandoned? Are there any new streets or buildings in the old town site?

4. **Write story about proposed archeological dig.**

Your school archeology club is making plans to perform an archeological dig at the old town site of Ellenton, inside the Savannah River Site. Predict the types of artifacts you might find there. Then write a story about your prospective trip to Ellenton and include a detailed description of the people you think might have used the artifacts you found. Try to recount some event in the lives of those people that might have related to the relocation of the town.

5. **Compare towns of old Ellenton and New Ellenton.**

Locate the site of the abandoned town of Ellenton on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP and on the SAVANNAH RIVER SITE LITHOGRAPH. Also locate the Town of New Ellenton on the lithograph and on Figure 5A-2, "Topographic Map of New Ellenton" (note that New Ellenton is just off the north edge of the SAVANNAH RIVER SITE TOPOGRAPHIC MAP). Compare information about the two town sites and then fill in the following chart. Make intelligent guesses when you are unable to get exact data. How far apart are these two town sites?

<table>
<thead>
<tr>
<th>specific feature</th>
<th>old Ellenton</th>
<th>New Ellenton</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of streets in town</td>
<td></td>
<td></td>
</tr>
<tr>
<td>geometric pattern of streets (describe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>total number of buildings in town</td>
<td></td>
<td></td>
</tr>
<tr>
<td>average sizes of buildings (in general terms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>proximity to railroad (land transportation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>access to river (water transportation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of buildings that are business/commercial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>estimated total population of town (assume average of 2.5 people per house)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. **Explain distribution of cemeteries.**

Look carefully at the SAVANNAH RIVER SITE TOPOGRAPHIC MAP. Locate as many cemeteries as your group can find in two minutes and mark these locations on the map. Are the cemeteries clustered in one geographic area or are they more spread out over the entire site? Explain the reason for this distribution. Why are there so many cemeteries here? Why were the cemeteries near Ellenton not moved when the town of Ellenton was moved?

7. **Create poster expressing emotions of leaving home town.**

Think about what your family and community would do if you were forced to sell your home and relocate because of a major public project such as a reservoir, power plant, nuclear waste depository, or environmental preserve. How would you feel? How would you react? Would it make a difference if you agreed with the need for the public project? What things would you take with you? What things would you have to leave behind? Read some of the comments of the citizens of Ellenton recorded in the two stories "The Move of Ellenton" on page 5A-3 and "The Sign at Ellenton" on page 5A-5. Compose some short slogans or phrases that might fit on a banner or a poster expressing your feelings about leaving your home town. Why do you think
that the relocated citizens chose the name "New Ellenton" for their town, instead of giving it a completely new and completely different name?

8. **Interpret and use the Savannah River Site grid system.**

   The Savannah River Site uses a unique grid system to identify exact locations of buildings and other features. Place the transparent grid overlay on top of the SAVANNAH RIVER SITE TOPOGRAPHIC MAP so that a center line on the overlay exactly lines up with the railroad track near the former town of Ellenton. Notice how all of the facilities and most of the roads line up parallel to this grid system. Mark these features on the overlay with a wipe-off pen. Examine the numbering system used for the grid and locate the origin line (zero line) for both the vertical and horizontal directions. In what state (Georgia or South Carolina) does the origin point (zero, zero) lie? Why do you think they chose this point as an origin? Why do you think they needed a separate grid system for the Savannah River Site? Why do you think the main railroad line ended up parallel to the vertical grid direction?

   Locate the following features and give coordinates in the SRS system

<table>
<thead>
<tr>
<th>feature</th>
<th>Savannah River Site coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>center of town of old Ellenton</td>
<td></td>
</tr>
<tr>
<td>site of reactor L</td>
<td></td>
</tr>
<tr>
<td>center of Pond B</td>
<td></td>
</tr>
<tr>
<td>location of Johnson Crossroads (near New Ellenton)</td>
<td></td>
</tr>
<tr>
<td>area H</td>
<td></td>
</tr>
<tr>
<td>approximate center of the Savannah River Site</td>
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9. **Design site layout for new tritium reactor.**

   Make plans to add a new tritium reactor at the Savannah River Site. Select the best spot to locate the facility and mark it on the map with a wipe-off pen. Be sure you are at least three miles from any existing site. Add roads, railroad sidings, etc. as needed. Be sure your facility, roads, etc. all line up properly with the Savannah River Site coordinate system (grid). Why is it important to be at least three miles from other sites? Justify your specific site selection. Compare it with other groups.

10. **Calculate average cost per acre of land bought by Savannah River Site.**

    The Federal Government spent 19 million dollars to purchase all of the land now part of the Savannah River Site. Calculate the average cost per acre of this land using an estimated value for total land area of 300 square miles. Would you expect all land to have the same value? Outline areas on the SAVANNAH RIVER SITE LITHOGRAPH that you would expect to have much higher than average land value. Using a different color wipe-off pen, outline areas you would expect to have the lowest land values. Refer to the black & white photo lithograph inset to determine the area of the average size farm at the time the land was purchased.
11. **Select an alternate site in SC with same characteristics as SRS.**

The Savannah River Site was chosen for four major reasons: it had a large and dependable water supply, it had a large, relatively flat land area, it had good transportation (railroads and river) available, and it was sparsely populated land but yet close to some large cities and towns. If the Department of Energy had to locate a similar facility somewhere else in South Carolina today, where would they put it? Use the **LAND USE/LAND COVER MAP** and the two **SATELLITE IMAGES** to determine the location that would best meet the four conditions listed above. Share your results and your reasons with the class or other groups.

12. **Plan best use for Savannah River Site after government returns it.**

Sometime in the future, the United States government may wish to completely shut down the Savannah River Site. If this happens, the land will be given back to South Carolina. What use would you recommend for this land? Study the topographic map and lithograph carefully before writing down your plan. Be prepared to debate your plan with other groups.

**ENRICHMENT**

1. **Research the stories of other abandoned towns located within the SRS.**

   Research the history of the Savannah River Site to identify other towns that were abandoned and/or relocated during the time this facility was being built. List similarities and differences between the experiences of these other towns and the Ellenton situation.

2. **List artifacts already discovered at SRS.**

   Contact the Savannah River Site to find out what artifacts have really been discovered at the site.

3. **Compare earnings in 1951 with today's value.**

   Consult an almanac or other resources to determine how much money an average family earned on an average size farm. Assuming that a 1951 dollar is worth two hundred of today's dollars estimate what that amount of money would be worth today. Would that be enough money to relocate your home to a different place? Explain your answer.
Activity 5A-3: Contamination and Remediation

Materials

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PERFORMANCE TASKS

(Icon Key) Overview = ☑; Science = ☑; Math = ☑; History = ☑; Language Arts = ☑

1. **Analyze the newspaper article. ☑**
   Read the newspaper article on page 5A-1, "SRS Cleanup Could Harm Ecosystem, Scientist Said." Explain how the story relates to the Coastal Plain Landform Region. Identify a possible location on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP (refer to the SAVANNAH RIVER SITE LITHOGRAPH if needed) where the story could have taken place. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same people as characters and the same location as your setting, write another newspaper article related to this incident, but date it either before or after the given story occurred. Choose a title and draw an appropriate picture to illustrate your main point.

2. **Trace cycle of water use for reactors at SRS. ☑ ☑ ☑**
   One of the reasons the Savannah River Site is located where it is relates to the availability of large quantities of water. Originally, water was pumped from the Savannah River through a series of pipes to the different reactor buildings. The waste water was then contained in a holding pond until it cooled and was then released through the natural stream drainage system back to the Savannah River. Divide into groups. Each group should select one of the reactor sites (R, P, K, L, C) and trace on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP with a wipe-off pen the route of the cooling water circulation system beginning at the Savannah River.

3. **Recommend locations for monitoring and treatment wells. ☑**
   Where would you place a well to remove water and reinject it into a seepage area? How far from the pollution source would the remediation well have to be placed in order to effectively deal with the problem? Refer to Figure 5A-3, "Geologic Cross Section of SRS."

4. **Analyze the pollution potential for tritium in groundwater. ☑ ☑**
   Locate Burial Ground in 'E' area and also the 'F' and 'H' Seepage Basins on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP. Assume that most of this seepage ends up in the groundwater system. The average flow rate for groundwater in these rock units is 2 meters per day. Assuming that most of this groundwater will eventually reach the Savannah River, calculate the amount of time it will take the contaminant to reach the Savannah River. If the pollutant is tritium, which has a half-life of 12.3 years, how much tritium will actually reach the Savannah River, and will there be a significant pollution problem once it gets there? Explain and justify your answer.
5. **Locate evidence of hot water discharge.**

In 1990 scalding hot water was accidentally released from Reactor K into Pen Branch Creek. Locate this reactor and trace on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP the flow of hot water down the creek to the Savannah River. What effect would the hot water have on stream habitat? How would it affect the animals in the creek and the surrounding area? Look at the SAVANNAH RIVER SITE LITHOGRAPH to see if you can determine any difference in vegetation along this creek compared to surrounding areas. How long would you expect complete recovery to take? Justify your answer.

6. **Trace route by which contamination entered Par Pond.**

Locate Par Pond on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP and the SAVANNAH RIVER SITE LITHOGRAPH. Trace the route by which you think contamination entered Par Pond. What type of contamination would you expect to occur, based on surrounding land use? Trace the outflow of Par Pond all the way to the Savannah River. Why was the small strip of land on either side of the creek included as part of the Savannah River Site? How far (average distance) from the creek does the Savannah River Site own? Why didn't they need to buy up land farther from the stream? Could they have purchased an even smaller amount of land? Explain.

7. **Calculate amount of newly exposed land from lake drainage.**

The Savannah River Site lowered the water level in Par Pond in 1991 in order to repair the earthen dam. If they lowered the water level a total of 10 feet, how much new land would be exposed? Outline on the SAVANNAH RIVER SITE TOPOGRAPHIC MAP the new shoreline representing the new lake level. Then, use the transparent grid overlay, or other method, to calculate the area of the newly exposed land.

8. **Document environmental effects of lowering lake level.**

Discuss the environmental effects of lowering the level of Par Pond. Divide into groups and list the pros and cons of cleaning up the sediment exposed by lowered lake level versus leaving it alone and raising lake level back to normal. Write up a 'position paper' summarizing your group's consensus in solving this problem. Use a technical writing style to convey the most amount of information in the shortest narrative.

9. **List potential pollution problems for animals.**

You are an animal (pick one of your choice) living on the Savannah River Site. Pick a location on the SAVANNAH RIVER TOPOGRAPHIC MAP where you might likely be living. Outline your day's activities and explain where and when you might run into possible soil or water contamination. Mark these spots on the topographic map and make a list of potential problems and how to avoid them. How many will your chosen animal be able to avoid?
ENRICHMENT

1. **Research tasks of reactors at SRS.**
   Write to the Savannah River Site for information on what tasks each reactor performed. Categorize the reactors based on their function. Which reactors are still actively functioning today? Which are expected to become active in the future?

2. **Research the process of vitrification of waste in borosilicate glass.**
   One of the methods for storing nuclear waste is vitrification, encapsulating the waste into glass pellets. Some of this work is done at the Savannah River Site. Research this method to determine the requirements for vitrification and explain why the facilities at the Savannah River Site are appropriate for this project.

3. **Compare reactors at SRS with those at Chernobyl.**
   The Chernobyl reactor incident in the former Soviet Union was one of the worst nuclear accidents anywhere on earth. Compare the reactors at the Savannah River Site to the reactors at Chernobyl. Could such a disaster happen at the Savannah River Site? Research your answer and present your findings to the class.

4. **Investigate the properties and uses of tritium.**
   Tritium is important for the production of thermonuclear weapons. Investigate the properties of tritium. Why is it dangerous? How long will tritium remain radioactive? What are the products of its decay? What safety precautions are being taken at the Savannah River Site to deal with tritium contamination of water?
**THE ITEM**

March 10, 1991

Swamp Fox Battalion Returns With Pride

by Erika Bolstad

“Swamp Fox” for out-maneuvering British troops in the swamps west of Charleston.

Marion’s battalion was made up of partisan volunteers from Georgetown, Andrews, Lake City, Hemingway and Manning. Today, the battalion’s units are located in the same towns.

The battalion was decommissioned and reorganized as the 178th Combat Engineer Battalion two years ago.

“There was much wailing and gnashing of teeth,” said battalion commander Lt. Col. Henry Richardson of Sumter, a member of the National Guard since 1969 and part of the Swamp Fox battalion since the early 1970’s.

Richardson and other battalion supporters did some politicking for the historic unit’s return, Richardson said, and it paid off. The unit doubled to about 900 strong, and it will receive and train with new weapons.

During Sunday’s ceremony, the battalion’s colors were uncased and returned to service. Richardson’s daughter, Elisa, returned the streamers, evidence of the unit’s 200-year history. It’s also one of the few units on the Army’s rolls that is allowed to have a “nom de guerre,” its Swamp Fox nickname, Richardson said, which reflects the “spirit of the 4th.”

The battalion boasts the most sustained days in combat --585 in World War II-- and the largest amount of artillery fire --158,687 rounds-- in combat of any field artillery unit, either active or reserve.

<table>
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<th><strong>RATIONALE</strong></th>
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<tr>
<td>The Santee Cooper Study Site encompasses an unusually large area of South Carolina's Coastal Plain, but this level of coverage is necessary to highlight the importance of the role of engineering in managing the state's water resources and water transportation routes. From the early days of canal building, when the Old Santee Canal was constructed to provide a water connection between the Cooper and Santee rivers, to the modern Diversion and Rediversion canals connected to Lakes Marion and Moultrie, South Carolinians have tried to connect the city of Columbia, at the Fall Line Zone, with the port of Charleston, at the Atlantic Ocean. Today, this effort is more likely to be focused on tourism than on commerce, but the need is still present. The Santee Cooper site provides perspective on both the natural and geologic obstacles to constructing reservoirs and canals and the cultural and historical implications of such large projects.</td>
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The Old Santee Canal

Part of the appeal that canals have always had for South Carolina lay in completing a dream that had persisted since Maurice Matthews noted in 1683, "the rivers are roads into the interior of this world." From such dreams came the thought and the notion that Columbia could be a port open to ocean-going ships, a notion that had existed from that city's founding. Merchants in Charleston also had a vested interest in providing a shorter route for goods from the upstate to reach their port. Historian David Duncan Wallace observed in 1934 that "grown men have dreamed of sailing ocean-going ships on streams that they waded across as children."

The first attempt to link Columbia and Charleston by connecting the Santee River with the Cooper River occurred during the 1790's when Charleston merchants finally agreed on a route which would allow commercial boat traffic to bypass the Santee Delta and Atlantic Ocean on the way from Columbia to Charleston. They contracted with Swedish immigrant Col. J. C. Senf to oversee the engineering work for the 22 mile long, 35 foot wide canal. Although only a few feet deep in most places, the canal was designed to accommodate vessels carrying up to 22 tons of freight. Construction took seven years (1793-1800) and cost $650,000. The canal was finally opened to boat traffic in 1801 and cotton boats began to take full advantage of the new route almost immediately. Commercial use of the canal peaked around 1830. After that date, the rapid construction of new railroad lines began to siphon off much of the cotton traffic bound for Charleston. The canal was finally rendered obsolete by the construction of even more efficient railroad lines and its charter was revoked in 1850.

Today, parts of the canal are preserved in Old Santee Canal State Park near Monck's Corner. The original locks and much of the original canal itself have been destroyed by the construction of Lake Moultrie and the modern Tailrace Canal in the Santee Cooper project, but a replica of one of the locks is preserved in the Visitor Center and canoe rentals are available for visitors wishing to paddle along a short stretch of the original route. Also, a small portion of the upper reaches of the canal is visible between Lake Marion and Lake Moultrie near Eadytown, but it no longer holds enough water to be navigable.

Santee Cooper Project

The dream of connecting Columbia and Charleston was resurrected in the early 1930's during the Great Depression. As a result of publicity about the success of the government sponsored Tennessee Valley Authority (TVA), the backlash against private utility companies unleashed by the economic collapse of 1929, and the demand to spread the use of electricity into rural areas, the 1930's saw many plans for power plants drafted throughout the country. Most of these plans never materialized because the thought of public power agencies raised the specter of socialism in the minds of many political critics. Of the three such projects planned for South Carolina (on the Savannah River, on the Broad River, and to connect the Santee River with the Cooper River), only the Santee Cooper Project, authorized in 1934, was ever built. In this project the United States Army Corps of Engineers retraced in part the route of the original Santee Cooper
Canal that had gone into service in 1801. This time, however, the massive project that was to produce power and to divert both water and, hopefully, water transport, from the Santee River to the Cooper River (and, ultimately, to Charleston's harbor), proved much more successful.

The Santee Cooper complex, operated by the South Carolina Public Service Authority since 1942, originally consisted of Lake Marion, Lake Moultrie, the Diversion Canal which connects them, and the Tailrace Canal. Two major purposes of the project were to bring affordable electric power to the rural population and to provide flood control. A side benefit would be the expansion of recreational opportunities for the region. The project was financed with federal grants and federally-backed loans. In 1934, the state legislature chartered the South Carolina Public Service authority which was to supervise the construction and operation of the Santee Cooper project. Private utilities attempted to block the new project but failed, and construction began in April of 1939. Near Pinopolis, workers built 42 miles of dams and dikes, including a 26 mile long earthen dike. The waters impounded by this system of dams became Lake Moultrie. The Pinopolis dam also included a hydroelectric station capable of generating 128 megawatts of electricity and a navigation lock. A lock was built to lift barges and boats from the Tailrace Canal to Lake Moultrie.

A further goal of flood control on the Santee River was accomplished just to the north of Lake Moultrie by constructing an eight mile long earthen dam across the river channel with a 3,400 foot long spillway. Lake Marion was created behind this dam. A six and one-half mile Diversion Canal was built to connect the two lakes and to allow excess water from the Santee to enter the Cooper River system. Over time, however, the Santee Cooper project led to increased silting in Charleston's harbor, and a Rediversion Canal was later built from Lake Moultrie back into the original Santee River bed downstream from the dam.

The entire Santee Cooper project was completed in only two years, six months, and twenty-one days. In completing the project 171,000 acres of swamp and timberland had been cleared, 42 million cubic yards of earth had been moved, and 3.1 million cubic yards of concrete had been poured. The Santee Cooper project was the largest earth clearing project in the history of the United States. The completion of the project dramatically improved the lives of thousands of South Carolinians. Before Santee Cooper, less than 2.5 percent of rural citizens had electricity, but, by the late 1940's, 91 percent of rural residents had electricity in their homes and Santee Cooper was providing electricity for 35 of the state's 46 counties. Moreover, the construction of Lake Marion and Lake Moultrie created new recreational and business opportunities for an economically depressed part of the state. Even though large locks were made a part of the dam complex at Pinopolis, few commercial boats ever use them.
Bubba and the Big Fishing Hole
By Jody Tinsley

When Bubba was a baby, he was a big, big baby. It took a whole herd of cows to keep him in milk. A cotton mill near the Fall Line Zone ran extra shifts to make his diapers. When he’d cry, folks thought it was a hurricane; his laugh was a thunderstorm.

As he grew up, thank goodness, he learned to control himself. He smiled instead of laughing and frowned instead of crying. He’d nod his head gently or shake it softly rather than saying “yes” or "no" just to keep the noise down around the house. He walked slowly and carefully so as not to bump into the church and knock off the steeple or squash the farm animals.

But one thing he couldn’t control was his appetite. It wasn’t big. It wasn’t huge. It was enormous. His family had a special corn field just to grow his grits. He got permission to pick poke salad and blackberries from the roadsides in five surrounding counties (which saved the counties a lot of money in road maintenance fees). And Bubba hunted and fished to keep himself fed.

He had a dozen hunting dogs which he kept in a box in his shirt pocket. He let them out, and they would help him catch about 25 deer or 150 rabbits or so, which was just enough to make him a nice lunch or light supper. But the other hunters in the area didn’t much care for Bubba’s hunting trips. They liked Bubba, but they didn’t like him hunting all day.

So Bubba turned to fishing more and more. He’d go to the river and catch about 50 big old catfish and make a catfish stew. But he trampled the banks so much while fishing that he began to feel bad about it. “I need a boat,” he said, softly, “a little canoe.”

He walked to the coast, which took most of the afternoon, and looked for the smallest boat he could fit in. A tug boat was much too little. An old coast guard ship didn’t give him room to stretch out his legs. But a cargo ship was just big enough for him. He threw it over his shoulder, which was a little bit of a strain, and carried it up to his favorite fishing river.

But the boat wouldn’t fit. It was so wide it blocked the river from bank to bank, and when he sat in it the boat stuck fast on the river’s bottom. Even the biggest rivers in the state were too small. He wasn’t getting any fishing done. He was getting hungry and a little angry. “I need some big fishing holes,” he said. “Something really big.” He forgot to whisper, and windows rattled in houses for miles around at the sound of his voice. (One man complained, “Must be one of them danged sonic booms,” but he was wrong.)

Sitting in his boat, blocking the river, watching the water back up upstream of him, Bubba got an idea: "Maybe I can make me some fishing holes, something even big enough for me.”

About the same time, the Army Corps of Engineers and the state of South Carolina decided that South Carolina needed some large reservoirs for power production, flood control, and recreation. The plan was huge, and no one was sure the task could be done. “Can it be done?” they asked. “Can we move that much dirt? Cut that many trees? Build those giant dams and canals?”

These questions were discussed in the newspapers of the day, which Bubba could read using a large magnifying glass, and Bubba knew that he could do the work. He special ordered, by mail, an extra large shovel, the biggest ever made, which was just his size, and he offered his help to the people in charge.
Over the next few months, Bubba worked hard and all the reservoirs anyone could ask for were built. He dug holes; he made dams; he moved earth; he built canals to connect the reservoirs and rivers together. And finally, when the work was done, Bubba slid his boat from Lake Moultrie into Lake Marion, carving out a ditch and creating the Diversion Canal in the process, and he finally relaxed on the open water with his fishing pole. (After all, Bubba was getting older and it wasn’t as easy for him to carry his boat on his shoulder from place to place.) Thanks to Bubba’s invaluable work, the state of South Carolina has the benefits that come from having reservoirs, and Bubba can fish in comfort all he wants. And if you’re ever on Lake Moultrie late at night and hear loud noises like thunder, but without any storm, you’ve probably heard Bubba grumbling about the big one that got away.
Activity 5B-1: Engineering Impact of the Santee Cooper Project

**Materials**

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**PERFORMANCE TASKS**

(Icon Key) Overview = ➤; Science = ⚑; Math = ☰; History = ▶; Language Arts = ❋

1. **Locate the study site.** ➤ ⚑
   
   Locate the Santee Cooper Project Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map, to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Compare Coastal Satellite Image with State Base Map.** ➤
   
   Compare the lithograph entitled COASTAL SATELLITE IMAGE with the STATE BASE MAP #2, WITH HIGHWAYS. Locate Lake Moultrie, Lake Marion, the Pinopolis Dam, and the Diversion Canal. Locate the earthen dams that hold back the waters of Lake Marion and Lake Moultrie. How long is the straight segment of the Lake Marion Dam? Use the scale bar on the lithograph to determine your answer. Locate the Tailrace Canal, which connects Lake Moultrie with the Cooper River. This canal replaced most of the original Old Santee Canal. Why do you think they needed to build a new canal? From the Lake Marion Dam, follow the Santee River floodplain to the Rediversion Canal (only visible on the satellite image) coming off the north side of Lake Moultrie. Trace on the map, with a wipe-off pen, the pathway of the Rediversion Canal (passing a little to the north of Russellville near St. Stephens). How long is the Rediversion Canal? Why was it built?

Identify the city of Charleston and the Ashley and Cooper rivers. Follow the Cooper River up to the Tailrace Canal, Lake Moultrie, and Lake Marion. Continue on down the Santee River to the Santee Delta, which is the largest delta on the East Coast. North Island, Waccamaw Neck, and Georgetown are on the right edge of the lithograph. Look for the junction point of the Wateree and Congaree rivers. Part of the city of Columbia is just visible in the upper left-hand corner of the lithograph. Also visible on the top edge of the satellite image is Shaw Air Force Base. Interstates such as I-26 and I-95 can be readily identified along with a number of US highways.
and secondary roads. Along the Coastal Zone notice the striations. These are remnants of beach ridges caused by wave action along coastal shorelines a long time ago.

3. Analyze land use changes through time. 🌍
Look in the margins of the COASTAL SATELLITE IMAGE and the STATE BASE MAP #2, WITH HIGHWAYS, to determine the year the map was printed and the year the satellite image was produced. Examine each cartographic product carefully to identify any changes which have occurred during the interval. How many of these changes are manmade? How many have occurred naturally? Does the small scale of both the map and satellite image make it easier or harder to recognize changes? Explain your answer.

4. Analyze the newspaper article. 📝 📤
Read the newspaper article on page 5B-1, "Swamp Fox Battalion Returns With Pride." Explain how the story relates to the Coastal Plain Landform Region. Identify on the STATE BASE MAP #2, WITH HIGHWAYS, (refer to the COASTAL SATELLITE IMAGE if needed) where the places and events named in the story might be located. Explain why the publisher thought this story might be of interest to newspaper readers. Using the same people as characters and the same location as your setting, write another newspaper article related to the same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

5. Trace navigation route, Charleston to Lake Marion. 🌍 🛥️
Trace with a wipe-off pen on the STATE BASE MAP #2, WITH HIGHWAYS, the route a ship captain would have to follow to get his cargo from the port of Charleston to the I-95 bridge over Lake Marion. List of all the man-made improvements, and other changes from the natural setting, that you would see from the ship while traveling this route. What kind of cargo might this ship be carrying? What kind of cargo might a similar ship have been carrying 50 years ago? 100 years ago? 150 years ago?

6. Trace Santee River System, calculate travel distance. 🌍 🛥️
Using the STATE BASE MAP #1, SHADRED RELIEF, and beginning with the headwaters, review names of the rivers flowing through South Carolina that make up the Santee River system. Outline with a wipe-off pen the approximate boundaries of the watershed area that depends on the Santee System for drainage. List several ways that water from the Santee system is used. The Santee River system has several prominent reservoirs. Identify the tributary river systems for each reservoir. Why were the reservoirs built and how are they used? What effects do these reservoirs have on the Santee delta? Where are the sediments deposited that would have normally been deposited in the delta?

Once water in the Santee River system reaches Lake Marion, there are three pathways by which that water can reach the Atlantic Ocean. Divide into three groups to trace the different pathways on the COASTAL SATELLITE IMAGE. Describe what you will see on your way to the coast. How much of what you see is natural versus man-made? How fast would you be able to travel? What is your total distance from Lake Marion to the Ocean? What obstacles might you run across in your journey?
Each group should report its conclusions to the rest of the class. Discuss why these different courses exist. Which pathway would you choose if you were paddling to the ocean in a canoe? Explain your answer.

**Group I**  
Over Lake Marion spillway, down Santee River to Ocean

**Group II**  
Through Diversion Canal to Lake Moultrie to Tailrace Canal to Cooper River to Ocean

**Group III**  
Through Diversion Canal to Lake Moultrie to Rediversion Canal to Santee River to Ocean

7. Write story about legendary superhero.  
Using the story "Bubba and the Big Fishing Hole" on page 5B-4 as a model for your group, select a public works project either in your neighborhood or somewhere within South Carolina and create a legendary superhero who can do the job quickly and easily. Construct a story in which your superhero comes to save the day and finish the project. Be sure to give your superhero an appropriate name. Why do we like stories about people who can quickly accomplish things that would take regular workers a very long time to finish? Share your stories with other groups both in writing and orally. Make a list of character traits that all of your different superheroes have in common.

**ENRICHMENT**

1. Research Old Santee Canal route options.  
Write to the Old Santee Canal State Park office and ask for information about the different original routes proposed for the project. List the pros and cons of each route and explain why the selected route was chosen.

2. Research literary examples of superheroes.  
Go to your local school or community library and look up as many legends and stories about superheroes as you can find. Match the superheroes with the particular industry or occupation they represent. Obvious examples would be Paul Bunyan with the timber industry, or John Henry, the "steel driving man," with railroads. See how many others you can identify. Give class reports about the most interesting examples you find.
SECTION 6

COASTAL PLAIN REGION / RIVER FLOODPLAINS

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      - locate river floodplains and characterize topography ➔ ◘
      - identify major South Carolina rivers and floodplains ➔
      - determine percentage of state draining into swamp ☐
      - identify features upstream which might cause pollution ➔ ◘
      - trace Alonzo's Jackson's route and write account of escape Ⓡ ☒
p. 6-16 6. trace possible escape route for slaves on Underground Railroad
p. 6-16 7. explain location of agricultural areas near swamp
p. 6-16 8. analyze railroad's effect on town of Gadsden

- Enrichment
p. 6-16 1. research how Four Holes Swamp got its name
p. 6-16 2. draft letter about protecting swamps
p. 6-16 3. explain soil productivity.

- STUDY SITE 6A : CONGAREE SWAMP (PRISTINE FOREST)

- Rationale

- Brief Site Description
p. 6A-2 - Tall Trees
p. 6A-2 - State and National Champion Tree Selection
p. 6A-3 - story - "Directions for Nominating Big Trees"
p. 6A-4 - figure 6A-1 - "Champion Trees Located in the Congaree Swamp National Monument"
p. 6A-4 - Ecological Factors Affecting Tree Size
p. 6A-5 - Life Along a Floodplain Swamp
p. 6A-5 - story - "Interview with Mr. Booker T. Sims"
p. 6A-6 - story - "The Legend of the Sturgeon in Weston Lake"
p. 6A-6 - Legends and Tales of the Congaree Swamp
p. 6A-6 - story - "The Big Swamps of the Congaree"
p. 6A-7 - story - "Spirit Dogs and Barking Snakes"
p. 6A-8 - story - "A Freshet on the Congaree"
p. 6A-9 - story - "Jack-Ma-Lantern"
p. 6A-9 - The Naming of the Swamp
p. 6A-10 - Early History of Congaree Swamp
p. 6A-10 - Reclaiming of Swamp Land
p. 6A-11 - The Lumber Industry in Congaree Swamp
p. 6A-11 - Establishment of Congaree Swamp National Monument

- Activity 6A-1 : Meandering Rivers and Geologic Change

- Materials

- Performance Tasks
p. 6A-13 1. locate the study site
p. 6A-13 2. locate evidence of river migration
p. 6A-13 3. predict the occurrence of oxbow lakes
p. 6A-14 4. interpret wetness of soils by analyzing vegetation patterns
p. 6A-14 5. outline boundary of national monument
p. 6A-14 6. make topographic profile of bluff and swamp
p. 6A-15 7. analyze and interpret Congaree Swamp flood data
p. 6A-16 8. determine length of Congaree Swamp boardwalk
p. 6A-16 9. estimate time of day of photo by positions of shadows
- Enrichment
p. 6A-17 . . . . . . . . 1. compare modern and ancient maps
p. 6A-17 . . . . . . . . 2. complete table about life habits of five swamp animals
p. 6A-17 . . . . . . . . 3. graph water levels of local river or lake

- Activity 6A-2 : Life in a Floodplain Swamp
- Materials List

- Performance Tasks
p. 6A-18 . . . . . . . . 1. analyze the newspaper article
p. 6A-18 . . . . . . . . 2. where would you look for Native American artifacts?

p. 6A-19 . . . . . . . . 4. graph champion trees vs. normal height trees
p. 6A-20 . . . . . . . . 5. calculate ages and sizes of trees

p. 6A-20 . . . . . . . . 6. write about experience as an old tree
p. 6A-20 . . . . . . . . 7. evaluate the practice of draining swamps for farmland
p. 6A-20 . . . . . . . . 8. compare Sim’s account with "The Big Swamps of Congaree"

p. 6A-21 . . . . . . . . 9. locate possible site for story "A Freshet on the Congaree"

p. 6A-21 . . . . . . . . 10. rewrite swamp tales in your everyday dialect

- Enrichment
p. 6A-21 . . . . . . . . 1. research the history of logging in Congaree Swamp
p. 6A-21 . . . . . . . . 2. identify historical events when trees were seedlings
p. 6A-21 . . . . . . . . 3. document record trees in National Monument
p. 6A-21 . . . . . . . . 4. research Harry Hampton and his stories of Congaree

p. 6A-22 . . . . . . . . 5. find biggest tree in community and calculate formula
POWER THINKING ACTIVITY - "Bobcat Buffet"

Suppose you are a bobcat walking along the highest bluff on the south side of the Congaree River looking for food. Locate this spot on the CONGAREE SWAMP TOPOGRAPHIC MAP and on the CONGAREE SWAMP LITHOGRAPH. You know from past experience that there is a public trash dumpster that you can raid across the swamp where the Southern Railroad line crosses Highway 48. Locate this spot on the topographic map. Sometimes people are not as careful as they should be about how they dump their trash and the site has attracted a small population of plump juicy rats and mice who love to eat the spilled trash whenever they get the chance. Bobcats, on the other hand, always prefer well-fed, tasty rodents for dinner.

But, to get to the dump site you must first swim across the river and make your way through the swamp, all the time being sure to stay out of sight of any people who might want to shoot you. Trace your best route on the topographic map, being very careful to avoid populated areas. How many creeks do you have to swim across before reaching the dump site? How many total miles will you have to travel? What are some of the other animals that you might encounter on this trip through the swamp? What types of vegetation will you see? What kind of natural bobcat food might you find along the way? What would be the best time of day to attempt this crossing? What problems might you encounter? Where would you encounter them? How would you solve these problems?

PERFORMANCE OBJECTIVES

1. Identify and locate major river floodplains in South Carolina.
2. Explain why escaping slaves, fugitives, and others traveling secretly favored river floodplains as hideouts.
3. Predict location and explain process of future oxbow lake development.
4. Estimate time of day by analyzing angles of tree shadows relative to coordinate system of lithographs.
5. Outline historical events leading to establishment and preservation of Congaree Swamp National Monument and other environmentally sensitive sites.
6. Read and practice telling and retelling swamp tales and legends.
7. Graph frequency distribution of record tree heights and other environmental data of floodplain forests.
8. Analyze floodplain landscape features, ecological functions, and ground cover variations relative to differences in elevation and moisture content of soil.
9. Evaluate potential land uses of floodplains to maximize economic gain and minimize environmental impact.
Characteristic Landforms of Coastal Plain River Floodplains

River floodplains represent one of South Carolina's most intriguing and mystifying natural environments. Some would argue that floodplains are synonymous with swamps, but in actuality, a floodplain is composed of several different sub-environments, of which swamps are but one example. While the edges of a floodplain may exhibit steep hills or bluffs, which may rise quite a distance above the river level, swamps themselves contain very few significant areas of topographic relief. They are essentially flat, low-lying, featureless areas broken only by river meanders, oxbow lakes, and slightly elevated parallel ridges, called levees, along river banks. Levees form when swiftly flowing river water overtops the banks, slows down, and drops its coarsest sediment near the river's edge. Also within the floodplains are low swampy depressions called sloughs usually filled with mud. Most of this landscape has been created by the deposition of sediment from flooded rivers as they overtop the levees and spread out over the surrounding bottom land. As the water spreads out, it loses energy and can no longer carry its full load of sediment. The resulting soil, because of all the naturally deposited mineral content, is some of the best in South Carolina.

Geographic Features of Special Interest

Typical Coastal Plain river bottomland is found throughout the Coastal Plain Region of South Carolina and includes the swamps found along the Congaree, Wateree, Santee, Pee Dee, Little Pee Dee, Lynches, Black, Cooper, Edisto, Salkehatchie, Coosawhatchie, and Savannah rivers. The most famous of these is the Congaree Swamp National Monument along the Congaree River, which has been preserved because of its pristine forest and record sized trees. It contains the oldest sizable group of old growth river bottom hardwood trees in the United States and also typifies the rich plant and animal diversity of the floodplain environment.

Other notable sites include Four Holes Swamp, near Harleyville in Dorchester County, and Webb Wildlife Center, near Garnett in Hampton County. Four Holes Swamp flows for almost 60 miles before it empties into the Edisto River. One virgin stand of bald cypress and tupelo gum trees in this pristine wetland is thought to contain the largest such trees in the world. This stand of trees has been preserved as the Francis Beidler Forest and is managed by the Audubon Society as a wildlife sanctuary. The Webb Wildlife Center is located on the Savannah River floodplain and is home to several rare plant and bird species. It is managed by the South Carolina Department of Natural Resources for a variety of land uses, particularly as a hunting and fishing preserve for sportsmen and as an outdoor laboratory for scientists. The Center is also known for its large deer population.
Meandering Rivers and Oxbow Lakes

Coastal Plain rivers are often called lazy or meandering rivers because they wind their way to the ocean, forming curves and loops, called meanders, along the way. Such behavior is favored by the low slope or gradient of the river and the easily eroded Coastal Plain deposits. The rivers flow from side to side, wearing away the outside of the curves and depositing sediment on the inside, thereby forming bends in the channel creating a series of meander patterns on the landscape. This process occurs because river currents flow faster on the outside of curves compared to the inside, just like race car drivers who must drive their cars faster around the outside of a track to keep up with the cars on the inside. Material is eroded from the outside of curves, where the water is flowing faster, and deposited on point bars on the inside of curves downstream where the water is flowing slower. Thus the curvature or bending of the channel creates a U-shaped feature whose curvature is continuously made more extreme through time. Eventually, during high water, the river may swell and flood over the banks, cutting a new straight channel across the narrow neck of a meander and leaving behind a crescent-shaped abandoned meander containing a body of water called an oxbow lake. The term oxbow refers to a curved wooden yoke or collar used to harness oxen. Most Coastal Plain rivers meander extensively across their floodplains and have left behind a large number of oxbow lakes and old meander scars as evidence of their former channel locations.

Figure 6-1: Formation of Oxbow Lakes

STAGES IN THE FORMATION OF AN OXBOW LAKE

<table>
<thead>
<tr>
<th>STAGE 1</th>
<th>STAGE 2</th>
<th>STAGE 3</th>
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</thead>
<tbody>
<tr>
<td>EROSION ON OUTSIDE BANK AND DEPOSITION ON INSIDE BANK BRNGS CHANNEL MEANDERS CLOSE TO EACH OTHER</td>
<td>HIGH WATER OVERFLOWS RIVER BANKS WHERE MEANDER BENDS ARE CLOSEST CAUSING BANKS TO ERODE AWAY</td>
<td>RIVER WATER TAKES NEW EASIER PATHWAY DOWNSTREAM LEAVING OLD MEANDER BEND BEHIND AS A LAKE</td>
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</tbody>
</table>
Geologic Change Through Time in Floodplains

The geological process of stream meandering gradually widens the floodplain as new channels form and new meander bends cut deeply into the adjacent bluffs. Most floodplains contain a large number of old oxbow lakes, some of which are located a considerable distance from the present-day river. However, it is not necessarily true that the oxbow lakes farthest from the present day channel are the oldest. The main river channel may have wandered back and forth across the entire floodplain many times in recent geologic history. A better estimate of relative age is provided by measuring the amount of water still present in the lakes. Many of the older oxbow lakes have partially filled in with sediments and are now grown over with trees. Lakes with deeper open water are usually younger.

An unrelated factor also influences the changing position of the main river channel through time. **Tectonic** uplift in the eastern portion of South Carolina, along what is called the Cape Fear Arch, has caused the landscape surface of the entire state to tilt slightly towards the southwest. Although this uplift is slow enough so that erosional processes are able to keep pace and maintain a relatively level land surface, there is still a slight tendency for rivers in South Carolina to slide to the west over time and preferentially erode their southwestern banks. Partially in response to this effect, most major river floodplains in the state have developed a dominance of high bluffs on their southwestern sides and low flat floodplain deposits on their northeastern sides.

In geologic terms, river floodplains have developed their present day shape and size over millions of years. The physical forces associated with meandering rivers depositing sediments and eroding bluffs on their way to the ocean are never-ending. The large volume of flood water and suspended sediment in the larger rivers (although less now after the construction of major reservoirs upstream from the swamp) greatly enriches the soil in both organic matter and mineral nutrients through the deposition of large amounts of silt and clay. Since the building of dams, less sediment has been supplied to the floodplains, which eventually may result in lower fertility levels for river bottomland soils.
Influence of Topography on Historical Events and Cultural Trends

River Trade and Transportation

The earliest colonial settlements in South Carolina were restricted to major rivers because those rivers provided the only readily available form of transportation. The Ashley and Cooper rivers, in particular, provided easy routes for expansion into the coastal interior of the state. The continuing desire for more and bigger canals in the early 1800's highlighted the state's dependence on its waterways for commerce and trade. For a time, over 80 percent of the cotton produced in the state and shipped to Charleston came by water. Even after the railroads took over most of the major commercial cotton shipping, small businessmen and farmers still took advantage of cheaper water transportation, as did local inhabitants living along the river.

In addition to facilitating commerce and trade, Coastal Plain rivers were also used for a variety of smuggling operations, both of commodities and people. While the almost deserted swamps which often surrounded rivers were a nuisance to some travelers, they were a sanctuary to others. Following the Civil War, the Provost Marshal General of the Federal Department of the South held hearings to learn how several contingents of Yankee soldiers had escaped from Confederate prisons and traveled safely out of enemy territory down a series of lonely coastal rivers. At one such hearing, he heard testimony from a black merchant named Alonzo Jackson, who was asked whether he had ever helped the Union forces.

Alonzo Jackson Rescues Union Soldiers

Yes--about 8 months before Georgetown was occupied by Union soldiers--while I was in the freighting business on my flat boat on Mingo Creek (up Black River) about 30 or 40 miles from Georgetown by water, 3 white men came near the boat which was at the bank of the river---I was on the boat with only one person a colored man (in my employ named Henry) As soon as the 3 white men saw we were colored men they came to the boat and said "we are Yankee soldiers, and have escaped from the rebel 'stockade' at Florence, we are your friends, can't you do something for us we are nearly perished." As soon as I saw them, before they spoke, I knew they were Yankee soldiers by their clothing. They were all private soldiers--so they told me--I invited them to come on the boat and told them I would hurry and cook for them, which I did and gave it to them in my boat--As soon as they entered the boat I shoved off from land and anchored in the creek about 60 ft from shore--I was loading cord wood in my boat when the soldiers came and had completed my load within about 4 cords. I did not wait to take it all--fearing that, someone else might come and catch these Yankees--Neither of the 3 soldiers ordered me to take them in the boat, or made any threats--They did not go in the boat or secure it in any way so that I could not leave it--They only entered the boat after they had told me who they were (as stated) and when I invited them--They were very weak--and had no weapons--They had no shoes on--It was then winter weather, and cold--The 3 Yankees did not suggest anything for me to do for them except to feed them--and wanted to get to the gun boats--They did not know where the gun boats were--I did--and I told them I would take them where they could get to the gun boats unmolested. The soldiers did not pay or give me anything--or promise anything to me at any time--
and I have never received anything for any service rendered to any Union soldiers--
They did not threaten me or use any violence-- they were very friendly and glad to get into such good hands-- They showed that they felt very grateful-- In about 3 days time we came to "North Island" (about 12 miles from Georgetown) which I then knew was in possession of the Union forces-- I did not pass Georgetown by day light for fear of being stopped by the rebels who had "pickets" all along the shore to stop all boats from going below-- In the night I floated with the ebb tide (without being seen) to "North Island"-- I got there in the night and landed the 3 soldiers in my small boat-- I showed them the direction to cross the island so as to get to the gun boats-- I knew there were many of the gun boat people on the shore there at that time-- I saw the 3 soldiers go as I directed-- I never saw or heard from any of the 3 soldiers afterwards-- but through a colored man named "Miller" (who was on the shore near the gunboats) learned about 3 soldiers had got to the fleet-- "Miller" told me this about 2 weeks after I took the 3 soldiers-- he saw them and described them so that I was certain he had seen the same 3 soldiers safe in the protection of the gun boats--

Two captured Union officers who slipped their guards in Charleston, South Carolina, also received the protection and aid of black people, slave and free. Unlike the enlisted men assisted by Alonzo Jackson, however, the two officers found allies among the white populace as well. The willingness of white Southerners to abet the escape of Union prisoners exposed growing disaffection-- and even disloyalty-- within the Confederacy. The Union officers recounted their saga to the Provost Marshal General of the Federal Department of the South.

Swamps as Hiding Places

Most Coastal Plain rivers have a significant portion of swampland on their floodplains and these swamps are usually uninhabited because they are too wet for most agricultural or other land uses. Yet, these riverbottom swamplands have held a certain mystery and intrigue for settlers throughout the history of South Carolina. Both Francis Marion, nicknamed the "Swamp Fox," and Thomas Sumter, the "Gamecock," attacked British troops during the American Revolution with hit and run tactics which today might be described as guerrilla warfare. They managed to elude the British by using their familiarity with the swamps to hide where the British could not follow. Likewise, during the Civil War, plantation owners hid in nearby swamps to avoid General Sherman's troops as they marched through the state.

Escaping slaves also used river floodplain swamps as hiding places in their journey northward to freedom along a route often referred to as the "Underground Railroad." In South Carolina, some followed the Pee Dee and Lynches river systems upstream into North Carolina, traveling by night and sleeping in the swamps during the day. Abolitionist sympathizers assisted the escaping slaves by providing food, clothing, and hiding places. While some slaves successfully reached freedom by following this route, it posed a great risk not only to those escaping, but also to the whites who assisted them.

Word of the existence of the Underground Railroad, and other escape routes, spread rapidly among the slave population, but such information could not be discussed openly for fear of discovery and punishment. Geographic landmarks, trail routes and other instructions were often hidden in code within stories and songs which slaves shared with each other. The song, "Follow the Drinkin' Gourd," contains an example of such a
code. Runaway slaves and white sympathizers would sing this song to remind themselves about certain landmarks and travel directions essential to their journey. Codes hidden in songs could be easily memorized and shared without any fear of detection. In addition to being a source of hope and encouragement, this song also contained such practical advice as "keep to the river," "sleep by day," and most importantly, "follow the drinkin' gourd." The "drinkin' gourd" refers to the stars in the night sky which make up the Big Dipper, a group of stars called an asterism, in the constellation Ursa Major. Those stars always shone in the northern sky, pointing the way towards freedom.

"Follow the Drinkin' Gourd"
Traditional

Think I heard the Angel say; Follow the Drinkin' Gourd
Stars in the heaven gonna show you the way; Follow the Drinkin' Gourd

Step by step keep a travelin' on; Follow the Drinkin' Gourd
Sleep in the hearth till the daylight is gone; Follow the Drinkin' Gourd

When the sun comes back and the first quail calls; Follow the Drinkin' Gourd
The old man is a waitin' for to carry you to freedom; Follow the Drinkin' Gourd

Well the river bank makes a mighty good road; The dead trees show you the way
Left foot, peg foot, travelin' on; Follow the Drinkin' Gourd

Follow that river till the clouds roll by; Follow the Drinkin' Gourd
Keep on movin' as you look to the sky; Follow the Drinkin' Gourd

When the great big river meets the little river; Follow the Drinkin' Gourd
For the old man is a-waiting for to carry you to freedom; If you follow the Drinkin' Gourd

Well the river ends between two hills; Follow the Drinkin' Gourd
There's another river on the other side; Follow the Drinkin' Gourd

There's a new day comin' and it won't be long; Follow the Drinkin' Gourd
All God's children got to sing this song; Follow the Drinkin' Gourd

CHORUS:
Follow the Drinkin' Gourd; We're gonna' follow the Drinkin' Gourd
Keep on a travelin' that muddy road to freedom; Follow the Drinkin' Gourd
Natural Resources, Land Use, and Environmental Concerns

Timber Resources

South Carolina's river floodplains continue to be an important source of cypress and hardwood timber once thought too difficult to harvest commercially. Originally a highly labor-intensive activity, logging before the Civil War was restricted to small localized plots controlled by plantation owners. After the Civil War, with the ending of slavery, agricultural patterns changed significantly in South Carolina and labor-intensive crops, such as rice, were no longer financially profitable. Logging activity within the state declined precipitously. Most of the land previously used for logging lay open. Because of tax payment defaults, ownership of many tracts changed hands frequently. Some tracts were sold at sheriff auctions, but even on the open market, land that was worth $20 an acre in 1825 was selling for $1 per acre in 1880.

In 1895, the Beidler family of Chicago began acquiring river floodplain tracts of land in South Carolina. By 1910, a 15,000 acre tract had been consolidated along the Santee River basin under the name of the Santee River Cypress Lumber Company. The acquisition dates are important, because much of South Carolina forest land was still covered in virgin timber in the 1880's and 90's. During the next thirty years, as the lumber industry began heading southward from its mid-western roots, southern forests were nearly all clear-cut, leaving only small, scattered pockets of virgin timber in isolated areas. With the development of modern harvesting equipment, lumbering has become an even more profitable industry in recent times.

A growing environmental concern is that the harvesting of timber may be taking place at too fast a rate in some areas of the state, particularly in old growth stands. Many feel that these remaining stands should serve as scientific reserves. Only 13,000 acres of old growth riverbottom forests are left in South Carolina. In Congaree Swamp National Monument, 11,000 acres are under the protection of the National Park Service and in Four Hole Swamp, 1,700 acres are protected by the Audubon Society. Both tracts were acquired from the Beidler family for scientific as well as educational purposes.

Habitat Diversity Based on Water Level

Most Coastal Plain rivers undergo periodic flooding, normally during the peak rainfall season from December through April. The river banks cannot hold the additional flow and rising river water begins to enter low-lying channels, guts, and sloughs. When water overflows into the bottomland, it is already laden with rich topsoil washed from the mountains and especially from the farmland upstream. The flood leaves behind a record of its presence in the form of distinctive yellow, brown, and black mud deposits. In some floodplains, such as the Congaree Swamp in the Santee River basin, major flooding episodes can occur eight to ten times a year. As the waters recede, silt and mud settle out and are left behind making a very productive landscape for growing magnificent forests with their associated ecosystems. Trees on the floodplain grow much larger than their Coastal Plain neighbors as a result of the frequent influx of rich topsoil. The exact characteristics of the soil depend on the location of the land with respect to the river, as the type of sediment is dependent upon the velocity of the water that was carrying it. Elevation differences of even a few inches can result in the formation of significantly different soils.
Ever since Piedmont reservoirs were constructed upstream of the Coastal Plain floodplain swamps, engineers have tried to manage river flow to avoid extremely high or low water levels. This management practice may pose a threat to plants and animals living in marginal habitats which depend on extremes of water level for their existence. The type of vegetation found in each area of the swamp is primarily determined by how long and to what depth the landscape is flooded. Floodplain areas closest to the active river channel are usually lower than the older, inactive areas and therefore are the first areas to become flooded and the last to dry out. Just a few feet of elevation difference can produce dramatic changes in the plant and animal communities found on the floodplain. For example, big trees thrive on slopes between sloughs and ridges. The roots are allowed to dry out between floods, yet receive fresh nutrients each time there is a freshet. Levees can occasionally stay high and dry while adjacent floodplain areas are completely under water. Filled-in oxbow lakes are extremely wet and contain moisture-tolerant tree species such as the bald cypress and water tupelo. On the higher bluffs alongside the floodplain, black and sweet gums, dispersed pines, and various oaks dominate the forest. The highest bluffs overlooking the floodplain are comprised of pine and hardwood mixed forests.

Ecological Functions of Floodplain Swamps

Once considered only as a breeding ground for mosquitoes and snakes, the mighty Carolina wetlands are now considered to be one of the state's most precious natural resources. Today, as in the past, the Carolina floodplain swamps provide an excellent recreational environment, a unique ecological function, and an abundant source for hardwood timber. Wild boars, water moccasins, raccoons, bobcats, and barred owls are just a few of the wildlife inhabitants that depend on riverbottom forests for survival, creating a rich and diverse unique habitat area for both sportsmen and naturalists.

In addition to wildlife habitat, the Carolina wetlands provide other important ecological functions, among which are flood control, ground water recharge, soil nutrient replenishment, and pollution filtration. In seasons of heavy rainfall, approximately ten times a year, the swamps provide a wide flat area to accommodate water that spills over the banks of the rivers. By slowing the water down, a greater percentage of floodwater is able to soak into the ground, raising the water table and depositing additional sediments. Pollutants in the water tend to settle out and become trapped in the newly deposited sediment, and as a result, the water leaving a floodplain swamp is usually much cleaner than the water entering.
River Floodplains as a Unique Natural Habitat

Swamp forests along rivers play a key role as wildlife corridors and are home to a diverse assemblage of plants and animals. Waterfowl, migratory birds, reptiles, and amphibians thrive in these wetland environments. Three hundred years ago, when European colonists were first arriving, South Carolina had over 20 million acres of pristine bottomland hardwood forest. In 1995, only about 5 million acres remained. Population growth and increased development around swamp areas generated a relentless pressure to replace the so-called useless swamps with something of more immediate benefit to the society. As a result, many swamp lands were drained and ditched, a process which removes the water, the lifeblood for a functioning ecosystem, and other lands were subjected to indiscriminate logging, which not only removes trees but also destroys surrounding soft soils and disturbs the balance of the environment. A recent environmental concern is the alarming rate at which these swamplands have been deforested for timber and converted to agricultural or commercial developments. Coupled with this concern is the possibility of contaminants entering these swampy floodplain areas through commercial waste disposal sites or polluted rivers. Many of the remaining swamp lands are now protected by law and serve as a last refuge for many threatened and endangered species.
Coastal Plain Region rivers meander their way eastward to empty into the Atlantic Ocean at many points along South Carolina’s coast. Sometimes along their way they shoulder up against high bluffs, but they are normally bordered by wide, low floodplains. Floodplains are formed by the meandering of the rivers so that where U-shaped curves grow larger through time, these channels are cut off from the main flow to form oxbow lakes, and eventually fill with sediment and vegetation. Floodplains provide rich and varied homes to the plant and animal communities that inhabit them.

Slight variations in elevation on these floodplains create a great diversity of related ecological niches, but a broad distinction can be made between two major floodplain habitats. Most of the floodplain is dry except during periodic floods, but much of the rest is swampy. Each environment is important to its plant and animal inhabitants, and each is rich enough to attract people with plans to harvest the bounty of the land, despite the access and transportation challenges of these remote and often wet lands. Timber and agriculture operations have succeeded in many areas, to the point that undisturbed floodplains are the exception rather than the rule. The Congaree Swamp National Monument and other preserves protect from development some of what remains of these floodplains.

Protection from a more subtle change, the effects of upstream reservoirs, is more difficult. A major purpose of reservoir building on South Carolina’s major rivers was to control downstream flooding, for the protection of people living along Coastal Region rivers and their property. But without frequent floods, which deposit organic and mineral-rich sediments onto the floodplains, the fertility of the floodplains is lessened, which adversely effects both natural plant communities, timber, and other agricultural operations. Managing the flow of rivers to meet the sediment needs of the floodplains while providing the flood control promised by the dams is a complicated and difficult balancing act, one which is probably not always completely successful. Additionally, research suggests that contaminants from upstream urban areas are now deposited along with the sediments when there is flooding along the rivers. This contaminant-trap effect may well benefit people living downstream, but the long-term effects on the floodplain environments are unknown.

Historically, Coastal Plain floodplains have provided people with refuge. Soldiers hiding from their enemies, slaves seeking escape to freedom, hunters and botanists and bird watchers looking for a wild place away from the alterations of human kind—all of these and more have found what they sought in the wide floodplains of the Coastal Plain rivers of South Carolina. With careful, far-sighted management, these areas can continue to be a refuge in the future.
PLACES TO VISIT

Congaree Swamp National Monument. Southeast of Columbia off Highway 48. For information call (803)-776-4396 or (803)-765-5571.

Francis Beidler Forest, Four Hole Swamp, Audubon Society. Off I-26 on to SC 28 in Dorchester County. For information call (803)-462-2150.

Playcard Swamp Environmental Center near Conway. For directions and information call (864)-756-1277.

REFERENCES AND RESOURCES


Coly, John. "Is the Biedler Tract in the Congaree Swamp Virgin?" Congaree Swamp: Greatest Unprotected Forest on the Continent.


STUDY AREA 6: RIVER FLOODPLAINS

Activity 6-1: Overview

Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale</th>
</tr>
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<tbody>
<tr>
<td>STATE BASE MAP #1, SHADED RELIEF</td>
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<tr>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
<td>1:500,000</td>
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<tr>
<td>GENERAL SOIL MAP</td>
<td>1:594,000</td>
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<td>LAND USE/LAND COVER MAP</td>
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<td>COASTAL SATELLITE IMAGE</td>
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<td>CONGAREE SWAMP TOPOGRAPHIC MAP</td>
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<tr>
<td>State Map of Major Drainage Basins</td>
<td>Figure 1-2</td>
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<tr>
<td>Wipe-off Pens</td>
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</tbody>
</table>

PERFORMANCE TASKS

(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts =

1. Locate river floodplains and characterize topography.

   Locate all areas on the LAND USE/LAND COVER MAP which are categorized as saturated bottomland forest (purple). With a wipe-off pen, outline all of these areas. Estimate the percentage of the Coastal Plain Region (be sure to exclude the Coastal Zone) that consists of river floodplains. Are these floodplains randomly distributed throughout the Coastal Plain, or are they concentrated in certain parts of that region? What is the relationship between the width of a floodplain and the size of the river flowing through it? What determines where river floodplains occur? Why are they mostly found in the Coastal Plain Region? Characterize the general topography of river floodplains? What are the major ecological functions of floodplains?

2. Identify major South Carolina rivers and floodplains.

   Using the STATE BASE MAP #1, SHADED RELIEF, and Figure 1-2, "State Map of Major Drainage Basins," review the four major drainage basins covering South Carolina. Using the map symbol for swamps as a guide, list several major rivers which have floodplain swamps. Which river system seems to have the greatest amount of swampland? Which river bottom swampland is nearest to your school? Look at the GENERAL SOIL MAP and locate all areas containing floodplain soils (light blue). Match these areas with rivers on the base map. Do floodplain soils extend all the way to the coast? Do any Coastal Plain rivers not have floodplain soils? Compare the channel pattern of the Black River, which drains only the Coastal Plain, with the Congaree River, which drains the Piedmont. What similarities or differences are there between these two rivers in terms of swampland and soils?

3. Determine percentage of state draining into swamp.

   The Congaree and Wateree rivers join near the northern end of Lake Marion to form the Santee River. Each of these two tributaries forms a large river floodplain swamp before it reaches the junction point. Locate these two rivers and the two swamps on the STATE BASE MAP #1, SHADED RELIEF. Divide into two groups to determine the size of the drainage basin providing water for each of these floodplain swamps. First trace, with a wipe-off pen, all the rivers and streams which flow into your
assigned swamp. Then, with a wide-tip wipe-off pen, outline the drainage basin which contains those rivers. Use the transparent grid overlay and the scale bar on the map to determine the area of your drainage basin. To calculate the percentage of the state drained by your swamp, divide your area value by the total area of South Carolina, 31,113 square miles (80,583 square kilometers), then multiply by 100. Compare your answer with other groups. Which swamp, the Congaree or Wateree, drains a larger percentage of the state?

4. **Identify features upstream which might cause pollution.**

Several large floodplains are not far from major cities and industrialized areas. Others are surrounded by agricultural fields. Divide into groups and use the wide-tip wipe-off pen to outline, on the STATE BASE MAP #1, SHADED RELIEF, the watershed area for your assigned river. Investigate all sources of upstream pollution which might affect your particular river floodplain. Be sure to include non-point source pollution in your region. Make a list of pollutants and their possible origins, and then compare your list with those of other groups. Discuss ways of solving these pollution problems and protecting the floodplain swamps. Refer to the base map, the STATE BASE MAP #2, WITH HIGHWAYS, the COASTAL SATELLITE IMAGE, and the LAND USE/LAND COVER MAP as needed.

- **Group I** Savannah River, Allendale County
- **Group II** Congaree River, Richland County
- **Group III** Edisto River, Dorchester County
- **Group IV** Black River, Clarendon County
- **Group V** Pee Dee River, Marion County
- **Group VI** Lynches River, Lee County

5. **Trace Alonzo Jackson's route and write account of escape.**

Using the STATE BASE MAP #1, SHADED RELIEF, and the story, "Alonzo Jackson Rescues Union Soldiers," on page 6-5, locate Mingo Creek (Black Mingo Creek) and find where it joins the Black River. Trace a probable route that the escaping Yankee soldiers may have used to reach Mingo Creek from Florence. Explain why they followed the particular route you have laid out. How would the geography of this area have helped them escape detection? How many miles was Jackson from Georgetown? Why do you think he was so far from Georgetown? Why would he have had to come this far to cut wood? If you drew a straight line between Mingo Creek and Georgetown, how many miles would it be? What made the trip for Jackson so much longer? Before he could leave Mingo Creek with the Yankees he had to wait for the tide. How could the tide affect the river this far inland? Trace Jackson's route down the Black River to North Island. What body of water did he have to cross in order to reach North Island? Why might he have been afraid to go by Georgetown during daylight hours? Why do you think the Union gunboats were stationed at North Island?

Imagine that you are one of the escaping Union soldiers. Write an account of your trip for a Northern newspaper. Remember to include details of the landscape and the people you might have met in South Carolina, because you know people in the North are not familiar with the type of terrain or the culture found in this part of the country.
6. **Trace possible escape route for slaves on the Underground Railroad.**
   Suppose your group represents several slaves on a plantation who have come up with a plan to join other slaves from other plantations to escape to freedom on the Underground Railroad. Each group will have to decide what route to travel and when to leave in order to rendezvous with the others at midnight on April 15, 1854 at the North Carolina state line along the Lynches River. Each group should compile a list of geographical or topographical landmarks, trail routes, and instructions that could be passed on to others desiring to escape. After finishing your list, write some of the instructions in code like the song "Follow the Drinkin' Gourd," on page 6-7. Share your new verse with other students and see if they can interpret its true meaning.

   **Group I**  A plantation near Timmonsville in Florence County
   **Group II**  A plantation near Boykin in Kershaw County
   **Group III**  A plantation near Oak Grove in Dillon County

7. **Explain location of agricultural areas near swamp.**
   Locate the agricultural areas (white) in the northern portions of the CONGAREE SWAMP TOPOGRAPHIC MAP. What is the major topographic difference between the white agricultural areas and the green swamp area? Why do you think the white area is more suitable for agriculture?

8. **Analyze railroad's effect on town of Gadsden.**
   Locate the small town of Gadsden on the CONGAREE SWAMP TOPOGRAPHIC MAP. This small community has historically been associated with the surrounding agricultural economy. Although this town is small, it is typical of hundreds of other similar agricultural communities within the Inner Coastal Plain of South Carolina. What impact did the railroads have on determining the location and development of this community? Why? What did the railroad contribute to these communities? What types of businesses and stores would you expect to be located in Gadsden that would support the small local farming community?

**ENRICHMENT**

1. **Research how Four Holes Swamp got its name.**
   Write a short story about how you think Four Holes Swamp got its name. Then research this topic in your school or community library to see if you were close.

2. **Draft letter about protecting swamps.**
   Draft a letter to the governor of South Carolina outlining your concerns for the fate of South Carolina swamps. Outline reasons for limiting the exploitation of our state's most valuable resource: timber. Why do floodplain swamps provide an excellent environment for growing big trees? Are trees a renewable resource? Explain.

3. **Explain soil productivity.**
   Describe in a short paragraph the formation of the particular type of soil you would expect on these farms. Where did it come from and what has helped make it become naturally productive? What modern-day crops are probably grown here? (Note the large sizes of the fields.)
The State
October 13, 1989
Trees with national significance fell to Hugo in Congaree Swamp

by Dawn Hinshaw

An oak tree at the Congaree Swamp National Monument that was recognized as the largest of its kind in the nation was destroyed last month by Hurricane Hugo.

The national champion Shumard oak was 20 feet around, 155 feet tall and had a crown spreading to 116 feet. "That's a tremendous tree," park superintendent Bob McDaniel said. For example, the Shumard was taller than the 12-story Blue Cross and Blue Shield building on Alpine road.

McDaniel estimated 30 percent of the Swamp's trees are down--translating into a loss of hundreds of thousands of trees. "There is nothing eternal in forests," McDaniel said. "What happened to us, by God and nature, is natural."

Park officials didn't know the age of the uprooted Shumard oak because it had not been cut. But of those trees cut up to re-establish access to the park, the number of rings indicates some were 140 to 165 years old, Rick Clark, resource management specialist, said. That means they could have been there a decade or more before the Civil War broke out in 1861.

To be a national champion, a tree must be the largest of its species. Before the storm, South Carolina was home to 17 national champions. Now, Steve Muzal, a forester with the Clemson Extension service, doesn't know how many it has.

Congaree Swamp used to have five of the champions. "We have none now," McDaniel said. The park superintendent said trees in the swamp are vulnerable to high winds because, with all the water available to them, their root systems are small.

The Shumard, along with other trees blown over in the storm, probably will be left to decompose naturally. "We'll just have to see what comes back in its place," McDaniel said.

<table>
<thead>
<tr>
<th>RATIONALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Congaree Swamp Study Site serves as an outstanding example of a pristine riverbottom floodplain forest similar to those which used to occur along many of the old meandering rivers draining South Carolina's Coastal Plain Region. These relatively flat floodplain areas are havens for anglers, hunters, research biologists, and naturalists. Riverbottom floodplains not only provide excellent habitat for wildlife but also serve several ecological functions such as flood control after heavy rains, ground water recharge, and a limited amount of pollution filtration. In spite of Hurricane Hugo's destruction, Congaree Swamp still contains the oldest significant stand of old growth floodplain hardwood forest in the country, with a number of record trees (largest on record for the species). Most of the big trees are at least 200 years old, and much of the site is in a pristine condition. In all, more than 90 species of trees can be found within the swamp boundaries as well as a number of threatened and endangered species.</td>
</tr>
</tbody>
</table>
Brief Site Description

Tall Trees

The Congaree Swamp National Monument is an undisturbed mature forested floodplain situated along the Congaree River about twenty miles downstream from Columbia. In 1976, the National Monument came under the protection of the National Park System. The 22,000 acre riverbottom floodplain park now ranks among the largest areas in the world known for its tall, broad-leafed forest. Often called the "Redwoods of the East," the Congaree forest can boast of record size trees found nowhere else in the United States. A tree's girth and the shape of its crown are considerations for achieving big tree status. If height alone was the only factor to consider, Congaree Swamp would emerge as one of the most impressive forests of the world. Trees growing in the Congaree floodplain attain astounding heights. Species of trees that normally reach a height of 60-80 feet often measure in the 130-150 foot range in the Swamp. Most of the 93 identified as "big trees" are deciduous hardwood species which require many years of growth to arrive at their tremendous size. Currently, the swamp boasts six National Champion (representing four species) and 29 State Champion (representing 25 species) trees holding these titles with the American Forests Registry. It is estimated that most of these trees are approaching 200 years of age and some could be as old as 600 years. This swampy old growth riverbottom forest can boast of not only the largest concentration of big trees found in North America but also the tallest broad-leaf trees remaining in the world.

State and National Champion Tree Selection

Congaree Swamp National Monument was surveyed for big trees in 1995, to determine the status of State and National champion trees after Hurricane Hugo blew through the area in 1989. In the process, additional trees of record or near-record size were located and measured. Furthermore, the ecological requirements of these big trees were assessed by a sampling process which divided the area into transects for plotting tree location, measuring dimensions of big trees, establishing soil type, determining type of topography, and identifying surrounding understory vegetation. Transects totaling 277 miles (446 kilometers) of old-growth forests were surveyed. Data were collected, the measurements were analyzed, and a list of qualifying trees was sent to the Big Tree Coordinator, Clemson University, and the National Register of Big Trees in Washington, D.C. This program, although originally designed for identification of State and National champion trees, has since become a stimulus for promoting conservation and wise use of our forest resources.

The American Forests organization keeps a register of champion trees. The formula for the point scoring system, established by the American Forestry Association, combines the tree circumference measured in inches at a level of 4.5 feet above the ground, the total height measured in feet, and one-fourth of the crown spread measured in feet. Only trees that are more that 9.5 feet in circumference, at least 12 feet tall, and possessing a well defined crown of foliage can be nominated as State or National Champions. When a tree is nominated, the exact size and location must be verified by a forester or a botanist.
Directions for Nominating Big Trees
Modified from the Alabama State Tree List

A tree is formally defined as a woody plant having one erect perennial stem or trunk at least nine and one-half feet in circumference at a point four and one-half feet above the ground, a definitely formed crown of foliage, and a height of at least twelve feet. If several stems from a single root system have grown together to form a trunk, only the largest stem will be considered.

CIRCUMFERENCE of a tree is measured at a point four and one-half feet above the ground, around the main stem/trunk, and is given in feet and inches.

HEIGHT of a tree can be measured accurately by special instruments such as a clinometer, hypsometer, or Biltmore stick. If none of these are available, a fairly good estimate of tree height can be made by using a straight stick five or six feet long. Face the tree, holding the stick horizontally at eye level with one end touching your eyebrow and the other end pointing at the tree. Holding the near end carefully to your eyebrow with your left hand, slide your right hand out along the stick until you extend your right arm fully, and grasp the stick between your right thumb and fingers. Holding your right arm in place, release the end of the stick at your eyebrow and let it go to the vertical position between the thumb and fingers of your right hand. Keep the stick at arm's length, keep your head straight up, and don't move your arm. Sight over your fingers to the point where the base of the tree touches the ground. Move closer to the tree or further away until the top of the stick lines up with the topmost branches. Mark the spot where you are standing. Measure from that spot to the base of the tree. This will give you an approximate measurement of height.

CROWN SPREAD can be measured by finding the two longest limbs opposite each other on each side of the tree. Mark a spot on the ground directly under the outermost part of each of the long limbs. Measure the distance between these two spots to the nearest foot. Find the shortest two limbs opposite each other on each side of the tree. Mark a spot on the ground directly under the outermost part of each of the short limbs. Measure the distance between these two points to the nearest foot. Add the two measurements together and divide by two. This will give the average crown spread which should be shown on the nomination form.

FORMULA VALUE is determined by the formula established by the American Forestry Association as follows: CIRCUMFERENCE (in inches) + HEIGHT (in feet) + one-fourth CROWN SPREAD (in feet).
### Ecological Factors Affecting Tree Size

Trees growing in open fields tend to produce larger trunks with broader crowns than those growing in heavily forested areas. With the canopy so dense in the Congaree River floodplain forest, trees must compete for sunlight. The American Forests' point scoring system weighs tree diameter and crown size heavily. When competition for sunlight is so intense, trees tend to grow taller, have smaller trunks, and have unshapely crowns. On the other hand, trees growing in open fields with less competition tend to spread out, thereby growing larger trunks and broader crowns, but somewhat less height. Many Congaree floodplain trees were not measured for big tree status, despite their height, due to trunk size or crown shape.

Topography, rich soil, abundant nutrient supply, and protection from past agricultural activities are the major factors contributing to the growth of big trees in the Congaree floodplain. Most record trees are found growing in broad, low, flat areas or on the edge of sloughs. Record trees thrive along the edges of sloughs and adjacent ridges because tree roots are not saturated with water but still have access to a continuous source of nutrients flushing the area. Over millions of years the soil has become very rich and

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<table>
<thead>
<tr>
<th>#</th>
<th>TREE SPECIES</th>
<th>TYPE OF CHAMPION</th>
<th>NORMAL TREE HEIGHT (ft &amp; m)</th>
<th>TREE DIMENSIONS circumference (in.) height (ft) crown size (ft)</th>
<th>COORDINATES distance (feet), direction (angle in degrees)</th>
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<td>Ash, Carolina</td>
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<td>6000, 2° N of W</td>
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<td>60</td>
<td>Elm, American</td>
<td>State</td>
<td>100' (30m)</td>
<td>203&quot;/128'/76'</td>
<td>15500, 20° S of E</td>
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<td>State</td>
<td>60' (18m)</td>
<td>81&quot;/77'/41'</td>
<td>15250, 40° S of E</td>
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<td>Oak, Cherrybark</td>
<td>State</td>
<td>80' (24m)</td>
<td>250&quot;/158'/124'</td>
<td>1500, 1° N of W</td>
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<td>Nat'l tie</td>
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<tr>
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<td>Elm, Water</td>
<td>State</td>
<td>40' (12m)</td>
<td>88'/73'/36'</td>
<td>7000, 28° N of W</td>
</tr>
</tbody>
</table>
easily provides abundant nutrients for big tree growth. Attempts have been made in the past to harvest the trees and clear-cut the land for agricultural purposes; however, the necessity of using hand labor, the tremendously dense canopy of vegetation, and the lack of a nearby market for timber products played a key role in limiting these practices.

**Life Along a Floodplain Swamp**

Mr. Booker T. Sims lives by the Congaree Swamp and has all of his life. He is now more than 70 years old. He tells stories of going into the swamp as a very young boy with his father. His father hunted and fished the swamp all of his life and died in the swamp while sitting on the bank fishing. Mr. Sims' last job was working for Congaree Swamp National Monument. He is now retired. Following are some of the stories Mr. Sims likes to share.

*Note: Mr. Sims feels that making the swamp a protected area was the right thing to do. He is worried about the land that the Georgia Pacific Company owns and is still logging.*

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**Interview with Mr. Booker T. Sims**

By Sandy Morgan

I've been going into the swamp since I was about three or four years old. I would go with my daddy fishing. We would dig for worms and then fish. There were always plenty of worms. We fished in the creeks. At this time we were fishing for eels. Nobody fishes for eels today in the swamp. There aren't any more eels. We would also fish for catfish. We could fill up a bucket with fish in no time!

There wasn't any road into the swamp. We followed a footpath. We always went late in the day and fished at night. When I was older, my friends and I would go into the swamp and fish at night. We would have a good ole time. We built a fire on the bank and cooked those fish as we caught them. Sometimes we stayed all night in the swamp. We always kept a big fire going.

Being in the swamp was a way of life for my daddy. I loved it too. My daddy and I would hunt in the swamp also. We would hunt mainly squirrels and coons. The interesting thing about the swamp back then is that mosquitoes did not bother you like they do today. We didn't have any insect repellent back then, but those mosquitoes just didn't bother us like they do today!

The trees in the swamp are huge. Sometimes people would think they had found a tree bigger than the ones in the swamp, but they never did. My daddy said that there weren't any trees bigger than those in the swamp!

My daddy spent a lot of time in the swamp. One day he went into the swamp to fish and just died sitting right there on the bank of Weston Lake. I found him there dead and had to carry him out. I guess he died doing what he liked to do most.

My daddy believed that Weston Lake did not have a bottom to it. He told us the story about the sturgeon to keep us from getting too close to the edge of the lake.
The Legend of the Sturgeon in Weston Lake
Retold by Sandy Morgan

A man was standing on the bank of Weston Lake fishing. He had his cane pole and worms and was fishing for sturgeon. The man knew there were stories about a giant fish, a sturgeon, in the bottomless lake, but he had never seen it. All he knew was that it was easy to catch fish in this lake.

All of a sudden a huge sturgeon came up to the surface of the water near the edge of the lake. The man was so excited that he jumped onto the sturgeon’s back. The giant fish carried this man around and around Weston Lake. He rode the sturgeon like a man rides a horse. The man was having a good time until he remembered the lake had no bottom. He knew he couldn't swim. Suddenly the fish swam rapidly to the middle of the lake and shook off the man. He is probably still going down.

It is said that on clear nights on Weston Lake, if you listen carefully, you can hear the laughter of a man riding a sturgeon around the lake.

Legends and Tales of the Congaree Swamp

Much of South Carolina's culture has been recorded in folk tales. Swamp tales are no exception. Events could easily be recounted and embellished as stories were passed on to friends and families gathered around the fireplace at night or on fishing trips in the swamp during the day. Many tales were made up to explain eerie sounds often heard in the swamp. Other tales reported what happened to those who stayed in the swamp too long. Several stories taken from Tales of the Congaree, recounted originally by C.L. Adams, are reprinted here as examples of swamp tales. Adams was a physician who lived in the Hopkins area near the Congaree Swamp. These tales are excellent examples of stories depicting an exciting part of South Carolina’s heritage.

The Big Swamps of the Congaree

From Tales of the Congaree by Edward C.L. Adams, edited by Robert G. O'Meall

Tad: Gentlemens, how is you-all?
Voice: Howdy! how you been?
Second Voice: Tolerable.
Tad: I been down in de big swamps on de Congaree.
Voice: Tell us, brother?
Tad: I been down to de Congaree in de big swamps, where de trees is tall an’ de moss long an’ gray, where de Bullace grow, an’ where I hear de tune of de bird in de morning; down wey de wild turkey gobbles, way down on de Congaree; wey God’s mornin’ leads to de devil’s night; down on de river, where night make her sign, where owls on a dead limb talks of de dead, talks wid de dead and laughs like de dead, way down in de big swamps of de Congaree; down where de blunt-tailed moccasin crawls in de grass, where de air is stink wid he smell; where de water is green, where de worms is spewed out of de groun’, where de groun’ is mud, where de trees sweat like a man; down in de home of de varmint an’ bugs, down in de slick yallow mud, de black mud an’ de brown, way down in de big swamps of de Congaree; down in de land of pizen, where de yallow-fly sting, in de home of de fever an’ wey death is de king. Dat wey I been, down in de big swamps. Down in de land of mosquito, in de big swamps, down on de Congaree.
Spirit Dogs and Barking Snakes
From Tales of the Congaree by Edward C.L. Adams, edited by Robert G. O'Meall

Preb: [Enters scratched and bleeding, clothes torn, muttering:] Huh, pup, huh! Huh, pup, huh!
Voice: Wha' ail you, Preb?
Preb: Ain't nothin' ail me. You must be ailin' yourself. Is you blind? Can't you see dem dogs?
Second Voice: Preb must be lossin' he mind.
Preb: What make I loss my mind?
Voice: How come you call dog when dey ain't no dog? How you say you see dog when dey ain't no dog, how come?
Preb: Brother, if you been wid me you see dog, 'en you see more'n dog? You see snake, an' hear 'em bark, bark like dog. I come out 'er mill pasture an' I hear dog bark, an' I like, an' heap 'er little dog an' snake all tangled up 'twixt my feets an' hit look like I guine step on 'em, an' I ain't step on 'em, an' all down mill-dam dog bark and snake tangle up 'twixt my feets, an' I lef de mill-dam an' I to'd out theu de brier an' dey dept wid me, an' dey tangle up 'twixt my feets an' dey bark, an' dey come here wid me, an' you ain't hear 'em bark, an' you ain't see 'em. Ain't nobody see 'em but me. Ain't nobody hear 'em but me, an' dey tangle up 'twixt my feets.
Spencer: Brother, you see 'em an' I see 'em. Dem is sperrit dogs, an' dey run dese woods wid de barkin' snakes, and dey run on certain night an' dey wait dey own time an' dey fun in mill-pasture an' Black Lake, an' dey home is God knows way, an' dey is a sign, a onlucky sign, which pass dis way 'afore de earthquake, an' dey come here wid de storm, an' 'afore death, an' 'afore war, and it is a sign of 'stress. Dey is de barkin' snakes an' sperrit dogs, an' dey travel in de night of storm, an' dey travel in de night of 'stress, an' dey tangles 'twixt de feets of men, and all men is feared ur de sperrit dogs an' de barkin' snakes. Dey come 'afore death an' in time of 'stress, an' dey tangles 'twixt de feets of men.
A Freshet on the Congaree
From Tales of the Congaree by Edward C.L. Adams, edited by Robert G. O'Meall

Leck: Gentlemens!
Voice: Sorter slow. Wuh’s de time, Ber Leck?
Leck: Time ain’t so much.
Voice: Wey you come from?
Leck: Jes come out of de Congaree swamp.
Voice: How come time ain’t so much, Ber Leck?
Leck: Jes come out de Congaree swamp and de ole river sho’ is ragin’. I never is seen a wusser freshet. De logs spin ‘round a hundred feet long and roarin’ ‘gainst de big trees like dey guh tear de heart out de earth wey de go,-- varmiints a settin’ on limbs and ridin’ on logs, and I seen er drove er cow swimmin’. Each one had a head a restin’ on de tail of de other cow. Den de call come and de first cow sink and all de other cows sink. After while I see ‘em whirlin’ over and over. Sometime dey feets in de air, sometime dey horns, and de river been mess up de cows’ horns and foots and it th’owed ‘em every which er way, and I see hog cut dey own throats tryin’ to swim out of dis torment and de river, and it look like God Almighty must a wrop he arm ‘round de flood and whirl it back in He anger. Every which er way I look I see ‘struction. I see sturgeon tangle up in a wire fence and de birds quit singin’ and went to hollerin’, and I look down on de yaller water and I see wey buzzard cast his shadow. Everywhere I look I see buzzard. I been prayin’ to God to help me and I been fightin’ de angry waters and ‘struction been rollin’ at me and I been lookin’ death in de face. And God save me dis time, and I reckon I’ll stay ‘way from de big swamp and try and don’t do nothin’ to defy Him.

Brother, when de Congaree gits riled, it mighty nigh look like Jesus Hisself forgits de poor critters, it look like he stan’ back and give de devil a chance to do he do. And if your heart ain’t right, my brother, de big swamps will ‘stroy it. Dey ‘stroy your body and if dey ain’t ‘stroy it, look like dey ‘stroy you soul.

Voice: Did you hear Ber Leck? He ain’t tell no lie. I see a heap of mens come out de big swamps. If dey stay dere long enough, when dey come out, dey look more like beasts or varmiints dan dey does like mens. Brother, God ain’t make dem swamps for mens. Dey de home of de devil, de home of ‘struction; dey de home of serpents, de home of buzzards, and if you put mens in dem swamps, de only way dey can live is to be like de critters dat live dere, and take on dere ways. Yes, my brother, stay ‘way from de big swamps.
Jack-Ma-Lantern

From Tales of the Congaree by Edward C.L. Adams, edited by Robert G. O'Meall

Jake: Who you reckon dat walk up and down dat ditch an’ ‘bout dat mash?
Bruzer: I ain’t know.
Jake: Aint you see ‘em wid dat light bob up and down like dey lost sumpen?
Bruzer: I ain’t know who dey is, dey must be sumpen perticular make ‘em walk all around in de rain an’ brier. I see ‘em but I ain’t know wuh ail ‘em.
Hooten: You sure God ain’t know. Dat ain’t no people. Dat’s a Jack-ma-lantern an’ you best l’um ‘lone. You ain’t know what kind of danger dey lead you in if you follow ‘em.
Jake: Wuh make dey lead you in danger. Ain’t you kin stop follow ‘em when you see danger.
Hooten: If dey gits a holt on you and you follow ‘em, it don’t lead you to no good. When you starts to follow, one mind will tell you l’um ‘lone and turn back, and another mind will tell you follow ‘em, and you follow ‘em.
Jake: What’s a Jack-ma-lantern?
Hooten: A Jack-ma-lantern is a sperrit. It is a evil sperrit. It is ole folks. Sinful ole folks. It is folks wuh ain’t ‘lowed in heben and can’t get in hell, and dey punishment is to wander in de bad places and on de bad night, and dey business is enticing mens to follow ‘em, an’ dey ain’t got no res’, les’ dey entice mens to lef’ de right road. Is you ‘member Ole man Lunnen? Well you know he been a ole man, and he been wise, and ole man Lunnen tell me, he say, one time he been walking down de road and he been wid dis same ole man, July Uncle, dey call him “Hock,” and say, him and Hock walk down dis road and dey see a light walking right out in dat dere mash and Hock say he guh see who it is and ole man Lunnen say he try to ‘suade Hock to stay in de road. Hock say he ain’t scared he guin dere and ole man Lunnen say he ain’t guh have nothin’ to do wid it, and Hock dat night Hock been fallin’ in de hole and scramblin’ in de brier, and dat night Hock ain’t come home and den dey search for him and dey find him that night back in de high grass and brier on Hog-Pen-Gut, and he stan’ in de mud up to he knee, and he reared back wid he head pulled back holdin’ both han’ out in front of him like he tryin’ to ‘fend hiself and he look in he face and he eye wide open and de look on he face were terrible, like it were froze, and he put han’ on him and he war stiff dead.

The Naming of the Swamp

The name "Congaree" refers to the Native American Nation who inhabited the Congaree River area until the Yemassee War of 1715. It was during this time that most of the native inhabitants were killed, driven out, or sold as slaves on the West Indian market. The remaining population moved out of the area or died of diseases introduced by the new settlers. Even though the Native Americans disappeared, the name Congaree lives on in the river formed by the confluence of the Broad and Saluda and as the home of the champion trees thriving in the Congaree Swamp National Monument. Prior to Columbia’s becoming the capitol of South Carolina, the local region surrounding the river was known as the "Congarees."
Early History of Congaree Swamp

By 1740, most of the Native Americans had left the area, and the region lay open for European settlement. The pioneers traveled mostly by river, this being the easiest means of transportation before a network of roads was established in the interior of the state. Congaree Swamp saw large numbers of people pass through, but few settled in the local area. Most settlers continued up the Congaree River until it became impassable because of the rock shoals at the Fall Line Zone in Columbia, where the Piedmont meets the Coastal Plain.

Prior to 1776, land was distributed to these settlers through a grant system by either the King of England or the Royal Governor of South Carolina. After the Revolutionary War, the state assumed responsibility for granting tracts of land. Those land grants were usually 100 to 500 acres, although a few reached several thousand acres. The State Archives contains some pre-Revolutionary plats (land surveys) of the Congaree Swamp region, showing the approximate location of some of these land grants. Most were along the riverbank, where access was easiest, and were usually marked "impassable swamp" or "all cane swamp." Just because land was granted to someone, laid out, and surveyed, didn't mean that it was used. Often the land remained in its natural state, unclaimed and uninhabited. "Re-grants" were common occurrences. Many of the old plats indicate the uncertain ownership of adjacent land by remarks such as "vacant" or "owner not known."

Reclaiming of Swamp Land

By the time of the Revolutionary War, nearly all the Congaree Swamp area had been fully land granted. Planters realized the great fertility of the alluvial Congaree bottomlands with its rich silt deposits, and a few small areas along the riverbank were cleared for Indian corn and indigo, which became an early money crop for South Carolina planters. The British paid a handsome price for this source of blue dye. It does not appear that Richland County exported much indigo, however, as most of it was grown in the Coastal Zone Region. After the Revolutionary War, the British no longer wanted to trade with the newly independent country, and indigo declined very quickly in popularity. Soon rice took the place of indigo as the state's money crop, but rice was never grown extensively in the Midlands or Upper Coastal Plain because it was less profitable than as a tidewater crop. The two main crops in Richland County were Indian corn, and after 1790, cotton. But neither did well in the poorly drained floodplain soils.

In certain instances, farmers were able to drain portions of the floodplain to create fertile fields. Although crop yields were demonstrably greater in the reclaimed Congaree bottomland, most planters were reluctant to drain the swamps due to the considerable expense. Construction of an elaborate system of dikes was required to protect the crops from periodic flooding. In addition, slaves were forced to work in a disease-ridden environment, which limited their effectiveness. Other pioneer activities in the Congaree area were raising cattle and building ferries to cross the river. Cattle were allowed to range freely to feed on the lush vegetation in the swamp, and elevated cattle mounds were constructed to provide a refuge for the livestock during times of flood. These mounds were simply piled up earth built by slave labor. Two mounds still existing today are the Starling Mound, near the river, and Cooner's Mound, in the interior of the swamp, built around 1840. Cooner's Mound measures 50 feet by 90 feet and is 6 feet high.
In 1786, General Isaac Huger established a ferry crossing over the Congaree River, and a ferry road was cut through the eastern edge of what is now known as the Beidler Tract, named for landowner, lumberman, and conservationist, Francis Beidler. Although this ferry was abandoned some fifteen year later, bridge abutments remain for "Huger's Old Bridge" that was to cross the river. It was marked on a 1910 plat of the eastern Beidler Tract. In the 1840's, Daniel Zeigler operated a small ferry on the river near the center of the Beidler Tract.

As late as 1839, much of the land in the Beidler Tract was still unclaimed and unused. In that year more than 4,000 acres of the 15,000 acre tract was re-granted to the James Adams family. A plat of this re-grant shows no signs of cleared land or fields. James Adams, Sr., evidently had plans to cultivate part of this tract, since his will of 1841 mentions the "hope his children will continue the dike construction he started." His children never finished this project, as evidenced by the incomplete dike system existing today. Another re-grant was a 370-acre tract on the river bank granted to Paul Spigner in 1839. This plat does show two cleared areas, each about fifteen acres. Corn or cotton was probably grown here, and the dike enclosure for one of these fields still exists.

The Lumber Industry in Congaree Swamp

The first major logging operations began in the Beidler Tract soon after 1895. The Santee River Cypress Lumber Company began cutting cypress exclusively, and by 1915 nearly all the original cypress had been removed. The cypress tree was girdled by ax, allowed to dry out, then cut and floated down the river to the sawmill. This cutting took place along the waterways, sloughs, and ponds where cypress trees grew. No roads were built to haul the logs out, none of the hardwood trees were cut, and most of the swamp was left undisturbed. Fortunately, some magnificent cypress specimens escaped cutting and are still standing today. Records from the Beidler's saw mill of 1910 indicate the average age of cypress being cut was between 500 and 700 years. One tree stump had 1600 rings. It wasn't until 1970 that the first commercial harvesting of at least thirty-five different species of hardwood trees began in the Beidler Tract.

Establishment of Congaree Swamp National Monument

In 1976, a portion of the Congaree floodplain was declared a national treasure when the United States Congress purchased the 15,000 acre tract. At that time, Congaree Swamp National Monument became part of the National Park System. Now much of the mature forested floodplain has been protected for future generations to enjoy. The rationale for selecting the Congaree Swamplands for purchase was presented in the following statement:

"In order to preserve and protect for education, inspiration, and enjoyment of present and future generations, (the Congaree swamplands is) an outstanding example of a near virgin Southern Hardwood forest."

Our generation and generations to come can be grateful for those who saw more in the majestic Congaree forest than so many board-feet of lumber. They saw a legacy of nature which, once destroyed, could never be replaced. One of the first of these vision-minded men was Francis Beidler, a rare kind of lumberman and conservationist whose family owned most of the property which now comprises the Congaree Swamp National Monument. Mr. Beidler, recognizing the pressures that mature forest areas were facing
from exploitation even in the early 1900's, instructed his heirs that certain unique forests should be preserved as a vital national asset. Another swampland in South Carolina that bears the name of this outstanding conservationist is the Audubon Society's Beidler Forest in Four Holes Swamp, Dorchester County. It too is an area preserved for educational purposes.
### Activity 6A-1: Meandering Rivers and Geologic Change

#### Materials

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<td>6</td>
<td>STATE BASE MAP #2, WITH HIGHWAYS 1: 500,000</td>
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#### PERFORMANCE TASKS

(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts =

1. **Locate the study site.**
   Locate the Congaree Swamp Study Site on the **STATE BASE MAP #2, WITH HIGHWAYS**, on the **LAND USE/LAND COVER MAP**, on the **GEOLOGIC AND MINERAL RESOURCE MAP**, and on the **GENERAL SOIL MAP** by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Locate evidence of river migration.**
   Using the **CONGAREE SWAMP LITHOGRAPH**, look for evidence that the Congaree River was once located in different parts of the floodplain. Identify several remnant river channels. Do many of these remnants still have the crescent or "U" shape typical of meanders? Refer to Figure 6-1, "Formation of Oxbow Lakes." Why are these features called cut-off meanders or oxbow lakes (if they contain water)? How many distinct oxbow lakes can you locate on the **CONGAREE SWAMP TOPOGRAPHIC MAP**? Compare the number of oxbow lakes on the topographic map with the number of meander traces on the lithograph. How do you explain this difference? Does the lithograph show any differences in forest type? Why? Describe the landscape of the area in general terms.

3. **Predict the occurrence of oxbow lakes.**
   Locate the Congaree River on the **CONGAREE SWAMP TOPOGRAPHIC MAP**. In what direction is the Congaree River flowing? What evidence are you using to determine that direction? Would you expect the flow to be swift or gentle during most times of the year? Why? Using a wipe-off pen, shade in the portion of the bends of the river that are experiencing erosion. Now use a different colored wipe-off pen to shade in the areas where deposition is occurring. Circle a meander that might be cut off during a flood to form an oxbow lake. Use a blue wipe-off pen to show your predicted new course of the river, during a period of high water, which bypasses the new oxbow lake. Use the scale bar on the **CONGAREE SWAMP LITHOGRAPH** to measure the average width of the Congaree River. Predict where two other oxbow
lakes could form. Measure the present-day length of the Congaree River on the lithograph. How much will the length of the river be shortened after these two new oxbow lakes are formed? Summarize the action of a meandering river as oxbow lakes are formed.

4. **Interpret wetness of soils by analyzing vegetation patterns.**
   Examine the color patterns on the CONGAREE SWAMP LITHOGRAPH. Trace, with a wipe-off pen, some of the abandoned meanders and oxbow lakes in the floodplain. Is there any connection between your tracings and the color patterns? Explain your answer. The bright red color on this lithograph is mostly due to infrared reflection from loblolly pine trees. Although these trees can live in wet soils, they cannot live in extremely wet soils. Very slight elevation differences can change the moisture level enough to exclude the loblolly pine. Use the color differences on the lithograph to distinguish the wettest from the driest soils in the floodplain.

5. **Outline boundary of National Monument.**
   Locate the Congaree Swamp National Monument on the CONGAREE SWAMP TOPOGRAPHIC MAP and outline its boundary lines with a wipe-off pen. (Use map symbols to help you find this boundary.) Is most of this area swampy? Is most of this property forested? How can you tell? Using the contour lines and other symbols for guidance, determine the highest and lowest elevation points within the monument area. Describe the landforms in this area using as many descriptive words as possible. What geological processes have been responsible for producing this landscape? Describe some of the characteristics of the soil that you would expect to find in the Congaree floodplain.

6. **Make topographic profile of bluff and swamp.**
   Make a topographic profile across the Congaree River floodplain. Locate the bluff running along the south side of the river floodplain on the CONGAREE SWAMP TOPOGRAPHIC MAP. Find the place where the bluff comes closest to the river (at the word "Congaree" written within the river margins). With a wipe-off pen, draw a straight line starting at the 324 foot elevation mark at the top of the bluff and moving northward through the word "Monument" in the label for Congaree Swamp National Monument, across Cedar Creek, until you reach the 115 foot elevation point marked with a small “x”. Determine the vertical axis scale by finding the difference between the highest and lowest elevations (the rise) along the drawn line. Mark intervals of 100 feet (based on your rise) along the vertical axis on your paper. Be sure your axis is at least one inch from the left edge of your graph paper.

   Fold your paper to form the horizontal axis. Place the horizontal axis along your line so that the origin is at the top of the bluff. Starting at the origin, imagine you are walking a path along the line you have drawn. Each time you come to an index contour line (darker contour line), stop and plot the elevation corresponding to that point. Continue to walk, stopping and plotting each index contour line until you reach the end of your profile line. Connect the points you have plotted being sure to show hills and valleys as appropriate. This graph is your profile of the river floodplain.

   Describe the scenery you would see along both banks while floating down the Congaree River on a raft. Do you think the top of the bluff ever gets flooded by the river? Explain your answer. Locate this exact same spot on the CONGAREE
SWAMP LITHOGRAPH. How can you distinguish between the bluff and the
floodplain based on the lithographic image?

7. Analyze and interpret Congaree Swamp flood data.

The United States Geological Survey operates several gauging stations across the
state that continuously monitor and record river, stream, and lake water levels. One
of these stations monitors the Congaree River as it leaves Columbia. These readings
are an excellent predictor for the water level in the Congaree Swamp, although it
usually takes about 20 hours for the floodwaters to reach the National Monument
boundaries. The chart below lists monthly maximum and minimum river flow. A few
extra dates have been included to provide additional points for graphing purposes.
Label a piece of graph paper so that the vertical axis represents the river level in feet,
and the horizontal axis represents time in days. Scale your axes appropriately so
your graph will fit on the graph paper. Draw reference lines indicating water levels for
the five different flood stages as indicated on the chart entitled Monument Guide to
Flood Stage in the Congaree Swamp. Divide into groups so that half the class is
graphing data from the first year and the other half is graphing data from the second
year. Compare your group’s graphs with those from the other group. What was the
highest river level reached during the year? When did it occur? What was the
lowest? When did it occur? What could cause the river level to change so
dramatically over time? Is there a seasonal pattern to river flow levels?

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Data compiled by Richard A. Clark, Chief of Research and Resources Management, Congaree Swamp National Monument.

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Data compiled by Richard A. Clark, Chief of Research and Resources Management, Congaree Swamp National Monument.
Use the chart, Monument Guide to Flood Stage in the Congaree Swamp, and your graph as references to determine how many times during your assigned year the river level reached or exceeded each stage. The area is considered flooded any time the water level is at stage 1 or above.

Divide into five groups so that each group is working with one flood stage. Sketch on the CONGAREE SWAMP TOPOGRAPHIC MAP, with a wipe-off pen, the approximate geographic limit of flooding for your assigned stage. Color in the flooded area of the map with the blue wipe-off pen so you have a clear distinction between water and land. Assume that gauge height equals elevation above the Congaree River (use 90 feet as an estimate of the normal river level). When all groups have finished, place the five maps side by side so the differences in floodwater coverage can be easily compared.

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<td>1</td>
<td>6.1</td>
<td>river waters begin to enter channels/guts/sloughs in park</td>
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<tr>
<td>2</td>
<td>8.4</td>
<td>channels/guts/sloughs overflow, flooding begins, road to Wise Lake is impassable</td>
</tr>
<tr>
<td>3</td>
<td>12.7</td>
<td>low boardwalk covered, all trails except Bluff Trail inaccessible</td>
</tr>
<tr>
<td>4</td>
<td>21.2</td>
<td>entire swamp flooded, portions of high boardwalk near Weston Lake are under water</td>
</tr>
<tr>
<td>5</td>
<td>23.0</td>
<td>most of high boardwalk flooded, some park roads near Weston Lake are under water</td>
</tr>
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</table>

8. **Determine length of Congaree Swamp boardwalk.**

On the CONGAREE SWAMP TOPOGRAPHIC MAP, locate and measure the length of the elevated boardwalk. Notice the position of the Ranger Station in relation to the boardwalk. Weston Lake lies along part of the boardwalk route. Locate Weston Lake on the CONGAREE SWAMP LITHOGRAPH. Can you see the boardwalk on the lithograph image? Explain. What is the advantage of having a boardwalk in a swamp? Why do you suppose the boardwalk was built in that particular area of the swamp? If you were asked to build a second boardwalk in the swamp, what location would you select? Use a wipe-off pen to mark your new boardwalk on the map. Justify your answer.

9. **Estimate time of day of photo by positions of shadows.**

Locate the Congaree River on the CONGAREE SWAMP LITHOGRAPH. Note the compass symbol in the lower margin of the lithograph. Compare the appearance of the north and south banks of the river on the image. On the south bank, you should recognize black shadows of trees extending over the blue river water in the main channel. These shadows will not be present along the north bank. Why not? Use the shadows like a sundial to estimate the time of day the aerial photograph was taken. Assume the shadows will point due north at 12:00 noon. How accurate is your estimate? Explain.
ENRICHMENT ACTIVITY

1. **Compare modern and ancient maps.**
   Compare today's map with the Congaree Swamp map from Mill's Atlas. Use Cedar Creek as a guide. How has the river changed course? Compare the land along the Congaree with that along the Wateree River. Did General Sumter have a valid point when he said the Friday's Ferry area was unhealthy?

2. **Complete table about life habits of five swamp animals**
   The different animals of the Congaree Swamp have different requirements for food, shelter, and habitat areas within the swamp environment. Also, the floodplain forest is covered with water several times a year, temporarily pushing some animals out of the swamp to higher land areas. This is especially true of the deer, bears, and wild hogs, which can't live in the trees. The table below lists seven different types of animals that live in the Carolina swamps. Complete the table with information about the life habits of each animal.

<table>
<thead>
<tr>
<th>ANIMAL TYPE</th>
<th>HABITAT TYPES</th>
<th>FOOD TYPES</th>
<th>ANIMAL RANGE</th>
<th>SWAMP CONDITIONS</th>
<th>BEST SUITED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bobcat</td>
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<tr>
<td>Bream</td>
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<td>Largemouth Bass</td>
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<td>Mosquitoes</td>
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<td>Owl</td>
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<td>Snake</td>
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<tr>
<td>Wood Duck</td>
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</tbody>
</table>

3. **Graph water levels of local river or lake.**
   Use water levels reported in local newspapers to graph fluctuations in river levels over a period of several weeks or several months. Why are these water levels printed in newspapers? Who uses this type of information?
Activity 6A-2: Life in a Floodplain Swamp

PERFORMANCE TASKS
(Icon Key) Overview = ⚪; Science = ⬤; Math = ⬦; History = ⛢; Language Arts = ⚫

1. **Analyze the newspaper article.** ⚫
   Read the newspaper article on page 6A-1, "Trees with national significance fell to Hugo in Congaree Swamp." Explain how the story relates to the Coastal Plain Landform Region. Identify on the STATE BASE MAP #2, WITH HIGHWAYS, (refer to the COASTAL SATELLITE IMAGE if needed), where the places and events named in the story might be located. Explain why the publisher thought this story might be of interest to newspaper readers. Using the same references and setting, write another newspaper article related to the same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

2. **Where would you look for Native American artifacts?** ⛢
The Congaree Swamp is named after the Congaree Nation, which once inhabited this area. Not much is known about the Congaree Indians because they disappeared before early explorers could record much about their lives. If you are an archaeologist wanting to learn more about this group of Native Americans and know that the swamp is prone to flooding, where might you begin looking for undisturbed artifacts? Where might you look for village sites? Where might you look for hunting artifacts? Locate these possible sites on the CONGAREE SWAMP TOPOGRAPHIC MAP and the CONGAREE SWAMP LITHOGRAPH. What route do you think a Congaree trader, traveling by canoe, would have taken to trade with a Cherokee village in the Blue Ridge Mountains? Outline your route on the STATE BASE MAP #1, SHADED RELIEF, with a wipe-off pen. Which counties would you go through today if you made this same trip?

3. **Plot location of champion trees on topographic map.** ⬤ ▬
Use the directional coordinates from Figure 6A-1, "Champion Trees Located in Congaree Swamp National Monument," to plot the positions of several record trees on the CONGAREE SWAMP TOPOGRAPHIC MAP. Use a protractor and a ruler to plot the location of the big trees from the radial coordinates given in the table. Use the letter "O" in the word "NATIONAL" on the map as your origin (starting point) and measure all angles and distances from this point. For example, the coordinate designation "2000, 30 N of E" means that the tree is located 2000 feet from the origin along an imaginary line that runs 30 degrees north of due east from the origin point.
Use a wipe-off pen to mark the location of each of your selected record trees on the topongraphic map. Can you locate these very large trees on the CONGAREE SWAMP LITHOGRAPH? With respect to distance from the current river channel, where are most of the big trees? Suppose you were a logger in the late 1800’s; where would you plan to market your timber? After using a crosscut saw to cut down the trees, how would you get these logs to that market? Why do you think this part of the park was never clear-cut for timber and used for agricultural purposes?

4. **Graph champion trees vs. normal tree height.**

Use Figure 6A-1, “Champion Trees Located in Congaree Swamp National Monument,” to make a multi-bar graph comparing the height of several champion trees in the Congaree Swamp to normal size trees of the same species. Let the vertical axis represent height in feet. Place labels for the different species you selected along the horizontal axis of your graph. Note that in the data table, the champion trees have three dimensions recorded. The first is the circumference in inches, the second is the tree height in feet, and the last is the crown size, also measured in feet. You will use only the tree height number for this exercise. Select eight tree samples to analyze. Write down the tree numbers of your selections in the appropriate column in the chart below.

Use your completed bar graph to contrast the height of normal trees to the trees in the Congaree Swamp. Calculate the percentage difference between the two heights for each species of tree you analyzed. Enter your calculated differences in the last column of the data table below. Compare your tree data with other tree data from your classmates. Identify the three trees with the greatest percentage difference and the three trees with the smallest percentage difference. Do your calculations show a relationship between tree type and percent difference? What is the average percent difference for all tree types in the chart? What do you conclude about the height of normal trees vs. Congaree Swamp trees? List factors that contribute to the enormous size of champion trees? Why do trees in the Congaree floodplain grow so much larger than usual?

### Table of Heights of Champion Trees vs. Normal Trees

<table>
<thead>
<tr>
<th>#</th>
<th>TREE SPECIES</th>
<th>NORMAL HEIGHT</th>
<th>CHAMPION HEIGHT</th>
<th>% DIFFERENCE</th>
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</thead>
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</table>
5. **Calculate ages and sizes of trees.**
   If a baldcypress tree increases its diameter 3/8" each year, what is the diameter of a tree that is 500 years old? What is its circumference? Estimate the age of a loblolly tree that was blown over by Hurricane Hugo in 1989. The tree measured 22.5" in diameter. The growth rings were an average of 3/16" apart.

6. **Write about experience as an old tree.**
   Write a story about your experiences as a 700-year-old baldcypress tree living in the Congaree Swamp floodplain. What animals or people visited you in the swamp? Did these visitors change the environment? How would you feel about being cut, left to dry, then floated to a sawmill? What was it like to change from a tree to so many board feet of lumber? How tall were you? How were you used? What did you help produce? Or maybe, you would rather be a loblolly pine, swamp tupelo, red maple, or cherrybark oak. Other stories can be written based on your experiences as a different tree. Why was it important to preserve the Congaree Swamp National Monument for future generations? Write a poem about a swampy area and read it to your classmates. Swamp tales can be frightful, because echoes of sounds bouncing off trees sound eerie.

7. **Evaluate the practice of draining swamps for farmland.**
   Robert Mills, as Superintendent of Public Works in 1826, urged that the Congaree Swamp be drained for farmland. List possible benefits and potential problems. History states that farmers used swamp land for grazing cattle. How were such uses possible? Why did the farmers construct dikes and cattle mounds? Can you find any evidence of this man-made construction on the present day CONGAREE SWAMP TOPOGRAPHIC MAP? Why or why not? During the 1980's several historic structures were found within the park. Earthen structures such as cattle mounds, earthen dikes, irrigation structures, logging roads and old bridge abutments attest to the use of the swamp for agricultural purposes. The cattle mounds themselves represent a previously unrecognized environmental adaptation in the swamp. Why did this effort prove impractical? Why does the railroad track run so far away from the northeastern edge of the swamp?

8. **Compare Sims’ account with "The Big Swamps of the Congaree."**
   Read the oral history presented in the story "Interview with Mr. Booker T. Sims" on page 6A-5. Then read "The Big Swamps of the Congaree" by Edward C. L. Adams on page 6A-6. Compare Adams' tale to Mr. Sims' description of the swamp. Locate as many features from the story as possible on the CONGAREE SWAMP TOPOGRAPHIC MAP and the CONGAREE SWAMP LITHOGRAPH.

9. **Locate possible site for story "A Freshet on the Congaree."**
   Read the story "A Freshet on the Congaree," on page 6A-8, and make a list of all adjectives and descriptive terms relating to the swamp. Use this list to try to identify a particular location on the CONGAREE SWAMP TOPOGRAPHIC MAP and the CONGAREE SWAMP LITHOGRAPH where the story might have taken place. Defend your choice in a discussion with other groups.
10. **Rewrite Swamp Tales in your everyday dialect.**

Divide into groups and read one of the stories from the section Legends and Tales of the Congaree Swamp, beginning on page 6A-6. Make a list of phrases, words, and colloquialisms which occur in the story. Translate these into your own words and rewrite the whole story. Read or tell your new story aloud to your group. Which version of your story is the most fun to read and listen to? Why? Select one story from your group to read or retell to the class. Discuss with the entire class why swamp tales are usually told with this type of dialect. What other recognizable dialects are common in South Carolina? Where in the state would you be most likely to encounter them?

**ENRICHMENT ACTIVITIES**

1. **Research the history of logging in Congaree Swamp.**

   Mr. Beidler purchased the land in the Congaree Swamp for the purpose of logging. Describe how this logging was carried out. How old were some of the trees that Beidler's men cut? Why did the loggers not use roads to get the logs to the saw mills?

2. **Identify historical events when trees were seedlings.**

   Identify the historical events in South Carolina that occurred nearest to the time the following trees were seedlings. A live cherrybark oak is estimated to be 325 years old. A 425 year-old baldcypress tree was cut in 1951. A loblolly pine tree, estimated to be 124 years old, went down as a result of Hurricane Hugo in 1989.

3. **Document record trees in National Monument.**

   Prior to visiting the Congaree Swamp National Monument, investigate the flora and fauna indigenous to swampy areas of South Carolina and make leaf rubbings of as many species as possible. The most striking features of the National Monument will be the large number and variety of big trees. There are 89 species of trees; several are recorded as national champions, and many hold the state record for size. Use one of the field guides as a reference to identify baldcypress, tupelo, sycamore, sweet gum, black gum, holly, ash, swamp chestnut, green ash, pawpaw, hickory, elm, palmetto, maple, holly, and a variety of oaks. Even though Hurricane Hugo, in September 1989, took its toll on these trees, this area is still considered the largest significant stand of old growth river bottom hardwood forest in North America. Identify the reptiles, birds and fur-bearing animals that thrive in this habitat.

4. **Research Harry Hampton and his stories of Congaree.**

   Harry Hampton wrote a column for *The State* newspaper for many years. His Column was called *Woods and Water*. He was supposed to know more tales and stories about the swamp than anyone. Find out more about Harry Hampton by researching his stories and tales of the Congaree Swamp.
5. **Find biggest tree in community and calculate its formula.**

Search your schoolyard or community to find the largest tree on school property. Follow the directions given in the Brief Site Description for calculating its numerical size using the "Big Tree" formula. Calculate its diameter by measuring the circumference and using the formula for converting circumference to diameter:

\[
\text{circumference} = \pi \times \text{diameter} \quad \text{where} \quad \pi \ (\text{pi}) = 3.14
\]

How many students does it take to reach around the tree by holding hands? Identify the species of tree by looking at leaves and/or bark. Is your tree a candidate for champion status compared to the Congaree Swamp trees of the same species?
SECTION 7
COASTAL PLAIN REGION / KARST TOPOGRAPHY

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| 2B | Lake Jocassee Region (Energy Production) | 6A | Congaree Swamp (Pristine Forest) |
| 3A | Forty Acre Rock (Granite Outcropping) | 7A | Lake Marion (Limestone Outcropping) |
| 3B | Silverstreet (Agriculture) | 8A | Woods Bay (Preserved Carolina Bay) |
| 3C | Kings Mountain (Historical Battleground) | 9A | Charleston (Historic Port) |
| 4A | Columbia (Metropolitan Area) | 9B | Myrtle Beach (Tourist Area) |
| 4B | Graniteville (Mining Area) | 9C | The ACE Basin (Wildlife & Sea Island Culture) |
| 4C | Sugarloaf Mountain (Wildlife Refuge) | 10A | Winyah Bay (Rice Culture) |
| 5A | Savannah River Site (Habitat Restoration) | 10B | North Inlet (Hurricanes) |
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  - Activity 7-1 : Overview
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      p. 7-11 - 3. write travel log on a trip through a cave
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7-ii

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   (Icons)  Overv =  Sci =  Math =  Hist =  Lang Arts =  

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   - Rationale

   - Brief Site Description

   p. 7A-2  - Santee National Wildlife Refuge
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   p. 7A-3  - Story - "The Big Catch"

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      - Materials
      - Performance Tasks

      p. 7A-4  1. locate the study site
      p. 7A-4  2. analyze the newspaper article
      p. 7A-4  3. locate sinkholes on topographic map and lithograph
      p. 7A-5  4. determine the elevation of the groundwater table
      p. 7A-5  5. trace disappearing stream
      p. 7A-5  6. calculate stream density in Karst areas
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      p. 7A-7  2. locate catfish beds by analyzing sediment load
      p. 7A-8  3. analyze land use changes through time
      p. 7A-8  4. estimate size of peach orchards
      p. 7A-8  5. determine average width and volume of Lake Marion
      p. 7A-8  6. compare topography of the east and west banks of Lake Marion
      p. 7A-9  7. locate Santee Indian Mound on map and lithograph
      p. 7A-9  8. determine size of Santee Wildlife Refuge
      p. 7A-9  9. calculate average weight of fish caught in Lake Marion
      p. 7A-10  10. calculate weekly percentage change in waterfowl population
      p. 7A-10  11. analyze seasonal population changes in Santee waterfowl
      p. 7A-12  12. determine probability of sighting a particular waterfowl species
      p. 7A-13  13. analyze population changes in the Lake Marion area
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SECTION 7
COASTAL PLAIN / KARST TOPOGRAPHY

POWER THINKING ACTIVITY - "Indian Mound Maneuver"

Imagine you are a Native American warrior in the Santee Nation in A.D. 1250 living near a set of caves (presently located in the southern portion of Santee State Park) not far from the west bank of the Santee River (the position of the Santee River channel underneath Lake Marion is labeled on the LAKE MARION TOPOGRAPHIC MAP). You want to attend a festival at the famous ceremonial mound (known today as the Indian Mound) across the Santee River in what today is called the Santee National Wildlife Refuge. Locate both landmarks, the caves and the Indian Mound, on the LAKE MARION TOPOGRAPHIC MAP and the LAKE MARION LITHOGRAPH. Remember that Lake Marion is an artificial reservoir and did not exist in A.D. 1250. What will be your quickest route from the caves to the mound? Explain. How long would it take you to travel that distance? How would you travel, by canoe, on foot, or a combination? What factors would affect the speed you could travel? List three major obstacles that you might encounter on your journey. From how far away could you actually see the Indian Mound? Explain your answer.

PERFORMANCE OBJECTIVES

1. Recognize Karst topography by the presence of sinkholes, disappearing streams, and other features on topographic maps and lithographs.
2. Determine elevation of groundwater table in Karst areas by estimating elevation of surface water features.
3. Explain distribution of limestone rock in South Carolina by referring to geologic history of the state.
4. Assess environmental impact of depositing hazardous materials in areas underlain by Karst topography.
5. Evaluate environmental and economic impact of damming rivers to form lakes, including specific impact on wildlife refuge areas from variation in lake levels.
6. Calculate percentages, seasonal population changes, and probability of sighting specific waterfowl species using National Wildlife Refuge data.
7. Interpret meaning of color variations in lakes, ponds, creek tributaries, Carolina Bays, and other wetland areas as seen on lithographs.
8. Locate Fort Watson and evaluate historical significance of this site as both an Indian Mound and later as the location of a Revolutionary War skirmish.
9. Use fishing tales and other outdoor stories as a springboard for storytelling and writing activities.
BACKGROUND INFORMATION

Description of Landforms, Drainage Patterns, and Geological Processes

Characteristic Landforms of Karst Topography

Karst topography is the term taken from the name of a region in Eastern Europe which is given to landscapes which are sculpted primarily by groundwater activity. Any soluble rock can produce typical Karst features, but nearly all examples in the eastern United States occur in limestone belts. A major clue to the presence or absence of Karst topography is the pattern of stream drainage. An area with several disappearing streams and many springs is a likely candidate for Karst. Groundwater slowly dissolves underground rock until the surface becomes unstable and collapses, forming sinkholes. Sinkholes often merge to form a linear valley, called a solution valley, which has no visible stream in it and may have no visible outlet for surface water. Karst areas are often hilly if the geologic processes have progressed far enough for sinkholes and solution valleys to form. Extensive cave systems often underlie these surface features, but are rarely visible at the surface. Some sinkholes may fill with water, creating small lakes. Karst features may not be immediately noticed on maps or photographs because sinkholes are the only distinct landform feature easily visible at the surface. Other features can be seen only from ground level or underground.

Geographic Features of Special Interest

The Santee Limestone underlies a large portion of the South Carolina Coastal Plain Region but is exposed at the surface only along the Santee River valley and its surrounding counties. The most spectacular example of Karst topography is located in Santee State Park along the western shore of Lake Marion. The park contains sinkholes, caves, disappearing streams, solution valleys, and sinkhole lakes. Park naturalists conduct tours of the caves during times when visits will not bother the native bat population. Rock samples, many of which contain fossils, may be found outside of the park boundaries on both sides of Lake Marion. The limestone itself is composed of a mixture of limey sands, lime muds, and shell-hash layers. Accumulations of oyster beds, from the shallow continental shelf located here 40 million years ago, are found in several places within the major sinkhole area of Santee State Park.

The best place to see large amounts of limestone rock is in one of the many limestone quarries located to the west of Lake Marion and Lake Moultrie. Most of these quarries will permit visits by school groups. One example is the Giant Portland Cement quarry located about two miles from Harleyville in Dorchester County. Walls of limestone rise up to 40 feet out of the bottom of the quarry and provide diverse examples of sediment from several different sub-environments present on the long-ago continental shelf. Some of the limestone layers are highly fossiliferous, with bryozoa and mollusk fragments being the most common fossils.
How Limestone Forms

The limestone, which lies exposed along the western shore of Lake Marion, is given the formation name, Santee Limestone, because it was first described near the town of Santee. This limestone is very pure and generally extremely porous. Most limestones are chemically produced rocks formed in warm, shallow ocean environments far away from sources of sand and mud which would tend to contaminate the deposit.

Environmental conditions necessary for limestone deposition existed in parts of South Carolina during the Eocene Epoch about 40 million years ago. After limey material was deposited and buried by overlying sediment, additional calcium carbonate and magnesium carbonate were precipitated from groundwater to glue the rock together. This rock formation is characterized by high porosity and permeability, traits which give it the ability to hold and transmit water. This distinguishing feature makes the limestone a good aquifer or carrier for groundwater. Because the formation underlies most of the Coastal Plain, farmers and others can drill wells down into the limestone rock and pump out large quantities of good quality water for crops and human consumption.

Fossils

Many animals and plants that live in a marine environment leave behind shells or other indicators of their existence when they die. These may eventually turn into fossils within the rock, and they can be used to help identify and date the geological formation in which they are found. Many kinds of fossils are found in the Santee Limestone Formation, but the most common are shells of clams and snails and colonies of bryozoa, which resemble coral but are internally quite different.

Another important use of fossils is to help geologists interpret environmental conditions in the past, when these organisms were alive. For example, fossils with thick shells are more likely to be from animals that lived in higher energy, wave-dominated environments where thick shells were an important protective feature for the organism. Organisms with very fragile shells could not have survived extensive wave action, so geologists use their fossils as indicators of deeper water, lower energy environments. Many of the fossil layers are composed of a mixture of broken-up shell fragments, suggesting the aftermath of a large storm, perhaps a hurricane. Similar deposits can be observed today along beaches which have experienced storm activity.

Development of Karst Topography

The Santee Limestone is the only rock formation in the state in which Karst topography has developed on a large scale. The formation of Karst topography requires acidic groundwater and time. Most rainwater is slightly acidic due to the absorption of carbon dioxide from the atmosphere by raindrops. It is this rainwater containing carbonic acid which soaks into the ground to become groundwater, which becomes even more acidic as it assimilates organic acids from plant roots and decaying vegetation. The result is a weak but effective chemical agent that slowly dissolves limestone rocks and soil particles. As dissolution continues, the limestone develops cracks, holes, passageways, and eventually open caverns which allow even more water to penetrate the rocks. In limestone regions, more water travels underground than on the surface and caves can grow so large that their roofs finally collapse to form sinkholes.
Caves

Open caverns, or caves, are some of the most interesting features in areas of Karst topography. As long as caves are below the groundwater table, they will continue to grow larger as the dissolution of limestone slowly continues. However, once the groundwater table drops below cave level, a different process takes over. Highly acidic water dripping into an open cave will slowly evaporate, leaving behind a crusty accumulation of mineral salts, especially calcium carbonate (calcite). Stalactites, stalagmites, and other deposits, known collectively as dripstone, will eventually fill a cave completely if the process is not interrupted. Until that time, caves provide important specialized ecosystems for animals like bats.

Groundwater Flow and the Groundwater Table

Karst topography can influence land use patterns to some extent, but its most important effect is on groundwater flow. Even in Coastal Plain counties where the Santee Limestone is not exposed at the surface, most wells for agriculture and home drinking water are drilled into this formation. Not only do wells in this region take advantage of the abundant supply of water stored in the underground pore spaces, but they also benefit from the high permeability or flow rates at which water can be pumped from the ground. However, with so many interconnected passageways underground, it is very easy for pollution to spread quickly from one area to another. A single contamination site can affect wells and water supplies in areas many miles away. Once pollution is introduced into this type of groundwater system, it is extremely difficult to contain the pollutant or to clean it up.

An important component of any groundwater system is the precise elevation of the groundwater table, the top of the saturated part of the soil. This term actually refers to the level in rock or soil above which water can only move downward, under the influence of gravity, but does not remain. This boundary is not fixed but can rise or fall through time depending on long-term weather patterns. For example, during times of drought, the elevation of the groundwater table would be significantly lowered. Because wells must be drilled below the groundwater table to be able to pump water, it is important to know the elevation of the groundwater table so that a well can be drilled deep enough to continue producing water even during a drought. The elevation of the groundwater table can be measured directly in wells, but it can also be approximated by observing water levels of lakes, swamps and other bodies of standing surface water. As is true for any humid region, the water elevation in a river, lake, or swamp is approximately the same as the groundwater table elevation in the immediate vicinity.
Santee Indian Mound

The Santee Indian Mound is a well-preserved example of flat-topped Native American ceremonial mounds that were once located throughout the southeastern United States. This particular mound was a gathering place serving much of the central Coastal Plain of South Carolina. It served as a platform on which a temple could be built. The temple was constructed of upright posts through which small sticks were woven and then plastered with mud. The roof was thatched with straw. The mound probably served as a central distribution point for food and other supplies as well. These mounds have sometimes been mistakenly identified as burial mounds, but their shape and function were very different from those of burial mounds.

Temple mounds first appeared in the Mississippi River Valley about A.D. 1000, and shortly thereafter became commonplace in the southeastern United States. Archaeologists theorize that the Santee Indian Mound was built sometime between A.D. 1200 and A.D. 1400 because it occurs along the easternmost extension of the region inhabited by the mound building culture. The spread of the mound culture coincided with the spread of large scale agriculture and trade among the Native American population.

It is highly probable that the Santee Indian Mound site was once a part of the Province of Cofitachiqui, a Native American cultural region with its center near present-day Camden. Cofitachiqui was visited between 1540 and 1542 by the Spanish explorer Hernando de Soto who wrote that the people he found around the mound site were generally healthy and taller than Europeans. The Province of Cofitachiqui was ruled at that time by a female priestess, a situation which was not uncommon in that culture. Nobody really knows why the mound builders died out over the next hundred years, but diseases introduced by Europeans, which are known to have killed thousands of Native Americans, may have played a significant role.

Francis Marion Captures Fort Watson

During the Revolutionary War, General Francis Marion became a hero because of the unconventional tactics he used to win battles. One of the most famous stories about his exploits is the capture of Fort Watson, formerly the Santee Indian Mound, within what is now the Santee National Wildlife Refuge. The British had established a fort on the mound by building a high wall around it, and this fort guarded one of the main roads from Charles Towne to Camden. They kept the fort closely guarded, and kept the bluff surrounding Fort Watson bare of trees. Marion and his brigade of southern patriots had recently been joined by General Light Horse Harry Lee and his Continental troops. After trying and failing to penetrate the wall by force, Lee requested a cannon from General Nathanael Greene, the commander of the Southern army, in Camden. The cannon was immediately dispatched, but, Greene’s troops lost their way and wandered around for days before finally returning to Camden without delivering the cannon.

Prior to the battle, the water for Fort Watson had been taken from a nearby oxbow lake. When Marion and his troops arrived, their first objective was to cut off the British water supply. But while Marion and Lee were waiting for the cannon, they noticed that the British were digging a well at the base of the Indian mound. In the meantime, however, an epidemic of smallpox had broken out in Marion's camp, and many of the
militiamen began to desert. Marion, realizing that they could not take the fort by storm, considered abandoning the siege. But Major Hezekiah Maham, a Continental officer, suggested building a tower higher than the fort. Immediately, Marion sent his horsemen to scour the neighboring plantations for axes so they could chop down pine saplings. Maham's tower was erected during the night. At daybreak on April 15, 1781, the best riflemen climbed into the crow's nest to fire on the British as they went to their well for water. The British immediately raised the white flag signifying surrender. Once again Francis Marion's ragged guerrilla troops had defeated the British in a clever, fox like manner. This episode added even more credence to Francis Marion's legendary nickname of "The Swamp Fox." His men, known for their ability to hide themselves in trees, make plates out of bark, and live for days on nothing but sweet potatoes and water, were greatly admired.

William Cullen Bryant wrote the following verse about Francis Marion, The Swamp Fox. Notice that Bryant emphasized the fact that Marion knew the Carolina swamps very well and used his knowledge to surprise the British troops. Notice how he has described the life of one of Marion's men who loves the moonlight rides and surprise attacks.

"Song of Marion's Men"
by William Cullen Bryant

Our band is few but true and tried, / Our leader frank and bold;
The British soldier trembles / When Marion's name is told.
Our fortress is the good greenwood, / Our tent, the cypress-tree;
We know the forest round us, / As seamen know the sea...

Well knows the fair and friendly moon / The band that Marion leads---
The glitter of their rifles, / The scampering of their steeds.
'Tis life to guide the fiery barb / Across the moonlit plain;
'Tis life to feel the night-wind / That lifts his tossing mane.
A moment in the British camp---/ A moment---and away
Back to the pathless forest, / Before the peep of day.

Grave men there are by broad Santee, / Grave men with hoary hairs;
Their hearts are all with Marion, / For Marion are their prayers...
For them we wear these trusty arms, / And lay them down no more
Till we have driven the Briton, / Forever, from our shore.
Natural Resources, Land Use, and Environmental Concerns

Storage of Hazardous Waste

Hazardous waste landfills exist in all regions of South Carolina but are considered to pose a special risk to groundwater in the Karst landscape around Lake Marion. Such landfills are a legitimate environmental concern because of the high porosity and permeability of the underlying limestone. Any pollutants entering this rock could easily be carried away from the site to contaminate not just local drinking water supplies but also the underground aquifers serving most of the lower Coastal Plain. One example of such a hazardous waste landfill is the GSX Landfill located near the town of Rimini near the northeastern shore of Lake Marion.

The land near Lake Marion was purchased for a hazardous waste storage area because it contained large quantities of fuller’s earth. This substance, commonly used for kitty litter, has huge absorbing abilities. However, well over a billion pounds of hazardous waste already has been buried in this landfill, and the fuller’s earth is losing its capacity to absorb. Instead, a polyurethane lining with only a 50 year warranty has been placed between the containers of hazardous waste and the underlying limestone rock. In time, the hazardous waste could seep through the polyurethane barrier and pollute the underlying aquifer that provides water for much of the Coastal Plain Region of South Carolina. It could also enter the head waters of Lake Marion and contaminate the entire Santee River basin as it flows on down to Charleston or through the Santee Delta. It is important for environmental regulators to work with industry representatives to ensure that adequate protection of drinking water will continue into the future.

Mining of Limestone

Limestone has been mined in South Carolina since the early 1800’s. Most of the limestone is mixed with clay and sold as portland cement. Some is marketed as crushed rock and building stone. As recently as 1991 there were 25 active mines in the state located in seven counties. Cherokee County is the only Piedmont county which has produced limestone commercially, from marble deposits in the Kings Mountain Belt. Horry County along the coast produces mostly coquina, a mix of broken shells cemented together by lime. The majority of the state’s limestone is quarried from the Santee Limestone Formation in Bamberg, Berkeley, Dorchester, and Orangeburg counties.

The first step in mining hard rock limestone is to remove the trees, soil, and other overburden from the top of the limestone formation. Bulldozers are normally used for this operation. In order for the quarry to be profitable, the limestone must be fairly close to the surface. Dynamite or other explosives are normally used to blast the rock into small pieces which are then hauled to processing areas to be ground up, sorted, and mixed with other materials when appropriate. The deeper the quarry extends, the more difficult it is to bring the material to the surface. Another common problem is water seepage. Because the formation is porous and a good aquifer, almost every quarry has great volumes of water flowing out of the fractured rock into the bottom of the pit. Pumps must be operated almost continuously to keep the lower portions of the quarry dry. When a quarry is abandoned, water will seep in to form a deep pond. These ponds are unsafe for swimming because of their great depth and the loose rock found around their edges.
Caves and Bats

It is not widely known that under Santee State Park, on the southern shore of Lake Marion, are caves, formed when the limestone that underlies the park was dissolved by the naturally acidic groundwater seeping down from the surface. Although not large like Mammoth Cave in Kentucky or Carlsbad Caverns in New Mexico, the caves at Santee State Park are big enough to provide visitors with exciting tours into the darkness. They also provide homes for bats. Several species of bats, such as the eastern pipistrelle, shelter in the protected environment of these caves for at least part of the year, some passing the entire winter huddled dormantly in small holes or cracks in the rock. However, one bat resident deserves special attention, the southeastern myotis.

This small bat is unique because in one cave at Santee they set up a maternal colony each summer, the only known maternal colony for this species in South Carolina. Hundreds, perhaps thousands, of female bats gather in one cavern, known as the birthing room, to give birth and to raise their young. The baby bats, called pups, are born like other mammals, and not hatched from eggs in a nest as many people think. This common misconception probably arises from the fact that bats fly, and so people assume that they must be related to and must reproduce similarly to birds. In fact, bat pups are like most mammal babies; they are nearly helpless, only able to cling to their mothers or to the rocky roof of their cave. Bat mothers must nurse and protect their pups until they mature.

During nursing time, bat pups face serious danger if their colony is disturbed. Like all mammals, bats must stay warm, and as tiny as they are (adults of this species weigh only a few grams) they can only do this in their cool cave by clinging to their mothers. If the colony is disturbed the mothers will suddenly fly, and there is a great chance that the bat pups will be shaken loose and fall into the water that covers the floor of their caves. Although older pups can swim and climb somewhat, their chances of being reunited with their mothers before dying of cold or hunger are slim. Therefore, access to the maternal cave is prohibited during summer, the birthing season. Tours are available during September and October, after the southeastern myotis have left and before the bats which do winter-over in Santee’s caves begin their hibernation.

Karst Topography as a Unique Natural Habitat

In addition to caves and bats, Karst areas host a variety of unique habitats which attract certain species of plants and animals. To begin with, the limestone rock acts as a natural fertilizer for soils in these areas. Most farms elsewhere in South Carolina require applications of pulverized limestone and dolostone to add calcium and magnesium ions to the soil and to counterbalance the natural acidity of most South Carolina soils. Soils formed on limestone, however, are naturally fertile and are chemically alkaline (the opposite of acidic). Certain trees and other plants prefer an alkaline soil and can grow to great size under these conditions. Their normal competitors cannot do as well in this specialized chemical environment.

Sinkholes are an excellent example of a specialized microenvironment. Plants in sinkholes are protected from storms and high winds and also benefit from moisture funneled in from surface drainage and from humid air released from underground caves. Cave environments maintain a temperature of about 60 degrees Fahrenheit (15 degrees Celsius) year round, so during hot summers, cooler air from caves will keep sinkholes
cooler than their surroundings. During winters, warmer air from caves will keep the sinkhole environment warmer than the surrounding area.

**Summary**

Limestone, found in the coastal plain of South Carolina, is exposed in the Santee area near Lake Marion, allowing the formation of features characteristic of Karst topography. This porous limestone is the aquifer for much of the lower part of the state. Because of the rapid flow of groundwater through the Karst system around Santee, the aquifer is highly susceptible to contamination. Quality groundwater supplies for home use and farm irrigation could easily be lost if proper conservation measures are not taken. Loss of water quality would also have a significant impact on the entire Santee community including the Santee National Wildlife Refuge and Santee State Park. As recreation and tourism become an even greater economic resource to this region, a readily available source of groundwater is a critical requirement. The public must become aware of the special properties of limestone rock aquifers and protect such areas from pollution. Measures must be taken so that hazardous waste is not placed in a location that could affect major underground water supplies.

Once an important center for Native American culture, the area around Santee, South Carolina, became strategically important during the Revolutionary War. Built on the Santee Indian Mound overlooking the Santee River, British Fort Watson controlled movement through this important transportation route. Its siege and eventual capture by Francis Marion and his men highlights an interesting chapter of the American Revolution.

This mound now stands within a stone's throw of Lake Marion, a large reservoir on the Coastal Plain, famous for its record fish. Fishing, camping, hiking, birdwatching—these are just examples of the recreation opportunities available around Lake Marion. For those with other tastes, numerous golf resorts exist. Given its easy access due to its location near the intersection of Interstate Highways 26 and 95, the future of recreation in this region looks bright.
PLACES TO VISIT

Santee State Park. West side of Lake Marion off Highway 6. For information call 803-854-2408.

Fort Watson. 1.5 miles south of Santee on US 301 and SC Highway 15. For information call 803-478-2217.


Santee Cement Company. Located near Holly Hill. For information call 803-496-5027.

Santee National Wildlife Refuge. Rt. 2, Summerton, SC. For information call 803-478-2217.

Giant Portland Cement Company. 463 Judge Street, Harleyville, SC. For information call 864-462-7651.

REFERENCES AND RESOURCES


Mining Association of South Carolina. (1989). Carolina Limestone. (Brochure) Irmo, SC.


STUDY AREA 7: KARST TOPOGRAPHY OVERVIEW

Activity 7-1: Overview

Materials

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<tr>
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<td>State Base Map #2, With Highways</td>
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<tr>
<td>Coastal Satellite Image</td>
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<tr>
<td>Lake Marion Topographic Map</td>
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<td>Lake Marion Lithograph</td>
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<td>Geologic and Mineral Resource Map</td>
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<td>Transparent Grid Overlay</td>
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<td>Wipe-off Pens</td>
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PERFORMANCE TASKS

_ICON KEY_ Overview = ; Science = ; Math = ; History = ; Language Arts =

1. **Outline counties with limestone resources.**
   Use the GEOLOGIC AND MINERAL RESOURCE MAP to locate major deposits of limestone. Outline the approximate boundary of the limestone outcropping on the STATE BASE MAP #1, SHADED RELIEF, with a wipe-off pen. Determine which counties would be the most likely sites for mining limestone. Are there any Karst features on the base map? Why don't you see evidence of sinkholes and other Karst features on this map? Use the transparent grid overlay to estimate the total area of the limestone region. What percentage of South Carolina is covered by limestone?

2. **Locate approximate position of Eocene shoreline.**
   Geologists think that the Santee Limestone formed about 40 million years ago during the Eocene Epoch of geologic time. Limestone forms today in the ocean far away from sources of sand and mud. Along coastlines like South Carolina's, limestone usually forms more than 100 miles seaward of the shoreline. Using that number as your estimated value trace on the GEOLOGIC AND MINERAL RESOURCE MAP, with a wipe-off pen, the approximate location of the Eocene shoreline, which should be 100 miles landward of the Eocene limestone deposits. Use a broad tip wipe-off pen to shade in the area between your Eocene shoreline and the limestone region. This shaded area represents the area of Eocene sand and mud marine sediments. Approximately what percentage of this region is in the Coastal Plain Region today? What do you think happened to the rest of the Eocene deposits which are now missing? Where do you think they went? How did they get there?

3. **Write travel log on a trip through a cave.**
   Caves are exciting places to visit. In some cases you can travel for long distances underground completely in the dark. Pretend you are a bat hiding in the deepest part of a cave or a drop of water dripping from a stalactite rock on the roof of the cave. Write a descriptive travel log explaining how you would get out of the cave, what you would see, and what problems you would encounter on the way out. Use lots of adjectives to make your story interesting. Locate on the LAKE MARION TOPOGRAPHIC MAP a sinkhole underneath which this trip could have occurred. Try to locate the point on the map where you would exit the cave.
4. **Locate limestone quarry on satellite image.**

The Giant Portland Cement quarry near Harleyville in Dorchester County is the largest in the state, and it is visible on the COASTAL SATELLITE IMAGE. First locate Harleyville on the STATE BASE MAP #2, WITH HIGHWAYS (locate the intersection of Interstate Highways 95 and 26, then go south on Interstate 26 about 9 miles to reach Harleyville). The quarry is located on the south side of Four Hole Swamp along State Highway 453 and the adjacent railroad line. Now locate the corresponding site on the coastal image and find the bright blue spot which indicates the quarry site. Locate another bright blue quarry site on the opposite side of the swamp. Approximately how many square miles of ground does each quarry cover? Why do quarries appear blue on the infrared image? How can you distinguish among quarry blue, water blue, and urban area blue? Using this information and the GEOLOGIC AND MINERAL RESOURCE MAP as a reference, see if you can locate other quarries on the satellite image. How many other quarries are you sure of? Share your findings with other groups and see if you agree on which blue spots are quarries and which are not. How could you find out whether some of your questionable spots are really quarries or not?

5. **Evaluate significance of location of Santee Indian Mound / Fort Watson.**

The Santee Indian Mound and Fort Watson were located along strategic early transportation routes. Mark with a wipe-off pen on the STATE BASE MAP #1, SHADED RELIEF, the approximate location of the Indian Mound (just west of the town of St. Paul in Clarendon County). Divide into two groups and evaluate the strategic importance of that location based on your historical and geographical knowledge of the Coastal Plain Region. Share your results with other groups. Remember that Lake Marion did not exist before the 1930’s. Is this site of strategic importance today, considering that it is located next to Interstate Highway 95? Refer to the STATE BASE MAP #2, WITH HIGHWAYS. Why do people come to visit the Santee Indian Mound / Fort Watson site today?

**Group I**  **Santee Indian Mound** - consider trade and travel route options for Native Americans in the 1500’s. Recall that the center of the local mound-building culture was near present day Camden in Kershaw County. Why do you think the Santee site was a good location for a ceremonial meeting place?

**Group II**  **Fort Watson** - consider trade and travel route options for both the British and the Americans in the 1700’s during the Revolutionary War. Why was the Santee site such a good location for a fort? Why do you think Francis Marion considered it important to capture this fort?

6. **Analyze poem for landscape references.**

Read the poem "Song of Marion's Men." Underline each word which refers to a landscape feature or a description of the local landscape. Which words or phrases match up with something you can see on the LAKE MARION LITHOGRAPH? Are these words enough to convince you that the scene is the coastal plain of South Carolina? Explain your answer.
7. **Trace the path of a pollutant.**

Using the STATE BASE MAP #2, WITH HIGHWAYS, locate Rimini on the east bank of Lake Marion in Sumter County. A hazardous waste disposal site is located in this area 200 feet from the headwaters of Lake Marion. Using a wipe-off pen, trace the possible route of this hazardous waste if it were to enter Lake Marion in that general area and flow all the way to the ocean. Assuming an average surface water flow of 1 foot per minute, how long will it take the pollutant to reach the ocean? Use the map scale to determine distance. Do you think groundwater transport would be faster or slower? Explain your answer.

8. **Assess potential for non-point source pollution of lake.**

Lake Marion is one of the primary water sources for the City of Charleston, as well as for other communities in the Coastal Plain Region. If you were the reservoir manager, which land uses along Lake Marion would you especially want to monitor to reduce the chances of non-point source pollution entering the lake? If necessary, refer to the Background Information. Use the LAKE MARION LITHOGRAPH as your reference. Which uses could you realistically expect to control? Explain your answer.

**ENRICHMENT**

1. **Write to a limestone quarry company.**

Write to a limestone quarry such as the Martin Marietta Aggregates facilities located in Eutawville or Georgetown; the Giant Cement Company, in Harleyville; the Santee Cement Company, in Holly Hill; or the Gifford-Hill Cement Company, in Harleyville. Ask for information about limestone deposits. Also, ask for a sample of limestone rock, preferably with fossils. Soak the sample in water and measure how much water is absorbed into the pore spaces of the rock. Break off a very small piece of the rock and soak it in a container of vinegar or other weak acid. Do you observe any reaction? How long does it take for the sample to totally dissolve?

2. **Research the life history of bats, in particular their association with caves.**

Why are most caves with bat colonies open to tourists only part of the year? How can visitors to caves help preserve bat habitat?
**Rationale**

The Lake Marion study site highlights unique rock exposures, significant historical sites, and land use characteristic of a tourist-based economy. The Santee Limestone is an important Coastal Plain rock formation. It is exposed at the surface only in the south-central part of the state in the Lake Marion vicinity, even though it is buried beneath other sedimentary rocks throughout a much larger area. The formation tilts gently towards the Atlantic Ocean. The Santee Limestone is significant because it is the major aquifer or water producing unit for most Coastal Plain wells. Also, its occurrence around Santee has allowed the development of the only major area in South Carolina featuring Karst topography. A further attraction of the Lake Marion area is the Santee National Wildlife Refuge, a wintering area for migratory birds such as Canada geese, pintail and mallard ducks. Fort Watson, built on the site of the Santee Indian Mound, was the location of Francis Marion's skirmish with the British. These features provide the geological, environmental, and historical significance of the site.

<table>
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<tr>
<th><strong>Orangeburg Times and Democrat</strong></th>
<th><strong>Santee Sinkhole</strong></th>
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<tbody>
<tr>
<td>by Carol Woodward</td>
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<td>Mother Nature pulled the plug on a 30-acre pond at Santee State Park last week. Park Superintendent Phil Gaines said a sinkhole measuring at least 35 feet across and 8 feet deep caused the man-made pond to drain. Gaines said engineers don't know exactly what triggered the appearance of the sinkhole, but pointed out there are &quot;a number of sinkholes&quot; in the park.</td>
<td>This sinkhole apparently had been seeping for about one year and finally eroded to the point of caving in, Gaines said. &quot;It was incredible,&quot; Gaines said. &quot;Wednesday a week ago, we noticed the water level was going down, and by 6:30 a.m. Thursday, the pond was empty. It looked just like a bathtub drain. The water was swirling down toward the sinkhole. It was amazing to watch.&quot;</td>
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<td>The water went through the sinkhole and bubbled up in a creek across the road from the pond. Sinkholes are not an uncommon occurrence in the Santee area, &quot;but this is the largest, by far,&quot; Gaines said. Gaines said the fate of the sinkhole and the empty pond is not certain. &quot;One thing is for sure,&quot; he said laughing. &quot;We can't use the pond for holding water anymore. It can't be repaired.&quot;</td>
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Brief Site Description

Lake Marion Once a Floodplain

Before 1940, the Santee River, a Coastal Plain river, meandered through this area, but with completion of the dam water levels quickly rose, inundating its floodplain. Because the water level was rising faster than the timber could be cut and removed, many stands of trees were swallowed up by the rising water. Some of these tree trunks can still be seen in portions of Lake Marion. The original floodplain is now under water, and new wetland areas have formed as rising lake waters encircled forests and fields, encroached on depressions such as Carolina Bays, and occupied formerly dry areas. The result has been a large and diverse wetland region containing pine, hardwood forest, marsh and swamp habitat, and open-water ponds.

Santee National Wildlife Refuge

The Santee National Wildlife Refuge, located on the north bank of Lake Marion, offers a great, protected expanse of natural habitat for migratory waterfowl such as Canada geese. In addition, it serves as a temporary residence for a few species of migrating birds. Due to its abundant supply of food, the Refuge has become well known to flocks of ducks and geese that winter-over, generally from October to March. The Refuge is carefully managed to allow the waterfowl to range freely in their natural habitat while feeding in the nutrient-rich waters. Data are collected daily and analyzed so that migratory patterns and habits can be studied, creating a better understanding of the area's avian residents.

Flying in a "V" formation and honking to announce their presence, the Canada geese arrive on nearly the same date each year. Many people wonder how these birds know exactly when to leave the Hudson Bay area of Canada and begin their southern migration each year. While weather may change significantly and unpredictably from day to day, the length of time between sunrise and sunset varies only slightly each day and is totally predictable. Although humans do not notice these small daily changes, birds are apparently aware of them. It is thought that some birds may have an internal clock, which makes them extremely sensitive to these daily changes, allowing them to determine the appropriate time to begin their journey each year. How the same Canada geese find their way to a specific location like the Santee National Wildlife Refuge each year is also debated by scientists. It has been established that many birds rely on visual memory for short distances. For larger distances, birds might use the position of the Sun by day and the stars at night to guide them back to the same feeding grounds. Current data also suggests that birds use the Earth's magnetic field as a navigational tool.

In recent years the numbers of waterfowl species have decreased dramatically, although management practices have not changed significantly. This decrease is presumably due to the loss of breeding and nesting habitat in the northern United States and Canada. Perhaps the effects of acid rain and lead poisoning are also contributing to the population decline. The waterfowl population decrease may provide a warning sign of environmental problems that could soon affect humans.
Tourism and Fishing on Lake Marion

The Santee region has experienced a noticeable increase in rates of population growth and commercial development since Lake Marion was constructed. The development of Santee State Park and the opening of Interstate Highway 95 have brought increased visibility to the area and created a demand for a wide variety of tourist facilities. Several historical sites also exist locally, including the Santee Indian Mound at Lake Marion; Francis Marion's grave, near Eadytown; and the Revolutionary War battleground at Eutaw Springs.

Lake Marion is nationally known for its fine fishing. Fishermen from all over the country come here to test their skills against the famous landlocked striped bass, normally a saltwater fish, but now trapped in freshwater behind the Lake Marion dam. This ocean bass has adapted well to its new surroundings and thrives alongside other game fish such as catfish, largemouth bass, and crappie. Many record-breaking catches have been recorded during fishing tournaments in the Santee area. In one type of tournament, anglers fish for tagged fish--some worth up to $10,000. Wherever there are favorite fishing holes, large or small, there are also an abundance of stories about the ones that got away. Following is one teacher's story of the big catch that she promised her students.

The Big Catch

A sixth grade teacher came back from a field trip to Lake Marion and told her class she had a riddle for them to figure out. Before departing her class the day before, the teacher, Ms. Mary Holmes, had told her class that she was going to catch a big tagged fish for them. Now, she pulled out a photograph of herself holding a large fish and told the class, "I caught this fish with my camera." She asked them to write a story about how that could happen. When they finished, and had shared their ideas, she finally agreed to tell them the real story.

During a hot summer day a group of 25 SC MAPS teachers were on a field trip to the Santee area and Lake Marion. After the teachers spent most of the day studying the Santee area, they arrived at Lake Marion. As they got out of their cars, Ms. Holmes saw an elderly couple by the water's edge struggling with a large fish that they had just caught. Ms. Holmes grabbed her camera, raced up to the couple, and begged them to let her hold the fish. The couple looked very, very confused. They had no idea why she wanted their fish--except maybe to eat it! Meanwhile the other teachers in the group continued on their trip leaving Ms. Holmes behind continuing to beg the couple. Finally, Ms. Holmes convinced the couple to let her hold the fish while they took her picture.

So Ms. Holmes really did catch that fish with her camera after all.
Activity 7A-1: The Effects of Groundwater

Materials

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<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<td>GENERAL SOIL MAP</td>
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<td>State Map of Major Drainage Basins</td>
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PERFORMANCE TASKS
(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts = 

1. **Locate the study site.  **
   Locate the Lake Marion Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the Scale Bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Analyze the newspaper article.  **
   Read the newspaper article on page 7A-1, "Santee Sinkhole." Explain how the story relates to the Coastal Plain Landform Region. Identify a possible location on the LAKE MARION TOPOGRAPHIC MAP (refer to the LAKE MARION LITHOGRAPH if needed) where the story could have taken place. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same people as characters and the same location as your setting, write another newspaper article related to this same incident, but date it either before or after the given story occurred. Choose a title and draw an appropriate picture to illustrate your main point.

3. **Locate sinkholes on topographic map and lithograph. **
   Compare the LAKE MARION LITHOGRAPH with the LAKE MARION TOPOGRAPHIC MAP. Locate and mark as many sinkholes as possible on the topographic map by looking for depression contour markings (contour lines with slash marks pointing inward). Ignore all oval-shaped depressions outlined by blue dashed lines. These are Carolina Bays and are formed by a different process. Can you find the sinkholes on the lithograph? Why or why not? What color of blue on the infrared
image do you expect a sinkhole lake to have? Do you think the sinkhole lakes should have a lot of sediment? Remember that bodies of water carrying a lot of sediment should be lighter blue than clear water, which appears black on the infrared photographs.

4. **Determine the elevation of the groundwater table.**

Locate the following features in the center section of the LAKE MARION TOPOGRAPHIC MAP and determine the elevation of the groundwater table for each location. Assume that the water level in the ponds and swamps is the same elevation as the groundwater table. Divide into groups. Each group should be assigned one of the following locations and share its results with the rest of the class so each group can construct their own groundwater map.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>FEATURE</th>
<th>ELEVATION OF WATER TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Small pond near Mt. Pisgah Church, north of the town Santee</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Small pond, Santee State Park, along the southern boundary</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Lake in sinkhole in golf course along Lake Marion west bank</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Either pond in town of Santee, north of US Hwys 15 and 301</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Larger pond south of Bell Cem., West side of SC Hwy 6</td>
<td></td>
</tr>
</tbody>
</table>

Groundwater flows downhill just like surface water. In fact, the groundwater table slopes downhill, and groundwater flows in the direction of that slope toward the lower groundwater table elevations. Plot your class's data about the elevation of the groundwater table on the topographic map and predict in which direction a contaminant would flow if it escaped from the sewage disposal pond near the landing strip west of the junction of Interstate Hwy. 95 and SC Hwy. 6. Assume the contaminant enters the groundwater system.

5. **Trace disappearing stream.**

Locate on the LAKE MARION TOPOGRAPHIC MAP the stream which flows past Chapel Hill Church in the southernmost part of Santee State Park. Note the dot-dash blue line which indicates this is an intermittent stream. Trace, with a wipe-off pen, the pathway of this stream from the left-hand edge of the map to the first crossing of the trail near the caves. Between the first crossing and the second crossing of the stream by the trail, the water flows underground through an interconnected system of caves. Do not mark the stream path between the two crossings. Continue tracing the stream path from the second trail crossing to Chapel Branch and Lake Marion. Why is this stream intermittent in this area even though there is lots of annual rainfall? What do you think happens to the stream water between the two trail crossings?

6. **Calculate stream density in Karst areas.**

Place the transparent grid overlay over the Karst region on the LAKE MARION TOPOGRAPHIC MAP (all of the land west of Lake Marion). Count the total number of squares covering this area (estimate partial squares). Now count the number of squares which have at least one perennial (permanent) stream in them. Divide the number of squares containing perennial streams by the total number of squares to
get the average stream density for the Karst area. Divide into groups and repeat this same procedure for the following topographic maps. Calculate the perennial stream density for each site and compare your answers with other groups. Discuss what factors influence the perennial stream density in each area. What special features influence this density in Karst regions?

Group I The northern half of the **MYRTLE BEACH TOPOGRAPHIC MAP**
Group II The southern half of the **SILVERSTREET TOPOGRAPHIC MAP**
Group III The northern half of the **WOODS BAY TOPOGRAPHIC MAP**
Group IV The southern half of the **TABLE ROCK TOPOGRAPHIC MAP**
Group V The northern half of the **FORTY ACRE ROCK TOPOGRAPHIC MAP**
Group VI The northern half of the **CONGAREE SWAMP TOPOGRAPHIC MAP**

7. **Evaluate effects of Karst topography on land use.**
   Analyze land use on the western side only of Lake Marion using the **LAKE MARION LITHOGRAPH**. List the most common land uses in this Karst region in order of abundance. Which are affected positively by the presence of Karst topography? Which ones are affected negatively? What environmental problems could affect this region in the next ten years?

ENRICHMENT

1. **Research sinkhole problems in South Carolina and compare to Florida.**
   Research sinkhole collapse in Santee State Park. The newspaper article, "Santee Sinkholes," page 7A-1 highlights the sudden sinkhole collapse event in March 1992 in Santee State Park. Research this event in more detail by writing to Santee State Park or the South Carolina Geological Survey in Columbia. Has sinkhole collapse been a common problem in South Carolina? Also, research the problems caused by sinkholes in Florida. Compare the size of the Florida sinkholes to the South Carolina sinkholes.

2. **Research GSX hazardous waste landfill controversy.**
   Research newspaper and magazine articles on the GSX hazardous waste landfill controversy in the Rimini area. The **Item**, Sumter's newspaper, is an excellent source for research information. What are the greatest potential hazards? What solutions have been recommended? What type of legislation would you recommend to protect the area from pollution by hazardous waste? Formulate a set of site suitability standards. Write these in a formal request to your legislator. Discuss the pros and cons of selecting a hazardous waste disposal site near Rimini 200 feet from the headwaters of Lake Marion. What type of material is classified as hazardous waste? How is it stored? How long will the lining last that is between the hazardous waste and the aquifer?
Activity 7A-2: Lake Marion Brings About Changes in Land Use

Materials

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
</tr>
<tr>
<td>6</td>
<td>LAKE MARION TOPOGRAPHIC MAP</td>
</tr>
<tr>
<td>6</td>
<td>LAKE MARION LITHOGRAPH</td>
</tr>
<tr>
<td></td>
<td>Transparent Grid Overlays</td>
</tr>
<tr>
<td></td>
<td>Wipe-off Pens</td>
</tr>
</tbody>
</table>

PERFORMANCE TASKS
(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts = 

1. **Locate land use features. **
   Using the STATE BASE MAP #2, WITH HIGHWAYS, locate Lake Marion and its dam, and the area designated as the Santee National Wildlife Refuge. Lake Marion is mainly in which two counties? Which counties have boundary lines located within Lake Marion? Why do you think the river was originally used as a boundary line between these two counties before the lake was constructed? Where can you cross Lake Marion by car? By train? Name the highways which have bridges that cross Lake Marion. Identify the area on the LAKE MARION TOPOGRAPHIC MAP which is covered by the LAKE MARION LITHOGRAPH. Locate the large golf course on both the topographic map and the lithograph. What specific landform features make this a desirable location for a golf course? Explain. Identify the characteristic geometric pattern of a golf course. Now identify lakes, rivers, Carolina Bays, I-95, US 301, roads, bridges, pine tree crowns, fields, ditches, and the boundaries of Santee State Park. Also locate State Highway 6, the rest areas on both sides of I-95, sewage disposal ponds, landing strips, and a railroad line. How do you think the small town of Santee, located on this map, got its name?

2. **Locate catfish beds by analyzing sediment load. **
   On the LAKE MARION LITHOGRAPH note the different intensity of blue (indicating sediment load) carried by the water in various parts of Lake Marion. One of the properties of infrared photographs is that the color of the water indicates the amount of sediment carried by the water: the lighter the blue the greater the sediment load. What is indicated by very dark blue water? Where do you find this color on the lithograph? Where is the smallest amount of sediment in Lake Marion? Where do you predict the water is flowing the fastest? Can you locate the position of the old river channel, before the river was dammed to form Lake Marion? Explain your answer.

Look for the former Santee River channel on the LAKE MARION TOPOGRAPHIC MAP. Notice that the former Santee River channel is marked with blue dashed lines. These lines mark the county boundary lines. Also notice that north of the I-95 bridge the river channel meanders extensively, while south of the bridge the channel is much straighter. What does this fact tell you about the flow pattern and characteristics of the original river? Use a wipe-off pen to trace the position of the old river channel onto the lithograph. This deep channel is where many huge catfish, or "cats," are caught.
3. **Analyze land use changes through time.**

   Look in the margins of the **LAKE MARION TOPOGRAPHIC MAP** and the **LAKE MARION LITHOGRAPH** to determine the year the map was printed and the year the aerial photograph was taken. Examine each cartographic product carefully to identify any changes which have occurred during the interval. How many of these changes are man-made? How many have occurred naturally?

4. **Estimate size of peach orchards.**

   Special symbols are used on the topographic map to indicate orchards. Locate several peach orchards on the **LAKE MARION TOPOGRAPHIC MAP**. Use the number of printed symbols to estimate the orchards’ size. Find these same orchards on the **LAKE MARION LITHOGRAPH**. Outline them, with a wipe-off pen, and estimate the total number of trees in each orchard without counting each individual tree. Explain your method. A magnifying lens will be helpful.

5. **Determine average width and volume of Lake Marion.**

   Measure the width of Lake Marion at the I-95 Highway bridge and also near the top and side edges of the **LAKE MARION TOPOGRAPHIC MAP**. Average these three measurements to obtain an average value for the width of Lake Marion. How consistent are your three measurements? What is the deviation of each measurement from the average value? Would it matter where you chose to determine lake width? Why?

   Estimate the volume of water in Lake Marion. Using the topographic map, and a wipe-off pen, draw a line from the campground at the top of Santee State Park to the north end of Persanti Island. Next, draw a segment from the southern tip of Persanti Island to Adams Landing just north of Interchange #102 on I-95. Follow the shoreline southward to the bridges. Use the old Francis Marion Bridge and Santee State Park as your other boundaries. The geometric shape you have just drawn is approximately rectangular, so use the formula for the area of a rectangle to calculate the approximate surface area of this part of Lake Marion. Also, determine the approximate area of this same part of Lake Marion using the transparent grid overlay. Which method do you think is more accurate? Why? Determine the total volume of water in this small area by using the formula for the volume of a rectangular solid. Assume the average depth is 15 feet. On the **STATE BASE MAP #2, WITH HIGHWAYS**, compare this small region to the entire surface area of Lake Marion. From your figures, use a ratio to estimate of the total amount of water in the lake.

6. **Compare topography of the east and west banks of Lake Marion.**

   Compare the east and west banks of Lake Marion as seen on the **LAKE MARION TOPOGRAPHIC MAP**. Note especially the differences in contour line spacing. What are the major elevation and slope differences between these two shorelines? How is the major land use different on each side of the lake? If the dam had been built higher and the water level had risen to 100 feet in elevation instead of 77 feet as it is now, which shoreline would change the most? Why? How would the Santee National Wildlife Refuge be affected? Locate two boat ramps indicated on the topographic map. Determine their slope based on the slope of the road. Compare your results. Does one have a greater slope than the other one? Is the water level the same for each of the boat ramps? Explain how boat ramps are used.
7. Locate Santee Indian Mound on map and lithograph.

On the LAKE MARION TOPOGRAPHIC MAP locate the historic Santee Indian Mound (later Fort Watson) on the east bank of Lake Marion, north of Interchange #102 on Interstate Highway 95. How can you determine the elevation of this Indian Mound on the map? How high is the Indian Mound above the surrounding land? Now look at that same site on the LAKE MARION LITHOGRAPH. Can you recognize the Indian Mound? What clues did you use to locate this feature on the lithograph? Does the lithograph give you any information about the elevation of the mound?

8. Determine size of Santee Wildlife Refuge.

Santee National Wildlife Refuge is located on the north-central section of Lake Marion. Locate this site on both the LAKE MARION TOPOGRAPHIC MAP and LAKE MARION LITHOGRAPH. This wildlife refuge is the winter home of a number of waterfowl. The open fields are used to plant corn and grains to feed the migratory birds. Mark, with a wipe-off pen, the boundary line of the Santee National Wildlife Refuge as indicated on the topographic map. Use the transparent grid overlay to estimate the size of the wildlife refuge. What percent of the wildlife refuge is land? Water? Outline these same boundary lines on the lithograph. What information does the lithograph tell you about the land use? Estimate the percentage of swampland and open fields for the refuge area.

9. Calculate average weight of fish caught in Lake Marion.

An average of 1,066,313 fish are caught in Lake Marion each year. Their total weight is 577,886 pounds. Find the average weight in pounds for each of the following fish species.

<table>
<thead>
<tr>
<th>FISH TYPE</th>
<th>NUMBER</th>
<th>POUNDS</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Mouth Bass</td>
<td>72,392</td>
<td>84,839</td>
<td></td>
</tr>
<tr>
<td>Crappie</td>
<td>167,498</td>
<td>91,604</td>
<td></td>
</tr>
<tr>
<td>Striped Bass</td>
<td>5,924</td>
<td>33,508</td>
<td></td>
</tr>
<tr>
<td>Bream</td>
<td>702,369</td>
<td>196,029</td>
<td></td>
</tr>
<tr>
<td>Catfish</td>
<td>118,130</td>
<td>171,906</td>
<td></td>
</tr>
<tr>
<td>Total Catch</td>
<td>1,066,313</td>
<td>577,886</td>
<td></td>
</tr>
</tbody>
</table>

If 1,000,000 fish were swimming an equal distance apart from each other in Lake Marion, how many cubic yards of lake water would each fish have for itself? Use the value for the total volume of water in Lake Marion you calculated in Performance Task #5. If this number is correct, how many fish would be in the average cubic yard of lake water? What is the relationship between the cubic yards of lake water per fish and the number of fish per cubic yard of water? Based on your experience fishing, would you expect the fish to be equally distributed throughout the lake? Refer to the LAKE MARION TOPOGRAPHIC MAP and identify areas you think would be best for fishing and explain your reasoning. Why do you think fish tend to prefer certain areas in the lake?
10. **Calculate weekly percentage change in waterfowl population.**

Locate the Santee National Wildlife Refuge on the LAKE MARION TOPOGRAPHIC MAP. The Refuge monitors a variety of migratory birds that winter over in this area. Part of this monitoring requires that a count of the waterfowl be taken each week. The population data from several species of ducks and geese that spend the winter at the Santee National Wildlife Refuge are listed in the table below. Find the percent of increase or decrease for each species from week to week.

<table>
<thead>
<tr>
<th>ANIMAL TYPE</th>
<th>DATE</th>
<th>NUMBER</th>
<th>PERCENTAGE CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada Geese</td>
<td>1-06-95</td>
<td>650</td>
<td>XXXXX</td>
</tr>
<tr>
<td></td>
<td>1-13-95</td>
<td>495</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-27-95</td>
<td>430</td>
<td></td>
</tr>
<tr>
<td>Mallards</td>
<td>1-06-95</td>
<td>785</td>
<td>XXXXX</td>
</tr>
<tr>
<td></td>
<td>1-13-95</td>
<td>555</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-27-95</td>
<td>1,196</td>
<td></td>
</tr>
</tbody>
</table>

11. **Analyze seasonal population changes in Santee waterfowl.**

Locate the Santee National Wildlife Refuge on the north-central section of the LAKE MARION TOPOGRAPHIC MAP and on the LAKE MARION LITHOGRAPH. Use a wipe-off pen to outline the Refuge boundary on the topographic map. Transfer these lines to the lithograph. Describe the terrain of the Refuge. Is it mostly water or land; is it mostly hilly or flat? Use Data Tables 1 and 2 to determine which months usually have the highest total bird population. Make a list of possible reasons why the bird count could vary from year to year.

Divide the class into six groups. Have each group use the monthly data provide to construct line graphs showing seasonal changes for the wood ducks and one of the other six species listed. Use your graphs to answer the following questions:

- In which months do the bird species arrive and in which months do they leave?
- In which month is the peak population recorded for each species?
- Which bird species migrate to the Refuge during winter months?
- Which bird species migrate to the Refuge during Summer months?
- Which bird species have yearlong residents?
- Do the graphs show the same general pattern of seasonal change each year?

As a class, construct a statement that best describes the migratory pattern of each bird listed in Data Tables 1 and 2. Which year had more migratory birds visit the Refuge? Would you expect most birds to arrive and leave in flocks or as individuals? Explain your answer.
### DATA TABLE 1: Monthly Waterfowl Population 1993-1994
#### Santee National Wildlife Refuge

<table>
<thead>
<tr>
<th>Month</th>
<th>Coot</th>
<th>Canada Goose</th>
<th>Mallard</th>
<th>Northern Pintail</th>
<th>Wigeon</th>
<th>Wood Duck</th>
<th>Ring-Necked Duck</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>October</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>745</td>
<td>473</td>
<td>476</td>
<td>95</td>
<td>4,956</td>
<td>277</td>
<td>6,471</td>
</tr>
<tr>
<td>December</td>
<td>1,547</td>
<td>560</td>
<td>1,792</td>
<td>79</td>
<td>3,534</td>
<td>168</td>
<td>6,545</td>
</tr>
<tr>
<td>January</td>
<td>1,642</td>
<td>535</td>
<td>4,702</td>
<td>134</td>
<td>4,561</td>
<td>240</td>
<td>7,705</td>
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<tr>
<td>February</td>
<td>649</td>
<td>624</td>
<td>2,344</td>
<td>59</td>
<td>1,343</td>
<td>263</td>
<td>929</td>
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<tr>
<td>March</td>
<td>277</td>
<td>74</td>
<td>211</td>
<td>1</td>
<td>115</td>
<td>311</td>
<td>106</td>
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<tr>
<td>April</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>May</td>
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<td>June</td>
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<td>July</td>
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</tr>
<tr>
<td>August</td>
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</tr>
</tbody>
</table>

### DATA TABLE 2: Monthly Waterfowl Population 1994-1995
#### Santee National Wildlife Refuge

<table>
<thead>
<tr>
<th>Month</th>
<th>Coot</th>
<th>Canada Goose</th>
<th>Mallard</th>
<th>Northern Pintail</th>
<th>Wigeon</th>
<th>Wood Duck</th>
<th>Ring-Necked Duck</th>
</tr>
</thead>
<tbody>
<tr>
<td>September</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>23</td>
<td>82</td>
<td>15</td>
<td>48</td>
<td>371</td>
<td>311</td>
<td>66</td>
</tr>
<tr>
<td>November</td>
<td>4,042</td>
<td>276</td>
<td>362</td>
<td>12</td>
<td>3,710</td>
<td>114</td>
<td>5,758</td>
</tr>
<tr>
<td>December</td>
<td>6,880</td>
<td>509</td>
<td>1,801</td>
<td>111</td>
<td>6,016</td>
<td>132</td>
<td>4,993</td>
</tr>
<tr>
<td>January</td>
<td>4,669</td>
<td>497</td>
<td>873</td>
<td>180</td>
<td>3,359</td>
<td>63</td>
<td>5,587</td>
</tr>
<tr>
<td>February</td>
<td>2,310</td>
<td>283</td>
<td>1,670</td>
<td>150</td>
<td>407</td>
<td>142</td>
<td>1,166</td>
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<td>March</td>
<td>730</td>
<td>40</td>
<td>245</td>
<td>12</td>
<td>52</td>
<td>330</td>
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<td>June</td>
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<td>August</td>
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</tr>
</tbody>
</table>
12. **Determine probability of sighting a particular waterfowl species.**

Wildlife biologists cannot possibly count each individual in a population so they often take a random count of a small number of animals and assume that their small sample has the same percentage distribution as the larger total population. The methods of statistics allow us to determine how reasonable a particular assumption might be. As part of a waterfowl census, your class has been selected to do a population survey for the Santee National Wildlife Refuge. Divide the class into six groups. Refer to the 1993-1994 Waterfowl Population Chart provided below.

### 1993-1994 WATERFOWL POPULATION CHART

<table>
<thead>
<tr>
<th>DATE</th>
<th>CANADA GEESE</th>
<th>MALLARDS</th>
<th>OTHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-05-93</td>
<td>239</td>
<td>210</td>
<td>354</td>
</tr>
<tr>
<td>11-12-93</td>
<td>431</td>
<td>537</td>
<td>325</td>
</tr>
<tr>
<td>11-29-93</td>
<td>677</td>
<td>467</td>
<td>135</td>
</tr>
<tr>
<td>12-09-93</td>
<td>420</td>
<td>790</td>
<td>140</td>
</tr>
<tr>
<td>12-16-93</td>
<td>424</td>
<td>1,531</td>
<td>160</td>
</tr>
<tr>
<td>12-23-93</td>
<td>630</td>
<td>2,660</td>
<td>210</td>
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<tr>
<td>01-05-94</td>
<td>722</td>
<td>3,136</td>
<td>185</td>
</tr>
<tr>
<td>01-13-94</td>
<td>532</td>
<td>5,710</td>
<td>140</td>
</tr>
<tr>
<td>01-21-94</td>
<td>237</td>
<td>4,160</td>
<td>140</td>
</tr>
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<td>01-28-94</td>
<td>590</td>
<td>5,910</td>
<td>280</td>
</tr>
<tr>
<td>02-10-94</td>
<td>800</td>
<td>2,120</td>
<td>280</td>
</tr>
</tbody>
</table>

**Group I** Use data from 11-05-93  **Group IV** Use data from 12-23-93
**Group II** Use data from 11-29-93  **Group V** Use data from 1-13-94
**Group III** Use data from 12-09-93  **Group VI** Use data from 2-10-94

Each group should carry out the following set of instructions for its assigned data. When each group has completed setting up its sample, the containers should be exchanged among various groups so that no group knows whose container it is using.

### Instructions

1. Divide each data number for your assigned date by ten and round off to the nearest whole unit.
2. Select the appropriate number of pieces of colored candy (or other small markers of different colors) so that the number of Canada Geese (reduced and rounded off) is equal to the number of brown pieces, the number of Mallards (reduced and rounded off) is equal to the number of green pieces, and the number of other waterfowl (reduced and rounded off) is equal to the total number of pieces consisting of a mixture of other colors.
3. Put the correct number of colored pieces into a small bag and shake it until the pieces are randomly distributed. Make a mark on the outside of the bag that your group will recognize but other groups will not.
4. Exchange bags with another group.
5. Repeat the following procedure five times.
   a. Pull ten pieces out of the bag, one at a time, without looking.
   b. Record the color distribution on the chart.
   c. Calculate the average number chosen and the percentage of each color.
   d. Put those ten pieces back in the bag and shake the bag well.

### FREQUENCY DISTRIBUTION BASED ON SAMPLE SIZE OF TEN PIECES

<table>
<thead>
<tr>
<th>GROUP</th>
<th>TRIAL 1</th>
<th>TRIAL 2</th>
<th>TRIAL 3</th>
<th>TRIAL 4</th>
<th>TRIAL 5</th>
<th>AVE. # CHOSEN</th>
<th>% OF SAMPLE CHOSEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada Geese (brown)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mallards (green)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (various)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Repeat the following procedure five times.
   a. Pull fifty pieces out of the bag, one at a time, without looking.
   b. Record the color distribution on the chart.
   c. Calculate the average number chosen and the percentage of each color.
   d. Put those fifty pieces back in the bag and shake the bag well.

### FREQUENCY DISTRIBUTION BASED ON SAMPLE SIZE OF FIFTY PIECES

<table>
<thead>
<tr>
<th>GROUP</th>
<th>TRIAL 1</th>
<th>TRIAL 2</th>
<th>TRIAL 3</th>
<th>TRIAL 4</th>
<th>TRIAL 5</th>
<th>AVE. # CHOSEN</th>
<th>% OF SAMPLE CHOSEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada Geese (brown)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mallards (green)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (various)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Look at the results from parts 5 and 6 and compare these percentages with the weekly numbers of each species as recorded on the waterfowl chart for 1993-1994. You will need to convert the numbers on the waterfowl chart to percentages. Based on the results of your sampling, make your best guess of which week your observations were taken. Return your bag to the group that prepared it and find out if your guess was correct. Which procedure, selecting ten pieces at random or fifty pieces at random, gave you more confidence in your answer?

8. As a class, discuss some of the factors which could influence the variability of your results. Separate these factors into a statistical category and a landscape category. Refer to the LAKE MARION LITHOGRAPH.

13. **Analyze population changes in the Lake Marion area.**

    Note the trend of population growth in the Lake Marion area since the early 1940’s when the Pinopolis Dam was built. Refer to the following data table for specific numbers. Graph the data for both Clarendon and Orangeburg counties in ten-year intervals and project total population numbers for the years 2000 and 2010. (Your
vertical axis should measure population and your horizontal axis should measure time in years.) Then calculate the percentage increase in population for each county for each of the ten year intervals and graph those results. (Your vertical axis should measure percent increase and your horizontal axis should measure time in years.) Which county has experienced the greatest population growth over that time period?

### POPULATION IN CLARENDON AND ORANGEBURG COUNTIES

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CLARENDON</th>
<th>ORANGEBURG</th>
<th>YEAR</th>
<th>CLARENDON</th>
<th>ORANGEBURG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>31,500</td>
<td>63,707</td>
<td>1980</td>
<td>27,464</td>
<td>82,276</td>
</tr>
<tr>
<td>1950</td>
<td>32,215</td>
<td>68,726</td>
<td>1990</td>
<td>28,450</td>
<td>84,883</td>
</tr>
<tr>
<td>1960</td>
<td>29,490</td>
<td>68,559</td>
<td>2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1970</td>
<td>25,604</td>
<td>69,789</td>
<td>2010</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Look at the area surrounding Lake Marion on the STATE BASE MAP #2, WITH HIGHWAYS, and also on the LAKE MARION TOPOGRAPHIC MAP and the LAKE MARION LITHOGRAPH. Make a list of land uses on the Orangeburg County side of the lake versus land uses on the Clarendon County side. Are there any significant differences in land use? Are there any landform-related reasons for those differences? Try to explain the differences in population growth in Clarendon and Orangeburg counties by referring to landform characteristics or land use patterns. Are there other factors, besides the development of Lake Marion, which might account for some of the population growth differences between these two counties?

14. **Predict reaction of Ms. Holmes' students.**

   Read the story "The Big Catch" on page 7A-3. What do you think the reactions of Ms. Holmes’ students were when she told them her riddle? Would you have believed her? After all, she did have a picture. Where on Lake Marion do you think Ms. Holmes had her picture taken? Locate this spot on the LAKE MARION TOPOGRAPHIC MAP and explain why you chose that spot. Do pictures always tell the exact truth? How would you have answered her riddle? Have you ever heard a tall story or fish tale? Has an unusual event happened to you while you were fishing? Tell your story to others. Can you find the location of your fish tale on a map?
ENRICHMENT

1. **Interview people in school or community for fish tales.**
   Interview both younger and older members in your community to collect fish tales. You may even want to broaden your collection to include animal stories in general. Don’t forget to include your own story and the stories from your classmates.

2. **Research how a saltwater fish got into Lake Marion.**
   How did the striped bass, a saltwater fish, come to reside in Lake Marion? Find out what conditions made this lake a natural habitat for the striped bass. Contact the Fisheries Division of the Department of Natural Resources for references.

3. **Estimate attendance at a school sporting or musical event.**
   During a game or a performance, randomly select a section of the stands or of the auditorium seating. Count the number of filled versus empty seats in your chosen section. Ask a school administrator to tell you the total number of available seats for the event. Use ratios to calculate the approximate attendance. Check your answer against the actual attendance recorded for the event. How close was your number? How did your selection of the sample section affect your answer?
SECTION 8
COASTAL PLAIN REGION / CAROLINA BAYS

Index Map to Study Sites

<table>
<thead>
<tr>
<th>No.</th>
<th>Study Site</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A</td>
<td>Table Rock (Mountains)</td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td>Lake Jocassee Region (Energy Production)</td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td>Forty Acre Rock (Granite Outcropping)</td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td>Silverstreet (Agriculture)</td>
<td></td>
</tr>
<tr>
<td>3C</td>
<td>Kings Mountain (Historical Battleground)</td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td>Columbia (Metropolitan Area)</td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td>Graniteville (Mining Area)</td>
<td></td>
</tr>
<tr>
<td>4C</td>
<td>Sugarloaf Mountain (Wildlife Refuge)</td>
<td></td>
</tr>
<tr>
<td>5A</td>
<td>Savannah River Site (Habitat Restoration)</td>
<td></td>
</tr>
<tr>
<td>5B</td>
<td>Santee Cooper Project (Engineering &amp; Canals)</td>
<td></td>
</tr>
<tr>
<td>6A</td>
<td>Congaree Swamp (Pristine Forest)</td>
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<tr>
<td>7A</td>
<td>Lake Marion (Limestone Outcropping)</td>
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</tr>
<tr>
<td>8A</td>
<td>Woods Bay (Preserved Carolina Bay)</td>
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</tr>
<tr>
<td>9A</td>
<td>Charleston (Historic Port)</td>
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</tr>
<tr>
<td>9B</td>
<td>Myrtle Beach (Tourist Area)</td>
<td></td>
</tr>
<tr>
<td>9C</td>
<td>The ACE Basin (Wildlife &amp; Sea Island Culture)</td>
<td></td>
</tr>
<tr>
<td>10A</td>
<td>Winyah Bay (Rice Culture)</td>
<td></td>
</tr>
<tr>
<td>10B</td>
<td>North Inlet (Hurricanes)</td>
<td></td>
</tr>
</tbody>
</table>
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- Table of Contents for Section 8
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    p. 8-2 - Characteristic Landforms of Carolina Bays
    p. 8-3 - Geographic Features of Special Interest
    p. 8-4 - Theories of Origin
    p. 8-5 - Castrophic Extraterrestrial Theory
    p. 8-6 - Gradualistic Terrestrial Theory
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    p. 8-8 - figure 8-1 - "Map of Marching Bays"
    p. 8-9 - figure 8-2 - "Typical Carolina Bays Soil Types"
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  p. 8-8 - story - "Objective Description of Carolina Bays"
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- Summary
- Places to Visit
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  (ICONS)  Overv =  Sci =  Math =  Hist =  Lang Arts =
  - Activity 8-1: Overview
    - Materials
      - Performance Tasks
        p. 8-13 . . . . . . 1. make an index chart of Carolina Bays  
        p. 8-14 . . . . . . 2. compare characteristics of Marching Bays  
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        p. 8-15 . . . . . . 5. compare objective and subjective descriptions of Carolina Bays  
        p. 8-15 . . . . . . 6. evaluate desirability of Carolina Bays for home sites  
        p. 8-15 . . . . . . 7. identify potential non-point source pollution by examining land use  
      - Enrichment
        p. 8-16 . . . . . . 1. request a copy of the Carolina Bay Project survey  
        p. 8-16 . . . . . . 2. compare your Carolina Bays index to official index  
        p. 8-16 . . . . . . 3. research what crops in your area were grown by sharecroppers  

- STUDY SITE 8A: WOODS BAY (PRESERVED BAY)
  (ICONS)  Overv =  Sci =  Math =  Hist =  Lang Arts =
  - Newspaper Article - "Lawmen say "Lizard Man" exists"
  - Rationale
  - Brief Site Description
    p. 8A-2 - Characteristics of Woods Bay
    p. 8A-2 - Park Facilities, Boardwalk, and Canoe Trips
    p. 8A-2 - Land Use in Woods Bay
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    - Materials
      - Performance Tasks
        p. 8A-3 . . . . . . 1. locate the study site  
        p. 8A-3 . . . . . . 2. analyze the newspaper article  
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        p. 8A-5 . . . . . . 9. explain unusual contour line patterns  
      - Enrichment
        p. 8A-6 . . . . . . 1. research the sand ridge habitat around Woods Bay  
        p. 8A-6 . . . . . . 2. use an equation to describe the shape of Woods Bay  

8-ii
POWER THINKING ACTIVITY - "Swamp Search"

A Hollywood motion picture studio has decided to do a re-make of the old monster movie *Creature from the Black Lagoon* using Woods Bay State Park as their filming location. You are put in charge of the local arrangements, since the movie makers have never been to Woods Bay before and know nothing about real swamps. Use the WOODS BAY LITHOGRAPH and the WOODS BAY TOPOGRAPHIC MAP to locate places the film crew needs to visit to get the right scenes.

Scene 1 - a dark, swampy, forested area where you can't even see the sky through the thick foliage
Scene 2 - an open water area where lots of sunlight gets through and you could film a small boat capsizing
Scene 3 - a wide, sandy area where the crew can build a bonfire safely to keep the monster away

Remember that for every actor you see in a movie there are many more workers behind the scenes running cameras, fixing lights, holding cue cards, preparing meals for crew and cast, and doing a variety of other tasks. For each scene, explain how you will get the entire film crew to the proper location, what problems you will encounter once you get there, and how you will overcome them. Also explain where the actors and crew will stay at night (there are no hotels or other lodging on Woods Bay).

PERFORMANCE OBJECTIVES

1. Describe the geological framework and ecological characteristics of Carolina Bays.
2. Compare scientific authenticity of current and past theories of Carolina Bay origins.
3. Compare and contrast physical features of Carolina Bays, including size, topographic relief, ground cover, land use, and spatial orientation.
4. Use mathematical concepts to describe geometric shape and spatial dimensions of Carolina Bays.
5. Classify Carolina Bay soil types by analyzing moisture content and vegetative cover from lithograph data.
7. Evaluate effectiveness of recent efforts to preserve Carolina Bays in their natural state.
8. Use folk tales of Carolina Bay area sharecroppers as source for storytelling and writing activities.
Characteristic Landforms of Carolina Bays

Carolina Bays are elliptical depressions, found primarily in the Coastal Plain Region of South Carolina, that have intrigued residents since the arrival of the first settlers. Additional investigations have shown that all of the Carolina Bays are smooth elliptical depressions only a few feet deep, with their long axis oriented in a remarkably consistent northwest to southeast direction. Most have a surrounding rim of sand that is especially obvious along the southeastern edge. Sand ridges usually have gentle slopes and rise only a few feet above the level of the Bay. In exceptional cases, sand rims may reach heights of 15 feet and widths of several hundred feet. However, ridges may be totally lacking. Bay size ranges from an area of only a few square feet to monster Bays having dimensions up to four miles long and two miles wide. Bays average 2,210 feet in length and 1,430 feet in width. The depth of these basins lies anywhere from a couple of feet to as much as forty feet below the surface level of the surrounding Coastal Plain. Depth can be misleading, however, since most Bays contain thick accumulations of soil and peat deposits.

Because they are such subtle features, and because they are usually very swampy and hard to cross, most Carolina Bays generally went unnoticed by the local population. The exact number and geographic extent of Carolina Bays were not recognized until aerial photographs, first made by the United States Geological Survey in the 1930's, revealed that hundreds of these unique Bays existed from Southern New Jersey all the way to Northern Florida. They are distributed over an area of 25,000 square miles along a strip of Coastal Plain nearly 80 miles wide. Estimates for the total number of Bays now range as high as 500,000. Estimates of ages for Bays range from 6,000 to 60,000 years, and even older. Data obtained from the bottom-most sediments in the Bays indicates that most existed as lakes many years ago and have since filled in with mud and vegetation. None appear to be developing today.

Geographic Features of Special Interest

Almost any large section of the South Carolina Coastal Plain Region will contain at least a few Carolina Bays. However, Bays are not uniformly distributed throughout this region. Horry County has over 400 known Bays while Beaufort County has none. Other counties with large numbers of Bays include Marlboro, Lee, Orangeburg, Barnwell, Allendale, and Darlington. Only a few of the Bays are still in their natural state; most have been ditched and drained. The original outlines of drained and cultivated Bays are hard to locate and often can only be seen from the air. A few Bays have been preserved in close to pristine condition and several of these may be visited by the public.
Several Carolina Bays are well enough known to have been given individual names. Woods Bay and Dials Bay, located along the boundary line separating Sumter and Clarendon counties, are good examples. Woods Bay is home to a state park which offers on-site educational programs. Dials Bay has been drained for agricultural purposes. Cathedral Bay, near the town of Olar, Bamberg County, is now a Heritage Preserve site and also offers tours. Big Sister and Little Sister Bays in Marion County are a another pair of Bays sitting side by side. One has been drained for agricultural purposes while the other is still in its natural state. A group of Bays called the Lewis Bay Complex, located in Horry County near Myrtle Beach, is an example of so-called Marching Bays. These Bays depict a closely-aligned group of Bays in stair-step sizes.

Figure 8-1: Map of Marching Bays

LEWIS BAY COMPLEX, HORRY COUNTY

Scale 1:31,000
Theories of Origin

The origin of Carolina Bays has intrigued local residents for years, with many theories being proposed, investigated, and discarded. With the advent of aerial photography in the 1930’s, a number of geologists and local citizens again became interested in these features. Many scientific theories (hypotheses) of their origin began to emerge. Listed below are several theories of origin which have been proposed over the years. Some are whimsical, having few if any observations to support them. Others are within the realm of possibility, having observations that do support them. Many of the early hypotheses have been eliminated because conclusive data did not match the theories. For example, the wave theory that giant schools of fish waved their fins in unison over submarine artesian springs has been eliminated because the depressions are flat and shallow. Waves would have left an uneven bottom profile and the artesian springs were never found. Likewise, the limestone sinkholes theory was never substantiated because of the lack of any limestone deposits associated with the Bays. Here are some of the many theories of origin for Carolina Bays:

- A basin scooped out by giant turtles,
- Fish nests made by giant schools of fish waving their fins in unison over submarine artesian springs,
- An extraterrestrial origin where meteorite showers struck the earth causing depressions on the land,
- Large sinkholes formed in limestone solution areas,
- Solution basins related to activity of artesian springs, and
- Natural circular depressions elongated by prevailing winds resulting in elongation and deposition of sand on the perimeter of the Bay.

The development of scientific knowledge begins with observations and a systematic investigation of a proposed hypothesis. Data are gathered and analyzed to determine if they fit the hypothesis model. Repeated investigations must be made to verify the hypothesis. If the data are conclusive, then the hypothesis becomes scientific knowledge. If there is not enough data to substantiate the hypothesis, then the hypothesis is modified or rejected. In the case of the Carolina Bays, there are no conclusive data that substantiate any of the theories. Geologists have proposed and investigated many hypotheses, but the origin of the Carolina Bays is still a mystery. The following two theories deserve further elaboration.

Catastrophic Extraterrestrial Theory

Of all the theories (hypotheses) that surround the origin of the Bays, the one that has captured the most attention and imagination is the suggestion of extraterrestrial origin. This theory, first proposed by Melton and Schriever in 1933, hypothesized that the Carolina Bays were caused by the impact of a cluster of meteorites striking the earth. The theory was based on the smooth elliptical shape, the peculiar rim of sand found predominantly on the southeastern edge, and a consistent northwest to southeast orientation of all the Bays.

Many geologists have conducted surveys trying to substantiate this theory. In 1952, Prouty carried out magnetometer surveys in an attempt to locate magnetic properties associated with meteorite material. His data were not conclusive. He also conducted projectile experiments using a .38 caliber bullet to determine if elliptical
Depressions could be made at a small angle of impact. The conclusion of his data was that a meteorite could produce an elliptical depression, but it would be 2-3 kilometers deep with an uneven bottom. The Bays, on the other hand, are flat-bottomed depressions only a few feet below the surface of the surrounding ground. After comparing the Carolina Bays with craters known to have been caused by meteorite impacts, most geologists now believe that the Carolina Bays were not caused this manner. An alternate possibility is that impacts related to comets or cometary fragments striking the earth may have been responsible. Because comets are almost entirely gaseous, there would be no fragments left behind.

Gradualistic Terrestrial Theory

The currently preferred theory hypothesizes a terrestrial origin for these Bays. Natural depressions in the Coastal Plain caused circular lakes to form. The prevailing winds over a lengthy period elongated the lakes into their present elliptical basin shapes. The winds also caused sand to be deposited on the perimeter of the Bays with the greatest amount deposited on the southeastern rim where the wind velocity decreased. This occurred before heavy vegetation covered the Bays. One piece of evidence that substantiates this theory is that radioactive Carbon-14 dating indicates the Bays are not all the same age. These ages vary from 6,000 to 60,000 years, although other estimates suggest the Bays are much older. Using the terrestrial origin of circular depressions, coupled with prevailing winds, the Bays could very well have been formed over a long period of time.

The very nature of science indicates that any theory must undergo constant scrutiny; therefore, the origin of the Carolina Bays remains a continuing and intriguing mystery perhaps awaiting yet another very different explanation. As more evidence is gathered and recorded other theories will be proposed that explain the data better.

Carolina Bays Soils

Carolina Bays have characteristic soil assemblages which are the result of the very moist conditions commonly found in these environments and which can be distinguished easily from one another and from surrounding soil types on aerial photographs. Wet soil generally appears darker due to the greater accumulations of black organic matter. However, when winter cover crops have been planted, wetter soils usually support more vigorous plant growth and appear a deeper red or pink on infrared photographs than drier soils. Soil mapping surveys, such as those run by the United States Department of Agriculture, commonly draw boundary lines, delineating different soil types, directly on aerial photographs while working in the field. These surveys look at factors such as landscape position, shades of bare soil, types of vegetation growing on the soil, and water drainage patterns commonly found on that soil. Although not all soils can be so easily determined, the unique soils of the Carolina Bays can usually be separated and identified on a variety of remotely sensed images.
Three distinct soil types are found in most of the larger Carolina Bays.

- **PONZER** - This is often the dominant soil in large Bays, and it is also found in the center of smaller ones. Due to the lack of oxygen caused by water saturation, which slows decomposition, this soil is almost all organic matter. The soil microbes which would normally cause complete decomposition need oxygen to break down the leaves and other plant litter that fall to the soil surface. Over the years, an organic rich "A" horizon layer accumulated that is several feet thick. This soil appears dark in an aerial photo. While some pine trees can grow in it, they cannot compete well with better adapted deciduous vegetation. When drained, this is a highly productive agricultural soil.

- **RUTLEDGE** - This soil is found along the inside of the boundary of large Bays and occupies most or all of the area of smaller Bays. It is slightly higher in elevation than Ponzer soils and is therefore slightly drier. It also has a high organic matter content but is much more sandy. It also more easily supports loblolly pine trees. Rutledge soils also make productive agricultural land when drained. The land appears dark in an aerial photo, but not as dark as Ponzer. In Infrared aerial photos (taken in winter), Rutledge soils will appear much redder than Ponzer due to the abundance of evergreen trees such as pines.

- **RIMINI** - This soil is sometimes found on the sandy rims of Carolina Bays. It is a rather unusual soil in that its subsurface "B" horizon layer is full of organic acids combined with aluminum atoms that leached from overlying horizons. While the surface color can be bright enough to appear almost white, the color of the "B" horizon layer is often brown or black, like topsoil, but it is found about four feet below the soil surface. [Soils of this type are usually found in northern regions, like New England, Northern Michigan, Minnesota, and Canada.] For several reasons, including acidity and possible aluminum toxicity, this is not a good soil for plant growth and is only sparsely covered by scrubby pines, blackjack oak, and turkey oak. This is not an extensive soil, and is almost never used for agriculture. It appears very light in an aerial photo due to the high sand content and dryness of the soil surface.

Figure 8-2: TYPICAL CAROLINA BAYS SOIL TYPES

<table>
<thead>
<tr>
<th>PONZER</th>
<th>RUTLEDGE</th>
<th>RIMINI</th>
</tr>
</thead>
<tbody>
<tr>
<td>thick black organic horizon</td>
<td>dark sand and organic matter mix</td>
<td>thin &quot;A&quot; horizon</td>
</tr>
<tr>
<td>loamy</td>
<td>sandy</td>
<td>sandy</td>
</tr>
<tr>
<td></td>
<td>sandy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>dark &quot;B&quot; horizon</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sandy</td>
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</tbody>
</table>
Influence of Topography on Historical Events and Cultural Trends

A Brief Historical View of the Bays

Soon after the Europeans settled in the state, they started to call these small swamps, dominated by small, aromatic bay trees, "bay swamps" or "pocosins" (a Native American term). Later, to avoid confusion with coastal bays, they were called "Carolina Bays." John Lawson recorded the first written mention of Carolina Bays in the late 1700's. In 1765, the Pennsylvania botanist John Bartram wrote of seeing "bay swamps" in South Carolina. He reported that local Native American fishermen utilized the buckeye tree’s branches and leaves to make a highly effective fish narcotic used to stun fish before catching them. They also used the seeds of the buckeye trees for making eyes for the deer masks they wore while stalking deer. The Native Americans made extensive use of these wetlands and their diversified biological productivity without changing them in any significant way.

In 1848, Michael Toumey, then South Carolina State Geologist, officially described these unique geological formations in the following terms: "A peculiar feature in the topography of this sand-hill region is the number of circular depressions that are scattered over the surface. They are not deep and conical, like 'lime sinks,' but flat and shallow, at first sight reminding one of a circular race-course." (Kaczorowski, 1977) The actual term "Bay" was first introduced to describe these features in 1895, by L.C. Glenn, who described them in an article published in Science. Glenn's scientific description follows, along with a more modern descriptive essay, which was published in South Carolina Wildlife, written by Glenn Oeland.

**Objective Description of Carolina Bays**
by L.C. Glenn

Having noted on a surveyor's map of my school district of Darlington, SC, several lake-like expanses usually represented as being at the head of some very small stream, I began inquiries concerning them and followed this up by visiting several of the largest.

To the lake-like expanses the term bay is usually applied and by it is meant a perfectly flat, clayey area with a surface some two to four feet below the general level of the country and varying from a few acres in size to stretches a mile or two long and a half mile or more in width; the smaller ones being much more numerous and having usually an area of 20 to 30 acres. They are in some cases approximately round in shape, though they are usually ovoid or elliptical, and are covered with vegetation-stained water from a few inches to a foot or two deep according to the season. Growing in this water, where the bay is uncleared, are cypress, juniper or black-gum trees with a moderately thick swamp undergrowth.
Subjective Description of Carolina Bays
Abridged from an article by Glenn Oeland

From the air they look like impressions made in the earth's surface by a giant egg, ovals of dark greenery surrounded by patchworks of tilled farmland. The Bays are a wetland oasis supporting a rich variety of plants and animals. About one-third of the bay is covered by a watery prairie of **marsh** grasses and water lilies, a sunny environment preferred by alligators and wading birds. The larger portion of the bay is a dense swamp forest of cypress and tupelo gum trees, a shaded realm inhabited by water snakes, wood ducks, and barred owls. The dense thicket of evergreen bay trees swells right to the edge of the swamp, but there it comes to an abrupt halt. Sporadic openings in the green vegetative curtain provide an intimate glimpse of the swamp at its wildest, a chance to experience one of nature's genuine mysteries.

Sharecropping

Sharecropping is a system of farming in which the landowner provides supplies and equipment and tenant farmers provide labor in exchange for a portion of the crop. The Coastal Plain Region experienced the greatest extent of sharecropping, although this system was common throughout the state during the period between the Civil War and World War II, even extending into the 1950's. Many Carolina Bays were ditched and drained to provide suitable land for sharecropping.

Unlike cash renting, where the landowner provided only land, house, and fuel, sharecropping required landowners to provide for all the needs of their tenant farmers. Usually supplies, food, and medical expenses were furnished through a credit arrangement in which the tenants were to pay back what they owed after the crop was harvested and sold. Unfortunately, merchants often overcharged for goods purchased on credit and many also charged interest. As a result, few sharecroppers ever amassed enough wealth to purchase their own land. Tenants had no choice in what they were to grow, as seed was also furnished by the landowner. As a result, almost all sharecropping during this period was dedicated to growing cotton. But low prices for cotton during that time limited earnings for both the landowner and the tenant.

Both Black and White families worked as tenant farmers, but Black farmers accounted for the majority of sharecroppers. Although the Reconstruction Government promised land to freed slaves following the Civil War, that promise came true in only a few areas of the state. Most Blacks ended up returning to the plantation, but as tenant farmers rather than slaves. Although the new system was not an enormous improvement, tenant farmers at least had mobility. After they fulfilled their annual contract, they were free to move to the property of another landowner who promised a better deal for the next year. A study published in 1924 reported that only about one-fourth of South Carolina's tenant farmers had been on the same land for more than five years. Even as late as 1945, tenants still operated 54 percent of the farms in the state.
From the early explorers who came to America long ago, we know that many, many foods are produced from corn. For example, there’s the popcorn plant handed down to us from the Native Americans who raised many types of corn including sweet corn and dent corn. According to members of the Timmons family who are local to these parts, corn is about all they ate in the old days and is still a big part of their meals. In this family of 16 children, it was the custom for this family to boil large black pots of corn with 5 to 10 dozen ears or more. Reverend James Curry said that the Timmons family loved corn better than a hog loves slop! Corn cobs were used to make fires to warm their homes and the shucks were boiled to make a tea to treat measles.

The cotton crop, according to Mr. Willie Moses III, was just as important in this area as tobacco. Cotton was picked by the sharecroppers--who were the people that lived in the tenant houses, which were usually of very poor quality. The families and their children would pick the cotton in sacks, tie it up in burlap sheets, and take it to the gin for payment and processing. Each sharecropper was paid an amount of money for the cotton minus the expenses charged him for the crop. For most sharecroppers, this was all they had to live on during the harsh winter months.
Natural Resources, Land Use, and Environmental Concerns

Draining the Bays for Agriculture and Forestry

The rich organic soils which underlie most Carolina Bays have attracted large numbers of farmers and led them to ditch and drain the Bays in order to convert them to agriculture. Once a ditch is dug through a Bay, water will seep out of the surrounding soil, under the influence of gravity, to seek a lower elevation. Of course the ditch must cut through the rim of the Bay to empty into a lower elevation stream which will carry the water out of the area. Eventually the Bay dries out enough so that the soil can be plowed and crops can be planted. Once the standing water is removed and the water table is lowered, the organic rich soils respond by producing abundant crops. The shallow water table helps to prevent crops from drying out during summer drought conditions.

A similar procedure was followed to provide access to valuable hardwood timber. Particularly cypress trees were normally inaccessible to large scale lumbering operations in the 1800's and early 1900's due to the swampy surroundings. Lumber companies would typically ditch and drain a Bay when possible, then build plank roads over the spongy landscape. After cutting the timber, the logs were dragged out of the Bay by horses or mules, or later by tractors. Some Bays still show the scars of the ditching and the paths of tramways even after decades of restoration efforts.

Carolina Bays as a Unique Natural Habitat

Carolina Bays are the dominant freshwater wetland feature of the Coastal Plain of South Carolina. But not all Bays provide the exact same habitat conditions. Some Bays are wet all of the time, supplied by springs, producing a bog-like ecosystem with its associated unique mix of plant and animal species. These Bays maintain an acidic environment with very low oxygen levels. Various species of blueberries, wild azaleas, hollies, loblolly bays, pond pines, and abundant vines and briers thrive in those unique habitat characteristics. Some wet Bays also contain rare insectivorous plants such as the Venus fly trap, pitcher plant, and sundew. In turn, this lush vegetation has attracted various species of wildlife, ranging from the small tiger salamanders and tree frogs, to much larger bobcats and alligators. The thick underbrush also offers a safe haven to deer. Other Bays are dry much of the time providing a more grassy savanna-like habitat. Rare plant species are also found in drier Bays. Examples include mock bishop’s weed, quill-leaf, rose coreopsis, and spoonflower.

Recent Efforts to Preserve the Carolina Bays

Many of the Carolina Bays have succumbed to our growing population’s desire to develop additional land. They are being logged, cleared, plowed, sliced up by roads, and built up at an alarming rate. In a recent survey, the South Carolina Department of Natural Resources identified 2,651 Bays, over two acres in area, in the state. It has been estimated that only 36 Bays are still relatively untouched. Woods Bay, in Sumter and Clarendon counties, now preserved in its natural state but once the site of a water powered grist mill, is part of the South Carolina State Park System and has been kept in an almost pristine condition. Several other Bays have been protected as nature preserves through the Heritage Trust Program. Cathedral Bay in Bamberg County was
purchased and is now under the care of this public foundation. Several other Bays purchased by the Heritage Trust Program include Junkyard Bay in Clarendon County, Cartwheel Bay in Horry County, and Savage Bay in Kershaw County. Bays are being preserved so that future generations will be able to continue to enjoy these unique elliptical shaped "botanical treasure houses" and continue the search for their origin.

**Summary**

Carolina Bays are interesting geological formations that have intrigued South Carolinians for generations. Many theories have been suggested to explain the formation of the Bays, ranging from the difficult to accept ones - such as the Bays' being scooped out by giant turtles - to the difficult not to accept ones - such as the Bays' being formed by a meteorite shower. However, the current front-running theory suggests that the Bays were formed gradually from pre-existing ponds by the slow action of prevailing winds. If this is true, however, some interesting questions arise. What formed the original ponds? Why are no Bays forming today? These and other related questions need the efforts of new scientists with fresh ideas.

However the Bays formed, they are organically rich and normally very wet. They support several rare and endangered plant and animal species and provide major wetland habitat for one of the most diverse biological communities of the Coastal Plain Region. If drained, the rich soils of the Bays can be used for farming. Except along the rim of the Bays, where the soil is sometimes almost totally sand, typical Bay soils are able to support the growth of both row crops and forest products.

Historically, sharecropping was common in and around the Carolina Bays, as it was throughout most of the Coastal Plain Region. Even though the system served as a way of life for many tenant farmers it is no longer practiced in South Carolina. Several of the Carolina Bays remain in their natural state, but the majority have been ditched and drained for agriculture or logging. Only 35-40, out of an estimated 2651 original Bays over two acres, have been protected. The preservation of remaining natural Bay areas is an important contemporary issue.
PLACES TO VISIT

Woods Bay State Park. Located near Turbeville and Sumter-Clarendon counties. Olanta, SC. For information call (803)-659-4445.

Cathedral Bay Heritage Preserve. Located in Olar and Bamberg counties. For information call (803)-734-3893.

REFERENCES AND RESOURCES


STUDY AREA 8: CAROLINA BAYS

Activity 8-1: Overview

<table>
<thead>
<tr>
<th>Materials</th>
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<td>6 STATE BASE MAP #2, WITH HIGHWAYS 1: 500,000</td>
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<td>6 COASTAL SATELLITE IMAGE 1: 332,640</td>
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<td>6 CONGAREE SWAMP TOPOGRAPHIC MAP 1: 24,000</td>
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<td>6 MYRTLE BEACH TOPOGRAPHIC MAP 1: 24,000</td>
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<td>6 WOODS BAY LITHOGRAPH 1: 12,000</td>
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<td>6 WOODS BAY TOPOGRAPHIC MAP 1: 24,000</td>
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<td>6 SAVANNAH RIVER SITE LITHOGRAPH 1: 8,900</td>
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<td>6 SAVANNAH RIVER SITE TOPOGRAPHIC MAP 1: 48,000</td>
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<tr>
<td>1 Map of Marching Bays</td>
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<td>6 Transparent grid Overlays</td>
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<td>6 Wipe-off Pens</td>
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PERFORMANCE TASKS
(Icon Key) Overview = ☑; Science = ☒; Math = ☑; History = ☒; Language Arts = ☞

1. Make an index chart of Carolina Bays. ☑ ☐

Divide into groups, each group using different maps. Locate as many Carolina Bays as possible on your assigned map(s) and fill in the Index chart below. Unaltered Carolina Bays will appear as oval depressions. Bays that have been altered for logging or agriculture may appear more irregular in shape. Organize your list of Bays according to names, assigning a number if there is no name. Measure the length of the long axis of the Bay and determine the size of each Bay in square feet or square miles. Use either the mathematical formula for the area of an ellipse, or estimate this value using the transparent grid overlay. Convert your answer to acres (there are 640 acres in one square mile). Next, record the direction (orientation) of the long axis of each Bay. Use contour line information to determine the elevation of the center of each Bay. Then determine the approximate elevation of the rim, and calculate the elevation difference. Also note land use by analyzing if the Bay has been disturbed. Green on the topographic maps indicates wooded areas, white indicates open fields. What percent of the Bays recorded on your index have been disturbed? What environmental concerns address the need for the protection of Carolina Bays?

Group I   Map of Marching Bays-Lewis Bay Complex (Figure 8-1)
Group II  Congaree Swamp Topographic Map and Lithograph
Group III Myrtle Beach Topographic Map and Lithograph
Group IV  Lake Marion Topographic Map and Lithograph
Group V   Savannah River Site Topographic Map and Lithograph
Group VI  Woods Bay Topographic Map and Lithograph
When you have collected all of your data, use information provided on your map to pinpoint its location on the **STATE BASE MAP #2, WITH HIGHWAYS**. Select one person from your group to mark your Carolina Bay locations on the map, at the front of the room, with a wipe-off pen. Discuss with other groups the geographic distribution of Carolina Bays throughout South Carolina. Which landform regions contain Bays? Which do not? Examine the **COASTAL SATELLITE IMAGE**. Are any Carolina Bays large enough to show up on the image? Use the Scale Bar to predict how large a Carolina Bay would have to be (minimum size) to show up on the satellite image.

### CAROLINA BAY INDEX

<table>
<thead>
<tr>
<th>NAME OR NUMBER OF BAY</th>
<th>LENGTH OF LONG AXIS (FT.)</th>
<th>SURFACE AREA OF BAY (ACRES)</th>
<th>DIRECTION (ORIENTATION) OF LONG AXIS</th>
<th>ELEVATION AT CENTER OF BAY</th>
<th>ELEVATION AT EDGE OF BAY</th>
<th>ELEVATION DIFFERENCE</th>
<th>LAND USE</th>
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2. **Compare characteristics of Marching Bays.** "Marching Bays" is the nickname for the pattern formed when several Bays are found sitting side by side, appearing to be grouped together. Examine the **WOODS BAY LITHOGRAPH**, the **LAKE MARION LITHOGRAPH**, and Figure 8-1 “Map of Marching Bays-(Lewis Bay Complex).” Outline all Marching Bays on each lithograph with a wipe-off pen. Compare these patterns to the Lewis Bay Complex shown on Figure 8-1. Are most Bays in the groups of Marching Bays about the same size, or is there a big size difference? How many Bays have sand ridges on the perimeter rim? Do the sand ridges go all the way around the Bay, or do they occur only in certain places? How can you recognize sand ridges on the infrared lithographs? What percent of the Bays on each lithograph are associated with swamps? Are there other swamps nearby which are not associated with the Carolina Bays? Which Bays drain into swamps? Into what do the other Bays drain?

3. **Evaluate pros and cons of Carolina Bay origin theories.** List what you think are the pros and cons of the proposed theories for the origin of the Carolina Bays. Discuss the possibility of proving each theory. Make up your own theory of the origin of the Carolina Bays and present it to your group or to the whole class. How could you gather data that would support, modify, or disprove your theory?
4. **Contrast Native American uses of Bays with modern uses.**

Contrast Native American uses of the Carolina Bays to the later or current uses of the Bays. Construct a Venn diagram showing which uses have not changed. Report your comparisons to the class. Set up a class debate on whether more of these unique wetlands should be preserved.

5. **Compare objective and subjective descriptions of Carolina Bays.**

Read carefully through both descriptive articles printed on pages 8-7 and 8-8. One was written for a scientific journal, while the other was written for a more general audience. Both are describing similar Carolina Bays. What are the similarities and differences between the two styles of writing? What landform features are mentioned by both writers? Are the landscape features described the same way? Explain any differences in the authors’ approaches.

Select a local landform feature that you know well. Write two descriptions of this feature, one an objective scientific description, the other a more subjective description. Which one was easier for you to write? Why?

6. **Evaluate desirability of Carolina Bays for home sites.**

Read through the selection of Sharecropper Accounts on page 8-9 and discuss various aspects of farming life within your group. Why do you think a farm family might locate their home site in a Carolina Bay? What about on the rim of a Bay? Make a list of pros and cons and decide where you would choose to live if you were a farmer. Select a Carolina Bay which fits your desired characteristics and which is visible on the **COASTAL SATELLITE IMAGE**. Mark its location on the lithograph and explain to the class why you would want to live there.

7. **Identify potential non-point source pollution by examining land use.**

On the **WOODS BAY LITHOGRAPH**, locate the outlet for the drainage ditches present in Dials Bay, the large drained Bay just west of Woods Bay. Use the **WOODS BAY TOPOGRAPHIC MAP** as a reference if needed. Into what waterway does this water drain? What kinds of non-point source pollutants would you expect to find in this water? Now locate the outlet from Woods Bay. Into what waterway does this Bay drain? What kinds of non-point source pollutants would you expect to find in this water? Is the danger from pollutants the same for each Bay? Explain your answer.
ENRICHMENT

1. Request a copy of the Carolina Bay Project survey. ⚫ ⚫
   Request a copy of the Carolina Bay Project survey results published by the South Carolina Department of Natural Resources. What has been done to preserve the Bays? What is the value of these unique wetlands? What are some of the rare and endangered plants found on the federal endangered species list? As a citizen, what can you do to save these Bays?

2. Compare your Carolina Bays index to official index. ⚫ ⚫
   The Department of Natural Resources has made an extensive index of Carolina Bays. Note that the index records only Bays with an area of more than two acres. Contact the Department of Natural Resources for their report of Carolina Bays and compare their data with your own data from Performance Task #1 (pages 8-13 and 8-14).

3. Research what crops in your area were grown by sharecroppers. ⚫ ⚫
   Ask around your community to see if you can find someone who picked cotton or cropped tobacco by hand. In your interview, ask about stories from those times. If you live in an area where tobacco or cotton is not grown, find out how these crops are harvested today. Are migrant workers used today to harvest cotton, tobacco, or other crops? How do the workers get in and out of your community? What about their children? Look for books or stories that talk about sharecropping. One book available is Picking Cotton by Sherley Anne Williams, illustrated by Carole Byard. The publisher is Harcourt Brace Jovanovich, 1992. Prepare a report and present it to your class.
The Greenville Piedmont

July 28, 1988

Lawmen say "Lizard Man" exists

<table>
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<th>Staff report</th>
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| A Lee County sheriff's deputy and a South Carolina Highway Patrol trooper say their experience responding to a report of a Bigfoot sighting along U.S. 15 and Interstate 20 before daylight Sunday left them convinced that "something is out there." They believe that whatever is out there watched as they stepped out of their car to examine garbage strewn onto a dirt road near Scape Ore Swamp. They also examined a broken tree limb dangling about 9 feet overhead before they got back in the car, drove down the road and turned around. When they returned to the site, the officers said, they found that something had walked across their tire tracks, leaving a fresh set of the three-toed, 14-by-7 inch prints before it entered the woods.

Trooper Mike Hodge, a former marine who has been with the patrol for 1 1/2 years, said, "If a prankster were out there and the law pulled up, they would have gotten out of there."

But Lee County Sheriff Liston Truesdale, skeptical to the core, said he believes the tracks were a prankster's work, designed to keep the Lizard Man mania alive. "Whoever did it sure did a convincing job," Truesdale said with a chuckle. "They were just some weird tracks," said Hodge. "They were too consistent to be fake. They were deep down in that hard dirt. "I stomped in the road, and I couldn't make a track."

Deputy Wayne Atkinson said, "I put my foot in the track and I'm 6-foot, 3 1/2 - inches tall and I lacked touching that limb by about 3 feet."

Truesdale seems to be growing weary of the Lizard Man, described as a red-eyed, tall, green creature by a Lee County youth, but Deputy Atkinson says, "I'll be back, you can bet on that. I'm going to stay on it until I find out what's out here. If it is a prankster, I've got one thing to say: He'd better cut it short."

<table>
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<tr>
<th>Rationale</th>
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<td>Of all the landforms in South Carolina that have aroused the curiosity of both geologists and local residents, Carolina Bays are at the top of the list. Woods Bay was selected as the Carolina Bay study site because it is the largest Bay preserved in a near-pristine condition and also because it is one of the most easily accessible, being located just south of Interstate Highway 95 on the border of Clarendon, Florence, and Sumter counties. In the 1920's, most of the cypress trees were logged, and tramways were laid over swampy areas to allow timber to be hauled out. In 1971, logging companies were prevented from repeating the harvest when Woods Bay was made a state park. It contains both swampland areas and grassy savanna areas, as well as pine barrens along its sand rim. A cypress-tupelo community dominates the interior of the Bay, while longleaf pines cover the drier rims. Woods Bay stands in sharp contrast with nearby Dials Bay, which was drained for agricultural use. The park is a refuge for many varieties of birds, amphibians, reptiles, and mammals, as well as to a host of rare and specialized plants.</td>
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Characteristics of Woods Bay

Woods Bay State Park was established in 1972 following the efforts of naturalist J.C. Truluck, who led the movement to protect the Bay from impending logging operations. The park contains the 1,548 acre Bay itself and just enough surrounding land to provide a buffer zone between neighboring agricultural fields and wetlands of the interior. This Bay is one of the wettest in the state because of artesian springs which flow year round and keep the basin covered with about three feet of water, pure enough to drink. About one-third of the area is covered by a watery blanket of marsh grasses and water lilies, while most of the remainder is a dense, swampy, shaded forest dominated by cypress and tupelo gum trees. Neighboring Dials Bay provides a clear contrast in land use, as it has been extensively ditched and drained for agricultural purposes. Several smaller Bays nearby have also been converted to agricultural use.

Park Facilities, Boardwalk, and Canoe Trips

Unlike many state parks in South Carolina, Woods Bay does not offer camping, swimming, miniature golf, or any other of the typical recreational amenities which traditionally draw large numbers of visitors to the outdoors. For individuals or groups who wish to experience the wilder side of nature, unspoiled by development, Woods Bay is the perfect location. The park offers a boardwalk which winds through dense forests and open swamp areas, offering close-up views of a variety of plant and animal life from the safety of a dry platform. More adventurous visitors can take advantage of canoe rentals. Although there is not a lot of open water available, there is enough for a leisurely hour-long paddle through several sub-environments of the Bay habitat.

Land Use in Woods Bay

Woods Bay was extensively logged for its cypress trees in the 1920's and 1930's. Because it was swampy year-round, the Bay could not be logged in the traditional fashion; instead, tramroads or boardwalks had to be constructed on top of the swamp so that logs could be hauled out without bogging down in the wet soils. Because of the underground artesian springs which keep most of its acreage under water, Woods Bay was never drained for agriculture. In fact it has seen some very different types of land use than most of the other Carolina Bays in this part of South Carolina.

Although it proved unsuitable for agricultural use, Woods Bay does offer a naturally occurring reservoir of fresh water suitable for another important type of land use. At least three water-powered grist mills were operated here by three different people. One of the mills was owned by Andrew Woods, for whom the Bay was named. The last of these mills ceased operation in the 1930's. At some time during this period, a mill pond was constructed along the north side of the Bay. Remnants of this pond, near the park's Visitor Center, can still be seen from several viewpoints along a mile long trail which encircles it. The former pond area has been almost totally reclaimed by nature and is now a favorite feeding ground for birds and alligators.
Activity 8A-1: Anatomy of a Carolina Bay

Materials

<table>
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<tr>
<th>Item</th>
<th>Scale</th>
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<tr>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<td>LAND USE/LAND COVER MAP</td>
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<td>GENERAL SOIL MAP</td>
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<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
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<tr>
<td>WOODS BAY TOPOGRAPHIC MAP</td>
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<tr>
<td>State Map of Major Drainage Basins</td>
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<td>Transparent Grid Overlays</td>
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<td>Wipe-off Pens</td>
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PERFORMANCE TASKS

(Icon Key) Overview = ☀; Science = ☘; Math = ☀; History = ☐; Language Arts = ☛

1. Locate the study site. ☀ ☘
   Locate the Woods Bay Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the Scale Bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. Analyze the newspaper article. ☘ ☛
   Read the newspaper article on page 8A-3 titled, "Lawmen say 'Lizard Man' exists." Explain how the story relates to the Coastal Plain Landform Region. Identify on the STATE BASE MAP #2, WITH HIGHWAYS (refer to the COASTAL SATELLITE IMAGE if needed), where the places and events named in the story might be located. Explain why the publisher thought this story might be of interest to newspaper readers. Using the same references and the same location as your setting, write another newspaper article related to the same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose a title (headline) and draw an appropriate picture to illustrate your main point.

3. Analyze land use changes through time. ☀
   Look in the margins of the WOODS BAY TOPOGRAPHIC MAP and the WOODS BAY LITHOGRAPH to determine the year the map data was gathered and the year the aerial photograph was taken. Examine each cartographic product carefully to identify any changes which have occurred during the interval. How many of these changes are man-made? How many have occurred naturally?

4. Relate different temperatures to habitat characteristics. ☀ ☘
   Crickets are known to chirp at different rates depending on the temperature of the environment they are living in. (Crickets in warmer habitats chirp more frequently.) As part of a school project, your group took an afternoon field trip to the Woods Bay
area to gather data about surface temperature differences between agricultural Dials Bay (large drained Bay west of Woods Bay) and forested Woods Bay. Your data consisted of two tape recordings of crickets chirping. Unfortunately, when you returned to school to analyze your data, you realized that nobody in your group had marked down which recording came from which Bay.

First your group will have to calculate the average temperature represented by each of the recordings of cricket chirps. Your data indicate that crickets from one of the Bays were chirping at an average rate of 200 times per minute, while crickets from the other Bay were chirping at an average rate of 180 times per minute. The formula for converting cricket chirps per minute (P) into Fahrenheit temperature (F) is:

\[
F = \frac{1}{4} P + 37
\]

Secondly, you will have to examine carefully the WOODS BAY LITHOGRAPH to determine, as best you can, which Bay would be cooler. Consider land use differences, vegetative cover, and soil differences to determine your answer. Put your answers together to report the afternoon surface temperature of Dials Bay and of Woods Bay.

5. **Identify features in and around Woods Bay State Park.**

Woods Bay and Dials Bay are situated on the Sumter-Clarendon County line near Turbeville, SC. Locate Woods Bay on the WOODS BAY TOPOGRAPHIC MAP. Woods Bay State Park is an excellent example of a Bay that, since the 1930's, has been preserved in its wooded state. On the WOODS BAY LITHOGRAPH, note the remnant pattern of the tram roads running through the Bay. Now examine adjacent Dials Bay. What do the patterns you see there indicate? Are those same patterns present on the topographic map? Continuing to examine the topographic map, determine the elevations of Woods Bay (in feet) and Dials Bay (in meters). Which Bay is higher? How far above sea level would you be if you climbed to the highest point on this map? How far would you be above Woods Bay? Locate the town east of the State Park. Name the main river and its tributaries flowing between the town and the Park. In which direction are these waters flowing? On the lithograph, locate the town of Olanta, Douglas Swamp, and sand ridges on the rim of the Bays.

6. **Estimate surface area of Woods Bay.**

Outline Woods Bay on the WOODS BAY LITHOGRAPH with the wipe-off pen. Estimate the image area in square inches using the transparent grid overlay. Then use the conversion factor for this map, 1 square inch = 22.9 acres, to find the approximate acreage of Woods Bay. Use a measured dimension of Dials Bay and the area of Woods Bay to set up a ratio to calculate the approximate surface area of Dials Bay.
7. **Trace boundaries for Carolina Bays soil types.**

Use the soil type descriptions in the Background Information section to identify exposures of the Ponzer, Rutledge, and Rimini soil types in as many Carolina Bays as possible on the *WOODS BAY LITHOGRAPH*. Trace the boundary lines between each soil type with a wipe-off pen. You may use the *WOODS BAY TOPOGRAPHIC MAP* as an additional resource. Which areas will require a lot of on-the-ground investigation to determine true soil boundaries? What is your reasoning for placing these boundaries where you did? Look at the cleared agricultural fields on the lithograph. Can you make any assumptions regarding different soil types in these fields? Explain.

8. **Make line plot graph of Woods Bay biota, identify vegetative groupings.**

The ability to organize, summarize, and communicate numerical information is a necessary skill in many situations, especially science projects and science laboratory reports. You will often find data presented in charts or tables, but one of the most efficient and revealing presentations of data is in the form of a graph. One of the simplest types of graph is the line plot.

The table below summarizes the relative diversity of flora and fauna found at Woods Bay State Park. To visualize relative levels of diversity on a line plot, place markers or symbols on a horizontal line containing a scale of numbers. Since the smallest number in your data is 5, and the largest is 96, the scale might run from 0 to 100. Some estimation will be required in placing your markers or symbols on the line plot. Identify gaps, clusters, or outliers (a lone point far from others) in your plotted data.

<table>
<thead>
<tr>
<th>GROUP</th>
<th>VARIETIES</th>
<th>SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees</td>
<td>16</td>
<td>S</td>
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<tr>
<td>Scrubs</td>
<td>20</td>
<td>B</td>
</tr>
<tr>
<td>Herbs</td>
<td>25</td>
<td>A</td>
</tr>
<tr>
<td>Ferns</td>
<td>5</td>
<td>W</td>
</tr>
<tr>
<td>Mammals</td>
<td>6</td>
<td>O₁</td>
</tr>
<tr>
<td>Reptiles</td>
<td>15</td>
<td>D</td>
</tr>
<tr>
<td>Amphibians</td>
<td>10</td>
<td>O₂</td>
</tr>
<tr>
<td>Birds</td>
<td>96</td>
<td>Y</td>
</tr>
</tbody>
</table>

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9. **Explain unusual contour line patterns.**

Locate Interstate Hwy. 95 in the northwest corner of the *WOODS BAY TOPOGRAPHIC MAP*. Why are contour lines so straight on either side of the interstate? Locate Dials Bay just west of Woods Bay. Why are the contour lines so unusual in parts of Dials Bay?
ENRICHMENT

1. Research the sand ridge habitat around Woods Bay.
   Write to Woods Bay State Park Headquarters for information about the sand ridge habitat on the southeastern rim of Woods Bay. Describe the plants and animals that are found growing on this sand ridge. Why is this considered a very different ecosystem from the interior Bay?

2. Use an equation to describe the shape of Woods Bay.
   Use the equation for an ellipse to determine if Woods Bay is truly elliptical. The following equation is used to define an ellipse.

   \[
   \frac{y^2}{a^2} + \frac{x^2}{b^2} = 1
   \]

   Using the Woods Bay Topographic Map, draw a line lengthwise across the Bay so that it divides the Bay into equal halves. This line is called the major axis. Draw a line across the Bay perpendicular to the major axis, so that it divides the Bay into equal quarters. This line is called the minor axis. From the intersection of the major and minor axes, measure the distance (convert to feet with Scale Bar) along the major axis to the edge of the Bay. This distance is "a" in the formula above, the semi-major axis. The measured distance (convert to feet with Scale Bar) from the intersection of the axes along the minor axis to the edge of the Bay is "b" in the formula above, the semi-minor axis. Substitute these distance figures into the formula.

   Use the transparent grid overlay to identify several (x, y) coordinate pairs along the edge of the ellipse. Orient your grid so that the semi-major axis "a" corresponds to the "y" axis in your coordinate system, and use the intersection of the major and minor axes as the origin (0,0). Use the scale of the map to determine the x and y distances associated with these coordinate pairs. Substitute your x and y values into the formula above. How close is your calculated value to 1? The answer is 1 if the Bay is an exact ellipse. Does the formula accurately describe the shape of Woods Bay?
SECTION 9
COASTAL ZONE REGION / OVERVIEW

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<th>Table Rock (Mountains)</th>
<th>5B</th>
<th>Santee Cooper Project (Engineering &amp; Canals)</th>
</tr>
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<tbody>
<tr>
<td>2B</td>
<td>Lake Jocassee Region (Energy Production)</td>
<td>6A</td>
<td>Congaree Swamp (Pristine Forest)</td>
</tr>
<tr>
<td>3A</td>
<td>Forty Acre Rock (Granite Outcropping)</td>
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<td>Lake Marion (Limestone Outcropping)</td>
</tr>
<tr>
<td>3B</td>
<td>Silverstreet (Agriculture)</td>
<td>8A</td>
<td>Woods Bay (Preserved Carolina Bay)</td>
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<td>3C</td>
<td>Kings Mountain (Historical Battleground)</td>
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<td>4A</td>
<td>Columbia (Metropolitan Area)</td>
<td>9B</td>
<td>Myrtle Beach (Tourist Area)</td>
</tr>
<tr>
<td>4B</td>
<td>Graniteville (Mining Area)</td>
<td>9C</td>
<td>The ACE Basin (Wildlife &amp; Sea Island Culture)</td>
</tr>
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<td>Sugarloaf Mountain (Wildlife Refuge)</td>
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  - Newspaper Article - "Long Lost Confederate Sub Found off Charleston"
  - Rationale
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Activity 9A-1: The Historic District

- Materials
- Performance Tasks
  1. locate the study site
  2. identify famous landmarks and natural features
  3. analyze changes through time
  4. trace boundaries of original city of Charleston
  5. compare modern to former positions of city wall and peninsula
  6. analyze the newspaper article
  7. determine navigational bearings in harbor
  8. determine distance cannonball traveled to Fort Sumter
  9. evaluate actual cost of earthquake damage
  10. recreate an interview with hotel owner Jehu Jones
  11. locate physical features with specific geometric shapes
  12. measure size of Charleston rivers and Intracoastal Waterway
  13. select suitable location for a commuter bridge to Daniel Island
  14. estimate roof damage to Charleston
  15. plan an evacuation route for an approaching hurricane

- Enrichment
  1. investigate relationship between English Lords Proprietors and Charleston
  2. research and report on Charleston Single House
  3. compare advantages of original and present sites of Charleston
  4. research current wetlands legislation

Activity 9B-1: The Tourist District

- Materials
- Performance Tasks
  1. locate the study site
  2. identify land use features and the location of landmarks
  3. analyze changes through time
  4. analyze the newspaper article
  5. predict new shoreline position for Myrtle Beach
  6. determine nature and extent of non-point source pollution
  7. relate landforms to land use
  8. contrast sediment load in different bodies of water

- Study Site 9B: Myrtle Beach (Tourist Area)

  - Newspaper Article - "Myrtle Beach vs. the Sea"
  - Rationale
  - Brief Site Description
  - Myrtle Beach, 200 Years Ago
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  - Myrtle Beach, Today
  - A Common Species: Touroid
  - story - "Signs of a Touroid Sighting"
  - The Myrtle Beach Railroad
  - Atlantic Beach Set Aside for African Americans

Activity 9B-1: The Tourist District

- Materials
- Performance Tasks
9. design plan for future use of Air Force Base site
10. develop a class list of Touroid characteristics
11. tell a funny story about being a Touroid
12. compare Florida and S. Carolina tourism and spending habits
13. estimate capacity for tourists and parking
14. design a brochure for a Myrtle Beach resort
15. estimate time of day by angle of shadows
16. analyze impact of Myrtle Beach railroad line

- Enrichment
1. research pros and cons of resort development
2. research beach erosion and implications for tourism
3. collect brochures from tourist attractions
4. locate other tourist beaches in South Carolina

- STUDY SITE 9C: THE ACE BASIN (WILDLIFE AND SEA ISLAND CULTURE)

- Newspaper Article - "Uncovering a Piece of History"
- Rationale

- Brief Site Description

- Activity 9C-1: The Wildlife District
- Materials

- Performance Tasks
1. locate the study site
2. describe river systems draining through ACE Basin
3. analyze changes through time
4. analyze the newspaper article
5. develop criteria for picking Spanish landing site
6. locate position of two forts protecting Port Royal
7. identify where long staple black seed cotton could grow
8. write follow-up to "The Precious Brooch"
9. tell story about a Gullah tradition and relate to historical
10. explain contour interval anomalies on map

- Enrichment
1. research current wetlands legislation
2. research wildlife habitat and seafood industry
3. research wood duck habitat
4. research origin of Gullah language and culture, relate
POWER THINKING ACTIVITY - "Turtle Trot"

Two sea turtles start walking South Carolina's coastline in opposite directions. Turtle #1 starts from the Georgia state line and heads north. Turtle #2 starts from the North Carolina state line and heads south. Both turtles travel at the same speed, whether swimming or walking. However, neither turtle can swim more than one-half mile without resting on land and neither can walk more than one-half mile without taking a dip in salt water. Using the STATE BASE MAP #1, SHADED RELIEF, make a quick, but intelligent prediction about where the two turtles will meet. Mark this spot on the map with a wipe-off pen. Note that there is some overlap between the main map and the small insert map of the Hilton Head Island area. Next discuss within your group a strategy to determine a more accurate location for their meeting point. Carry out your strategy, mark this new location on the map, and compare it to your original prediction. Was your original prediction close? Why or why not?

PERFORMANCE OBJECTIVES

1. Compare and contrast physical and land-use characteristics of the three distinct South Carolina coastal landscapes.
2. Analyze the effect of ongoing geological, astronomical, and meteorological processes on the geometry of coastal landforms.
3. Examine how topography, abundance of natural resources, and favorable climate along the coast influenced the development of Native American, early Spanish, European, and African American cultures.
4. Compare and contrast the early development and later history of South Carolina's three major port cities.
5. Document, and recognize the importance of, efforts to preserve the heritage of African American culture in the state.
6. Determine and trace navigable channel course for ships using bathymetry data from topographic maps and channel dimensions from lithographs.
7. Assess the economic and environmental impact people have had on the Coastal Zone through the development of beach and resort areas.
8. Estimate dollar value and percentage of structures damaged from natural disasters occurring in the Coastal Zone.
9. Construct stories or tales which have Gullah proverbs or sea island traditions as their basis.
10. Examine critically and explain thoroughly the ecological significance of the ACE Basin watershed and wetland areas.
BACKGROUND INFORMATION

Description of Landforms, Drainage Patterns, and Geologic Processes

Characteristic Landforms of the Coastal Zone

The Coastal Zone, sometimes referred to as the tidewater area, extends from the coast inland about ten miles and covers approximately 1.2 million acres. Elevations range from sea level to 25 feet and local topographic relief is usually less than five feet. The water height and salinity of streams in the area are influenced by the daily cycles of the tides and most stream valleys widen into estuaries before they reach the ocean. Coastal beaches are fairly wide and slope gently. Parallel ridges of sand adjoin the coast. Beaches are interrupted by many inlets, bays, and islands along with wide expanses of marshlands, particularly south of the Santee Delta.

The South Carolina Coastal Zone is usually divided into three distinct geographic regions based on different landforms produced by different geological processes. Each distinctive area can be easily identified on maps or on aerial photographs. The first area is a long, crescent shaped beach referred to as the Carolina Grand Strand or Myrtle Beach Grand Strand. The second area is primarily the Santee Delta, the largest cuspatte delta on the east coast. The third geographic area is composed of the Sea Islands and extends from the Santee Delta to the Georgia border. Some of these islands are referred to as barrier islands because they serve to protect the mainland from waves, tides, and hurricanes coming in from the Atlantic Ocean. Beaches of any kind protect inland areas by absorbing wave energy even though they may become eroded in the process. Formed through time by the steady transport of sand by water and wind, sand dunes serve as reservoirs of sand to replenish beaches during erosive events caused by storms.

South Carolina is fortunate to have an extensive 200-mile coastal area as one of its state boundaries. Including all of the bays, sounds, inlets, beaches, deltas, and marshes, the coastline is more than 3,000 miles long. Furthermore, the coast is within easy driving distance from all parts of the state. In comparing South Carolina with other states, only a few have the advantages of a coastal area, and none have one that is as diverse, intriguing, and delightful to explore as our Carolina coast.

Geographic Features of Special Interest

As mentioned before, the Santee Delta is the largest cuspatte delta on the east coast. Only the Mississippi Delta is larger in the eastern states. The Santee Coastal Reserve occupies some of the wildest, most diverse delta habitat in the nation. Waterfowl impoundments are of particular interest. Some parts are managed intensively, others are left entirely alone.

The Grand Strand area is known for its spectacular tourist beaches, such as Myrtle Beach, but it also contains some other unique points of interest. Brookgreen Gardens,
near Murrell's Inlet, is the preserved plantation site of Joshua John Ward, one of the original rice planters. Georgetown has a rice museum and offers tours of the old docks in the historic district.

Most of South Carolina's barrier and sea islands are also well known as resort areas. Sullivan's Island, The Isle of Palms, Folly Island, Hunting Island, and Hilton Head Island are all centers of tourism. Other islands, like Daufuskie Island, Capers Island, and Pinckney Island, have been preserved pretty much in their natural state. The port cities of Charleston, Georgetown, and Beaufort have a variety of historical sites which are open to the public.

**Carolina Grand Strand**

The crescent-shaped beach (sometimes called an arcuate strand) stretching from the North Carolina border to Winyah Bay at Georgetown is often called the Myrtle Beach Grand Strand or South Carolina Grand Strand. It is characterized by a 100,000 year old sand barrier formation which parallels the Waccamaw River. Only a few tidal inlets cut through this barrier, namely Murrell's Inlet, Pawleys Island Inlet, and North Inlet. The stable Grand Strand landform has greatly influenced the location and direction of the Waccamaw River, creating the historic Waccamaw Neck, a narrow strip of land between the ocean and the river.

**Santee Delta**

The Santee Delta is a triangular or fan shaped deposit of sediment at the mouth of the Santee River. It is the largest pointed or cuspatate delta on the east coast and is similar in shape to the Mississippi Delta in the Gulf of Mexico. The Santee River basin drains over 40% of South Carolina's land area and transports an incredible amount of sediment oceanward each year, contributing to the growth of the delta. Such deltas are also characterized by capes which jut out into the ocean and elongated spits (narrow peninsulas of sand) coming off the headlands. Behind the elongated sand spits is often located a series of marshes, which are very productive in terms of seafood and wildlife. In fact, the Santee Delta is considered to be one of the most magnificent waterfowl and bird rookeries on the east coast.

In 1942, a project, called the Santee Diversion Project, under the direction of the United States Corps of Engineers, diverted some of the water in the Santee River to the Cooper River by constructing a series of reservoirs connected by a canal. The project, consisting of Lake Marion, Lake Moultrie, and the Tailrace Canal, was intended to create hydroelectricity and provide a water transportation route to the port city of Charleston.

As a result of the Santee Diversion Project, much of the water from the Santee River flowed through Lake Moultrie into the Cooper River and on down to Charleston. With this increased water flow came an increase in sediment load in the Cooper River which resulted in the need for nearly continuous dredging in Charleston harbor. On the other hand, the decreased sediment load in the Santee River resulted in significant erosion of the Santee Delta because sedimentation could no longer keep pace with wave erosion rates. Recently, through the Re-diversion Project on Lake Moultrie, a large
channel now returns a significant amount of water into the Santee River channel, increasing the sediment load carried to the delta and partially reversing the recent loss of delta land.

Sea Islands

The Sea Island province, sometimes called the Barrier Island province, is characterized by islands and salt marshes. This area of the coast is made up of numerous inlets, bays, and islands. Two distinct island formations, differing widely in origin, use, and the effects of coastal processes, are found in this region: the remnant islands and the transgressive barrier islands. The remnant islands are thought to have been separated from the mainland by erosion. Coastal processes have had very little effect on the shape of these islands. Examples are St. Helena Island, Hilton Head Island, and Edisto Island. Sometimes referred to as beach ridge barrier islands, these islands contain interior wetlands and waterways, are several miles wide, and have mature maritime forests on the landward side.

The transgressive barrier islands slowly but continuously change shape because of winds, tides, wave action, storms, and currents. All transgressive barrier islands have very unstable coastlines. In most cases, the northern ends of the islands are eroding and the southern ends are experiencing deposition. Examples include Folly Island, Sullivans Island, Bull Island, and Hunting Island. Transgressive barrier islands can often be identified by their sparse vegetation, wash-over deposits from tides and storms, and frequently shifting offshore sandbar formations. The location and orientation of tidal inlets plays a major role in the erosion, deposition, and migration of barrier islands. People have attempted to influence the cycles of erosion and deposition by building jetties, sea walls, and groins.
Influence of Topography on Historical Events and Cultural Trends

Coastal Zone Attracts Settlers

South Carolina's coastline has an interesting cultural history because of its abundant coastal resources, natural harbors, and large river systems. Native Americans settled on the coast to take advantage of the plentiful fish, game, and shellfish. Later, Europeans landed on the coast and established settlements on several of the major rivers, which provided access into interior land areas. Rice plantations thrived on the natural tidal action in coastal fields and on the easy transportation of agricultural products. The port cities of Charleston, Georgetown, and Beaufort grew into major industrial and transportation centers. South Carolina's coast is again experiencing rapid cultural development with an emphasis this time on tourism and recreation.

Native American Coastal Cultures

The Carolina Coastal Zone was first occupied by people from several Native American Nations. The coast was well suited to their lifestyle because of the abundance of natural resources, ease of transportation, and the mild climate. Oyster shell mounds, called middens, found along the coast, are lasting evidence of their presence. In the 1700's, as many as twenty separate Native American Nations lived in the vicinity of the bays and sounds and along the coastal rivers. As a result, many coastal towns, rivers, and bays bear Native American place names, such as Winyah, Pee Dee, Waccamaw, and Sampit. Clashes with the European colonists, disease, and slavery all worked to displace or eliminate the native inhabitants within a two hundred year period.

Early Spanish Settlements

In mid-July 1526, Lucas Vasquenz de Ayllon, along with 500 Spanish colonists, including men, women, and children, a few slaves, and 89 horses, left Santo Domingo in six ships. They landed at the mouth of the Cape Fear River, North Carolina, which they called the River Jordan. From there the group traveled down the coast to settle at Winyah Bay. The exact location of the settlement, San Miguel de Gualdape, is unknown, but historical evidence points to the mouth of the Gualdape River, known today as the Pee Dee River, on the eastern shore of Winyah Bay. The settlers were threatened by disease, attacks from Native Americans, and a slave insurrection. Early in 1527, the colonists headed home for Spain with only 150 survivors. The revolt by the slaves at San Miguel de Gualdape was the first black slave revolt in North America. Apparently, most of the former slaves stayed behind, thus becoming settlers in the coastal area 144 years before the founding of Charles Towne (Charleston).

Establishment of Santa Elena

In 1521, Spanish explorer Francisco Gordillo had explored the area near present Beaufort, South Carolina, which he named Santa Elena because his ships reached land on the feast day of that saint. Pedro Menendez de Aviles, Captain-General in charge of protecting Spain's treasure fleets, obtained a contract from Philip II to establish settlements in "La Florida." He established the city of St. Augustine in 1565 and a fort on
Parris Island, South Carolina in 1566. The purpose of the Spanish settlement at Santa Elena was to protect the Spanish treasure ships which sailed up the coast of North America before picking up the prevailing westerly wind to carry them back across the Atlantic Ocean to Spain. Briefly, Santa Elena became the capital of Spanish La Florida. In 1576 the settlement at Santa Elena was destroyed in an attack by Native Americans, but the Spanish returned and rebuilt in 1577. When the English captain Sir Francis Drake burned St. Augustine, Florida, in 1586, the Spanish royal government realized that its colonial resources were stretched too thin for proper protection. Therefore, in 1587, the settlement at Santa Elena was abandoned—the same year that the first English attempts at settlement were being made on Roanoke Island, Virginia. However, the Spanish presence had briefly introduced not only a new culture, but also new diseases which would help to destroy many of the Native American Nations of South Carolina.

**Charles Towne: First British Settlement**

The English settlement of South Carolina began in 1670 when approximately 150 colonists, sent by the Lords Proprietors, settled on the west bank of the Ashley River. The settlement was named Charles Towne in honor of King Charles II of England. However, on December 17, 1679, the colony's Grand Council voted to move the settlement to Oyster Point, the site of present day Charleston. By 1700, a wall had been built around the entire town (because of expansion of the settlement, these walls were later removed). Several unexpected problems developed because of the wall. Ocean breezes could not penetrate the wall and so the town became extremely hot during the summer. The accumulation of sewerage and mosquitos caused the spread of diseases. A portion of the original wall can be seen today where it has been excavated in the basement of the Exchange Building. From this humble beginning, Charles Towne prospered and became the major port city in the colony of South Carolina.

**Eliza Lucas Pinckney Introduces Indigo**

Eliza Lucas Pinckney is given credit for successfully introducing the first major cash crop in the colony of South Carolina. Eliza Lucas was born in 1722 in the West Indies. With her family, she moved to a plantation her family had inherited on Wappoo Creek, near the Ashley River (about 17 miles from Charleston). Her father was a career military officer in the British army who had been recalled to duty. Since Eliza's mother was an invalid, Eliza took over management of the family's Carolina plantation.

Eliza experimented with various crops at Wappoo, attempting to find one which was commercially viable. Her father encouraged her to attempt to grow indigo and sent her some seeds. At the age of nineteen, she produced her first successful indigo crop in 1741. She then gave indigo seeds to other planters. By 1747, more than 100,000 pounds of indigo per year were being shipped from the colony. The British government encouraged its production by paying a bounty to planters for growing indigo. In 1744, Eliza married the prominent Charles Pinckney. The marriage produced two sons, Charles Cotesworth Pinckney and Thomas Pinckney, who each enjoyed a distinguished career in service to their country, and a daughter, Harriott Pinckney, who married into the famous Horry family.

President George Washington made a celebrated trip through South Carolina in 1791, riding four hours to arrive at Hampton Plantation, the home of Harriott Pinckney Horry. There Washington paid his respects to Eliza Lucas Pinckney. In 1793, Mrs.
Pinckney traveled to Philadelphia to receive medical treatment for cancer. She died in that city and President Washington served, at his own request, as a pallbearer at her funeral.

The expansion of indigo cultivation to the Port Royal Sound region led to the emergence of a plantation economy in the mid 1740’s. The leaves and stems of the indigo plant were processed to produce a dark blue dye. Indigo cultivation was also the source of blue pigment, skimmed from the indigo pots, used by Sea Island Blacks to paint their doors and window frames. Doing this was believed to prevent “hags” (witches) from entering. The Revolution ended the commercial growing of indigo due largely to the fact that the British government was no longer willing to pay Americans a bounty for its production, making it no longer profitable.

Figure 9-1: Map of Colonial Agriculture
Pirates: A Coastal Zone Legacy

The Pirate Era is another Coastal Zone legacy in South Carolina. Piracy along the Carolina coast began soon after the first settlements were established and grew along with the prosperity of the colonial seaports. By the 1700’s pirates were capturing British ships with a frequency that threatened English commerce. It has been estimated that in the early 18th century as many as 3,000 pirates operated out of the Bahamas alone. Charleston, as one of the busiest American ports, was plagued by some of the fiercest pirates in history. They used small, fast vessels to seize the larger, slower merchant ships. Then they would escape into the coastal shallow areas where heavy warships could not follow. The shallow creeks and inlets along the coast made ideal haunts for pirates. North Inlet and Murrells Inlet became favorite havens for pirates, for they could easily hide within range of abundant seafood and fresh water sources. Many tales have been told of pirates hiding treasures and never returning to claim their bounty. Many were killed in sea battles or captured and hanged in Charleston or other port cities.

Many stories about pirates have been handed down as part of South Carolina's history. Pirates came from all walks of life. Some were well-educated, while others were illiterate. Many were "ne're do wells" who just wanted to make a fast buck from their ships. They all hung gruesome flags that were designed to invoke fear. They also used aliases (false names) that were intimidating. Most were considered cruel and heartless, but one pirate did not fit the stereotype. He was a well-educated wealthy plantation owner from the Bahamas. He was given the nickname "Gentleman Pirate," as he bought his first ship and paid his crew wages instead of compensating them by sharing the booty. He was not a seaman, although he had served in the British Army. His name was Major Stede Bonnet, alias Captain Thomas. He is credited with the invention of "Walking the Plank" as a method of getting rid of his enemies. He raided the Carolina coastal areas for several years, but was finally hanged in Charleston while holding firmly to a flower bouquet given to him by a lady friend.

A famous woman pirate, Anne Bonny, called Charleston, South Carolina, her home. Born in Ireland, she had come with her father to the colony of South Carolina as a child. Her father was a lawyer who also became a successful merchant with a large plantation in the countryside. While growing into a young woman, Anne developed a reputation for being a spitfire. Against her father's wishes, she married a young sailor and went with him to Nassau. Once in Nassau, she abandoned her husband and took up with a colorful pirate captain known as Calico Jack Rackam. Joining the pirate's crew, she participated in the "sweet trade" (pirate slang for piracy) fighting alongside the male crew members. However, their luck ran out off the coast of Jamaica, and she and the crew were captured by a British royal sloop. Taken to Jamaica in chains, Anne was sentenced to be hanged. However, her father had influential business friends who managed to obtain a pardon for Anne. She returned to her father's South Carolina plantation and disappeared from the pages of history.

Of all the pirates that haunted the Carolina coasts, Captain Edward Teach, alias Blackbeard, was the most bloodthirsty and feared. With his forty cannon ship Queen Anne's Revenge, Blackbeard and his crew, called seahawks, preyed on coastal trade. On one raid, in June 1718, he captured a succession of nine ships and held a group of passengers hostage in exchange for medicine. In a message to South Carolina's Governor Robert Johnson, Blackbeard threatened to kill all of the passengers and raid Charleston if his demands were not met. Not surprisingly, his demands were met, and he sailed northward. Blackbeard was later killed by Virginia troops off the North Carolina coast. As a prize, his head was cut off and displayed, and his body was fed to sharks.
But because of the continued threat to coastal towns, Governor Johnson outfitted a strong naval force to pursue and apprehend the pirates. The golden era of piracy soon came to an end, but it remains an intriguing, and often romanticized, part of South Carolina's history.

Charleston Under Siege During the Civil War

At a meeting in Charleston on December 20, 1860, delegates from all over South Carolina voted to secede from the United States of America. Later, with six other states, they formed the Confederate States of America. As a result, South Carolina demanded the evacuation of all federal installations and forts in South Carolina, including Fort Sumter in the Charleston harbor. President Abraham Lincoln's decision to resupply the fort led Confederate officials to order a bombardment from Fort Johnson located on nearby James Island. After almost thirty-four hours of sustained artillery attack, Major Anderson was forced to surrender Fort Sumter to the Confederates. This battle constituted the first military action of the Civil War. Consequently, the Union government quickly moved to establish a blockade of Charleston's harbor and a siege of the city. In fact, the Union's siege of Charleston lasted 587 days, which was one of the longest sieges in the history of warfare.

The City of Charleston was physically and economically devastated by the war. Union artillery bombardment left the city in ruins below Calhoun Street. The news of Sherman's capture of Columbia panicked city residents and led to the evacuation of Charleston on the night of February 17-18, 1865. Union troops then occupied the city and engaged in widespread looting and destruction.

The Battle of Port Royal Sound

The Port Royal area played a significant, if now little known, role in the Civil War. Its capture was the first major Union victory of the war, providing the Union Navy with an excellent harbor which it used to supply and repair its fleet and maintain its blockade of the southern seacoast.

That specific course of action was recommended by President Lincoln's "Blockade Strategy Board" in an attempt to prevent the importation of supplies the Confederacy needed to wage war. On November 7, 1861, a Union fleet commanded by Commodore Samuel F. DuPont arrived off Port Royal Sound. Consisting of 15 warships and 36 troop transports, it was the largest fleet ever commanded by an American officer up until that time. The entrance to Port Royal Sound was guarded by only two dirt forts, one located on Hilton Head Island and the other on Bay Point Island. After a four-hour fight, the Confederate defenders abandoned both forts and withdrew. The fall of Port Royal led to the loss of one of the most strategically significant areas of South Carolina.

The Port Royal battle exemplified the Civil War's nickname of the "brothers' war." Brigadier General Thomas F. Drayton commanded the defending Confederate forces. His brother, Commander Percival Drayton, commanded one of the attacking Union warships.
Black Volunteers in Union Service on the Sea Islands

Because of the desperate need for troops in the Department of the South, the military district made up mainly of the captured Sea Islands, Union General David Hunter, in late 1861, organized a regiment composed of ex-slaves. However, because he had not received official authorization to do this, he was ordered to disband his "unofficial" black regiment. Later, in August, 1862, Union General Saxton finally was given such authority. Saxton chose Colonel Thomas Wentworth Higginson to command an all-black regiment, the First South Carolina Volunteers. This regiment later became the Thirty-Third United States Colored Troops and saw extensive duty on the Sea Islands. It was finally mustered out of service in February 1866 at Fort Wagner, on the site of the graves of Colonel Shaw and the men of the Fifty-Fourth Massachusetts Regiment, a Northern free black regiment that had participated in the attack on Fort Wagner on July 18, 1863.

The most famous black Union hero was Robert Smalls of Beaufort, South Carolina, the pilot and wheelman of the Planter, an armed transport boat used by the Confederates. Smalls, on the evening of May 12, 1862, commandeered the Planter with his family and some other slaves to the safety of the Union blockading fleet off Charleston's harbor. He later captained the Planter for the Union Navy. After the war, he entered politics and participated in the political convention that wrote a new state constitution in 1868. He also served in South Carolina's General Assembly and for several terms as a United States Congressman. His last public post was Collector of Customs for the port of Beaufort.

The following story by Dodie Marshall tells about the stealing of the steamship Planter and the resulting trial of its former captain. Marshall's story ends with the captain's being found guilty, but hers is not the real end of the story. While the captain and other officers of the Planter had been found guilty of violating a general order that required officers to remain on their ships at night, the Confederate commander of Charleston, Major General John C. Pemberton, remitted the sentences. He concluded that the general order had never been fully communicated to the officers in question. This story is an example of the revisionist history which occurs when a storyteller presents their own interpretation of what happened in a way which favors their particular bias. Dodie Marshall is the daughter-in-law of the granddaughter of the captain.

She was old and there were lots of statements that she made and stories that she told us over and over again. But there was one story that she told more often than all the others, about how her grandfather, the esteemed Captain Relyea, had his fabulous ship stolen from him during the Civil War by his trusted slave, Robert Smalls. That story recounted how Robert Smalls had tricked the sentry and traitorously turned her grandfather's ship over to the Yankee blockade just outside of the Charleston harbor and how he, the grandfather, had consequently been charged with dereliction of duty and court martialed by the Confederates, but had quite justly been found "innocent--innocent of all charges."

Years later I would read in many different publications all about the true life hero, Robert Smalls, visit his grave and see the monument of him in the town of Beaufort. I would learn that he did, indeed, achieve freedom from enslavement.
for himself and his family by seizing the steamer *Planter* and masterminding a
daring escape years before the Emancipation Proclamation and long before the
end of the Civil War. I would learn that he later rendered valuable service to state
and country in both the United States House of Representatives and the South
Carolina State Legislature and that he is celebrated as an inspiration to all South
Carolinians who love freedom and admire courage. But I never found anything
written about the trial of Captain Relyea, my mother-in-law’s much revered
grandfather. This seemed odd to me and I wondered about it.

It was several months after my mother-in-law died when my husband and I were
gathering her personal items to distribute to her grandchildren that we stumbled
upon the truth about Grandfather Relyea and of the steamboat *Planter*. Perhaps
you can imagine how surprised we were when we discovered a portfolio of papers
buried away deep inside a locked Samsonite suitcase on the top shelf of her
closet. Handwritten in brown ink, the sheaf of papers was thin, discolored and
deeply creased with age. Page corners were creased and powdery under our
finger tips. Rusted grommets remained partially lodged along the top edges of
each of the two long sheets from where they must have been held in a log book.
They were dated, July 25, 1862 and they reported that Captain C.J. Relyea,
Captain of the steamer *Planter*, had been arraigned and tried before a General
Court Martial convened in Charleston, S.C. on May 21, 1862. On this
uncomfortably hot summer day in 1988, the court-martial’s verdict we read was
written perfectly clear. The decision reported, on what appeared to be official
court documents, was that Captain C.J. Relyea had been found—Guilty—Guilty—
Guilty of disobedience of orders and guilty of dereliction of duty.

**The Future of the Coast**

Along most parts of the South Carolina coast, a certain amount of tension exists
between people who want to preserve the natural state of beaches and other natural
coastal features and those who desire to profit economically from those beaches or that
natural beauty. The crowding and clutter characteristic of many famous beaches is
balanced by the carefully managed development of resorts like Kiawah Island, nationally
famous for the successful effort to blend nature with human activities. Recent laws such
as the Coastal Zone Management Act have attempted to permit reasonable development
while considering the environmental implications of any construction which would
interfere with normal marine processes. Some areas, like the Myrtle Beach tourist
region, are growing so fast that they will soon have to make a decision whether to
maintain a small town family atmosphere, or become a much larger, more impersonal,
convention center. There are both benefits and drawbacks associated with each of these
choices.
Natural Resources, Land Use, and Environmental Concerns

Climate and Water Resources

The Coastal Zone is almost always cooler and more pleasant than neighboring areas even a few miles inland. The contrast between land and sea temperatures creates almost continual land or sea breezes, and causes many convection current based thunderstorms to develop during the hot summer months. During the cooler months, fog sometimes envelopes shoreline areas and helps to distribute moisture. Rainfall is abundant and temperatures usually moderate.

Although it would seem that the Coastal Zone has more than enough water, most of it is either salty or brackish. One of the major issues facing coastal South Carolina is how to acquire sufficient fresh water, for drinking and household use, to support the anticipated growth in both the resident population and in seasonal tourists. Coastal communities have traditionally handled this problem in one of two ways. Charleston, and a few other coastal cities, have constructed aqueduct systems to bring in large quantities of fresh water from upstate rivers and reservoirs, such as Lake Marion. The city also dug a tunnel to bring water eastward from the Edisto River.

However, most fresh water for coastal communities, especially in rural areas, comes from wells. Even Charleston, until 1883, got all of its city water from one public well. Although groundwater is plentiful, in many sections of the coast it is being used at a faster rate than can be replenished through natural geologic recharge. The result has been salt water incursion into many wells. Because fresh water is less dense, it forms a floating lens on top of the denser salt water. When wells are pumped too quickly, the freshwater lens thins to the point where salt water can enter the base of the well and contaminate the water supply.

Soil Resources of the Coastal Zone

The arable soils of the Coastal Zone, from three to twenty-five miles inland, are based on recent marine features. Since soils in this area are so young, little development, or formation of distinctive layers, has occurred. A number of unusual soil types have developed in this region, including Spososols, which are usually characteristic of the boreal forests of Canada and northern New England, and Sulfaquents, the sulfurous rotten-egg smelling soils of the salt marshes.

Although overall climate is favorable along the coast for agriculture, soils tend to be the limiting factor in determining what can be grown. Closest to the coast, unweathered minerals, which make poor soil, are often found in surface layers of the soil due to the very recent age of the coastal sediments. As one proceeds away from the coast, unweathered minerals are found at greater depth and the fertile soil thickness increases. North of Charleston along the coast, poor drainage limits suitability for agriculture, but pine forests do very well. South of Charleston are better drained loamy soils which have been used successfully for truck farming. About four percent of the Coastal Zone Region is considered prime farmland and approximately nine percent of the area is actually used for farming. Fifty percent of the area is in forest.
Issues Related to Growth and Development

The Coastal Zone Management Act (CZMA), at least in part, was passed by the State Legislature in 1976 in order to regulate and control development in the area of the coastal. The beaches and dunes of South Carolina's coast can only be protected with the aid of legislation, such as the CZMA, specifically designed for that purpose. The Act regulates what can be built along the coast, where it can be built, and what environmental engineering specifications must be met by builders. The operation and implementation of the Act has been controversial since the administrative apparatus was put into place in December 1977. However, the Act has prevented the type of excessive destruction that ravaged the Coastal Zone before the CZMA was enacted. Another law, the Coastal Barriers Resource Act, was passed in 1983. It removed previous subsidies and other incentives for commercial growth and set aside certain areas where further development was not permitted.

One of the most controversial issues facing Coastal Zone policy managers is the question of beach renourishment. Supporters stress the importance of wide, attractive beaches to the tourism industry and maintain that the cost will be recouped through increased revenue from vacationers and convention attendees. Detractors claim that beach renourishment is only a temporary solution and that in a few years, the procedure will have to be repeated at even greater expense. Recent renourishment initiatives have been completed at Myrtle Beach, Folly Beach, Hunting Island, Edisto Beach, and Seabrook Island.

The Folly Beach project was particularly controversial since geologic studies indicated that the island was eroding at the rate of almost five feet per year. The Folly Island shoreline has retreated over 800 feet since records were first kept. An 18 million dollar renourishment project, begun in October, 1991, put 2.5 million cubic yards of sand along 5.3 miles of beachfront near the center of the island. This amount of sand will widen the beach by 50-100 feet at high tide level and should last for at least ten years. The Federal Government paid 57 percent of project costs at Folly Beach, but any future renourishment projects will have to be paid from state, county, and local government sources.

Unique Habitats of the Coastal Zone

The Coastal Zone of South Carolina provides an endless variety of habitats and situations important to wildlife. Noteworthy areas indicative of Coastal Zone habitat diversity include: North Inlet Estuarine Reserve, Cape Romain National Wildlife Reserve, the ACE Basin Reserve, Santee Coastal Reserve, Hunting Island State Park, Yawkey Wildlife Center, and Bulls Island. Most of these sites include beaches, barrier islands, brackish and saltwater marshes, forested wetlands, and pine and hardwood upland areas. They also host a variety of wildlife resources including such threatened and endangered species as the bald eagle, woodstork, osprey, loggerhead sea turtle and the shortnose sturgeon. Publicly managed lands serve to maintain and enhance the present habitat diversity while improving recreational and educational opportunities for all citizens of the state. These unique resource components and critical habitats require continued intensive management and protection efforts if South Carolina's natural heritage is to be preserved.
**Fisheries and the Seafood Industry**

Part of the attraction of the coast to vacationers, convention planners, and other tourists is the availability of fresh seafood in markets and restaurants. Fishing is a multi-million dollar industry in South Carolina with shellfish accounting for about three quarters of that total. Not all coastal counties market the same products. Charleston and Georgetown are best known for fish, while Beaufort is the center of the crab and oyster industries. Charleston and Beaufort together supply about 80 percent of the state’s shrimp harvest. At one time six oyster canneries operated in the Sea Islands although only one, near Beaufort, is still operating today. Overharvesting, loss of marshland, and pollution problems have reduced some seafood production in recent years.

**The Intracoastal Waterway**

The Intracoastal Waterway is made up of a series of connected natural and constructed water passages along the Atlantic and Gulf coasts that provides a protected navigational route for all types of ships. It stretches nearly 3,000 miles from Boston, Massachusetts to Key West, Florida and westward to the Rio Grande River in Texas. Of this total, 210 miles are in South Carolina. Although there have been discussions and plans for developing a water passageway along the Atlantic seaboard since colonial times when George Washington surveyed the area, true enthusiasm for construction did not begin until the World War I era when the Army Corps of Engineers began designating certain navigable waters for military maneuvers. In 1936, the last section between Little River and Winyah Bay, in South Carolina, was completed. The river-like characteristic of the Intracoastal Waterway offers a tremendous advantage to commercial, recreational, and military vessels which no longer have to venture into the Atlantic Ocean where open water conditions are much more likely to be stormy and dangerous.

Today, with the exception of the segment between Charleston and Beaufort which is used weekly by the Marine Corps training facility on Parris Island, and routine Coast Guard patrols, the Intracoastal Waterway is seldom used for military purposes. About 95% of all boat traffic is recreational with the remainder being commercial. Nearly four million tons of cargo is shipped annually through portions of the Waterway. Scrap metal, fertilizers, paper products, construction equipment, and pipelines for dredging projects are examples of the types of materials that can be transported more economically by water than by train or truck. The Intracoastal Waterway also provides the fishing industry with easy access to shellfish resources. Oysters and clams are usually able to establish themselves in the Waterway in spite of periodic dredging. A bigger problem is the suspended sediment in the water caused by boat traffic as passing vessels stir up mud from propellers. This makes it more difficult for these siphon and filter feeders to obtain food and oxygen from the water.

The Army Corps of Engineers maintains a minimum depth of twelve feet (based on low tide level) and a minimum width of ninety feet for all sections of the Intracoastal Waterway. These conditions can be maintained only through routine dredging of sediments, which usually must be repeated every two or three years. The Port of Charleston requires annual dredging because of the continuous influx of sediment from river and tidal sources. Dredge spoil is deposited in designated areas which usually show up as small, low-profile islands parallel to the main channel.
Summary

The South Carolina Coastal Zone is divided into three distinct geographic areas based on different landforms produced by different geological processes. The Grand Strand area, where Myrtle Beach is located, can be characterized as a relatively uniform, gently curving beach extending without major interruption from the North Carolina border to Winyah Bay. Much of this area is highly developed with vacation homes and resorts, and beach erosion and rising sea levels are significant continuing concerns. South of the Grand Strand lies a large deposit of sediment known as the Santee Delta. This delta, formed by the Santee River, is a complex of marshland and islands stretching from South Island to Cape Romain. South of this point lies the Sea Island region, a string of islands and estuaries making up the majority of South Carolina's coast.

A distinction is made between the remnant islands and the transgressive barrier islands found in this region. Remnant islands are thought to have been formed by erosion of the mainland, and undergo very little additional change. Transgressive barrier islands, in contrast, are thought to be relatively mobile sediment deposits which are constantly being changed by wind, tidal action, storms, and currents.

The history of settlement in the Coastal Zone of South Carolina is long and varied. The natural bounty was especially important to the Native American peoples who inhabited the area until diseases introduced by European settlers and direct conflict with the newcomers caused the demise of the native population. There was, during the early colonial period, a competitive free-for-all by several nations to establish settlements and claim stretches of the Coastal Zone. In the area of Beaufort, for example, Spanish, French, and English colonies or forts were established, accounting for the multi-lingual place names of that region. But the British eventually solidified their claims in South Carolina, and the first permanent British colony was established in 1670 at Charles Towne. Indigo was the first successful cash crop of the Coastal Zone and by 1750 had shifted the economy of this area from trade to agriculture. Since the days of indigo production, rice, cotton, and other crops have supported the Coastal Zone economy.

However, peace and prosperity did not reign uncontested in the Coastal Zone. Pirates were a continuing problem off the coast of South Carolina, raiding merchant ships and holding hostages for ransom. Parts of the Coastal Zone were ravaged by British troops and loyalists during the Revolutionary War and, only 80 years later, by fighters on both sides of the Civil War. In the late 1800's, a new economy was required, both because labor for agriculture and industry would no longer be supplied by slaves and because increased mechanization was rendering labor-intensive practices obsolete. After weathering a long period of economic doldrums (with some exceptions like port activities) the Coastal Zone is once more reborn as a tourism and recreation mecca. Protecting the natural resources that attract the visitors to the Coastal Zone is, here as well as in other parts of the state, a problem of overwhelming importance and exceptional complexity.
PLACES TO VISIT

Huntington Beach State Park. On Highway 17 across from Brookgreen Gardens, Murrells Inlet, SC. For information call 803-237-4440.

St. Christopher Camp and Conference Center. Located on Sea Brook Island. For information call 803-768-0429.

Myrtle Beach State Park. Grand Strand SC. For information call 803-238-5325.

Edisto Beach State Park. 50 miles southeast of Charleston on SC 174 and 22 miles off of US 17 at 8377 State Cabin Road. For information call 803-869-2156.

Edisto Memorial Gardens. Orangeburg, SC. For information call 803-534-6376.


Pinckney Island National Wildlife Refuge. Located west of Hilton Head Island. For information call 912-944-4415.

Huntington Beach State Park. 3 miles south of Murrells Inlet on US 17. For information call 803-237-4440.


REFERENCES AND RESOURCES


Causey, Beth. South Carolina Legends. Out of print.


STUDY AREA 9: COASTAL ZONE OVERVIEW

Activity 9-1: Overview

**Materials**

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<thead>
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<tr>
<td>6</td>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
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<td>6</td>
<td>LAND USE/LAND COVER MAP</td>
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<td>COASTAL SATELLITE LITHOGRAPH</td>
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<td>ACE BASIN TOPOGRAPHIC MAP</td>
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<td>1</td>
<td>Map of Colonial Agriculture</td>
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**PERFORMANCE TASKS**

(Icon Key) Overview = ⭕; Science = ☑; Math = ☐; History = ☐; Language Arts = ☑

1. **Describe topography of Coastal Zone.** ⭕
   Using the STATE BASE MAP #1, SHADED RELIEF, trace with a wipe-off pen the boundaries of the Coastal Zone Region. Explain the criteria you used to separate the Coastal Zone from the Coastal Plain. Describe the typical landscape appearance of the Coastal Zone. Identify major bays, inlets, sounds, harbors, islands, and urban areas in the Coastal Zone Region of South Carolina. Do any rivers originate in the Coastal Zone? Explain your answer.

2. **Identify three shoreline types found in South Carolina.** ⭕
   Use the STATE BASE MAP #2, WITH HIGHWAYS, to identify the three types of shoreline which make up South Carolina's coast: the Grand Strand, Santee Delta, and Sea Islands. Itemize and discuss the similarities and differences among these three shoreline types. Using the scale bar, determine the distance in miles covered by each type of shoreline.

3. **Examine land use in Coastal Zone.** ⭕
   Trace the Coastal Zone boundaries onto the LAND USE/LAND COVER MAP. What land use is concentrated near rivers and harbors? What major land uses characterize the Grand Strand? The Santee Delta? The Sea Islands? Examine several sea islands. Do you notice any difference in land use on the seaward versus landward side of the islands? Explain possible reasons for such differences. Is there a difference in land use between the transgressive barrier islands and the remnant islands?

4. **Analyze the three shoreline types.** ☑ ☐
   Each group will use the COASTAL SATELLITE LITHOGRAPH, the BASE MAP #2, WITH HIGHWAYS, and a wipe-off pen to complete the following exercises. Prepare a group report on your shoreline category and present it to the rest of the class.

**Group I  Grand Strand Area**
Examine carefully the Grand Strand shoreline area of South Carolina. What is the general shape of the strand? List any other names given to the strand. Why was this called the "long beach" in George Washington's day? Name the three tidal inlets
found along the Grand Strand. How have geologic processes and the location of Grand Strand beach ridges affected the drainage pattern of the Waccamaw River? What are the other major rivers that drain into Winyah Bay? Are they affected the same way as the Waccamaw River? What percentage of the Grand Strand area is beach sand? What percentage is salt marsh or tidal flat? How can you distinguish those two environments on the lithograph?

**Group II Santee Delta**

Locate the Santee Delta at the mouth of the Santee River at Santee Point. Trace all the possible courses of the Santee River as it goes through the delta area. How many channels does the river use to empty into the ocean? Identify features that are characteristic of a typical delta, including elongated spits or narrow peninsulas of sand and capes which jut out into the ocean. How do you think these elongated spits formed? Do you think they are stable or susceptible to change? Compare the Santee Delta to the mouths of other South Carolina rivers. How high above sea level do you think the islands in the Santee Delta are? How would you describe the landscape between the North and South Santee Rivers? In which direction has most of the delta sediment been moved along the shore by longshore currents? What percentage of the Santee Delta is beach sand? What percentage is salt marsh or tidal flat? How can you distinguish these two environments on the lithograph?

**Group III Sea Islands**

Identify on the map the following transgressive barrier islands: Folly, Seabrook, Hunting, and Isle of Palms. All have been developed commercially. Identify the barrier islands that have remained virtually untouched, such as Bull and Capers. How might you account for the differences in developmental trends between these two groups of barrier islands? Other islands in this region have been formed by erosion from the mainland and are called remnant islands. Locate St. Helena, Hilton Head, and Edisto islands on the base map. How do the shapes and sizes of the remnant islands compare with the barrier islands? What percentage of each type of island is beach sand? What percentage is salt marsh or tidal flat? How can you distinguish these two environments on the lithograph?

5. **Trace Intracoastal Waterway route.**

Use a wipe-off pen to trace the path of the Intracoastal Waterway on the **STATE BASE MAP #1, SHADED RELIEF.** Start at the North Carolina State Line, near the town of Little River, and head southward toward Savannah, paralleling the coast. This is part of the regional transportation system used for maritime travel along the eastern seaboard. Use the scale bar to determine the approximate length of the Intracoastal Waterway in South Carolina. Use your information from the shaded relief base map to trace the Intracoastal Waterway with a wipe-off pen, on the **COASTAL SATELLITE LITHOGRAPH.** Which parts of the Waterway are hardest to trace? Why? What types of watercraft might use this system? What types of commodities might be shipped by water? Why not by truck? Why do you think the waterway was built in the Coastal Zone, and not further inland? Do you think any portion of the waterway is man-made? If so, where? How can you tell? Why do you think ships need an inland route instead of using the open ocean? Refer to the Background Information on page 9-14.
6. **Compare and contrast major South Carolina port cities.**

   Locate, on the **STATE BASE MAP #2, WITH HIGHWAYS**, the three major South Carolina port cities. Select one of these ports and trace, with a wipe-off pen, the surrounding rivers, inlets, bays, sounds, and/or estuaries. Explain the different characteristics of each of these features. Identify the names of all the natural features that you traced.

   - **Group I** Port Royal (Beaufort)
   - **Group II** Charleston
   - **Group III** Georgetown

   After you have completed this assignment, compare your results with teams that have completed tracings of the other two ports. As a class, construct a Venn diagram, which separates characteristics shared by all three ports from characteristics common to one or two ports. Why do you think a major port city did not develop at the mouth of the Santee River?

7. **Locate de Ayllon's settlement and trace his travel route.**

   Although the exact location is not known, de Ayllon is believed to have established the first European settlement in the United States at the mouth of the Pee Dee River (known then as the Gualdape River) along the eastern shore of Winyah Bay. Locate the approximate site for this settlement on the **STATE BASE MAP #2, WITH HIGHWAYS**. Which modern city is located nearest to this area? On de Ayllon's trip from the Cape Fear River, North Carolina, he followed the coastline southward to Winyah Bay and then sailed up the Waccamaw River. Indicate on the map the route that de Ayllon traveled after leaving North Carolina's Cape Fear River. What compass direction best describes his heading? In what compass direction did travel after he reached Winyah Bay? Why do you think he traveled up Winyah Bay before stopping? What attraction might Winyah Bay have had that convinced de Ayllon to establish his settlement in this area? List the geographic features that made Winyah Bay a good location.

8. **Identify places named for English proprietors.**

   Many of the places in the Low Country are named for the Eight Lords Proprietors, who were given the original land grants in South Carolina by King Charles II of England. Locate and mark, on the **STATE BASE MAP #2, WITH HIGHWAYS**, as many places as you can that bear the names of these English founders of the Carolina Colony.

   | Edward Hyde, Earl of Clarendon | Lord John Berkeley |
   | George Monck, Duke of Albemarle | Sir George Carteret |
   | Sir John Colleton, Baronet | William, Earl of Craven |
   | Lord Anthony Ashley Cooper | Sir William Berkeley |

9. **Evaluate offensive and defensive strategies for pirates and colonists.**

   Divide into teams that will be either Pirates or Colonists. Using the **ACE BASIN TOPOGRAPHIC MAP**, the Pirates must develop and write a plan for raiding ships and cutting off trade to Port Royal Sound. The Colonists must develop and write a plan for protecting their shipping from pirates. Share your results by comparing the strengths and weaknesses of each plan. As a class, evaluate the effectiveness of each plan and vote to determine who would have been victorious, the Pirates or the Colonists. Each group could develop a short skit about either Pirates or Colonists to
present to the class. Use the STATE BASE MAP #1, SHADED RELIEF, to illustrate escape routes and hiding places that pirates might have used along the coast.

10. **Design and draw a treasure map.**
Divide into groups representing pirate bands. After a successful raid on a British merchant ship in Port Royal Sound, you must hide the treasure chest quickly before you are discovered by naval patrols. You must pick a safe spot to bury the treasure and design a treasure map with enough detail that one of your crew can find the treasure if you are unable to return to the area.

Use the ACE BASIN TOPOGRAPHIC MAP and your map reading skills to locate a secret hiding place, and leave directions for finding it again, by writing down distances, place names, descriptions of the terrain, or coordinate points. Remember that pirates generally did not want just anyone to be able to use their treasure maps to find their hidden treasure; draw your map in such a way that only your own group members will be able to use it. (For example, if your treasure is buried near Frogmore, you could draw several small frogs.) When you have completed your map, exchange maps with another group and see if you can follow their directions to find their treasure.

11. **Contrast Native American shell mounds with modern landfills.**
It was part of the Native American culture to make mounds, called middens, of discarded oyster shells along various bays and inlets. Contrast their method of disposing of oyster shell garbage by making mounds to solid waste disposal methods used today. How are these methods the same? How are they different? How do you think oyster shells are disposed of today? How might oyster shells be used?

12. **Identify counties where indigo was planted.**
Indigo became an important crop in the Coastal Zone during the colonial period. Using Figure 9-1, “Map of Colonial Agriculture,” indicate with a wipe-off pen on the STATE BASE MAP # 1, SHADED RELIEF, the counties where indigo was planted. Look at the LAND USE/LAND COVER MAP. What is the major land use in each of these regions today? Why do you think indigo is no longer planted there?

13. **Explain the military importance of the Sea Islands.**
The Sea Islands played an important part in the Union Military strategy during the Civil War. Using wipe-off pens and the STATE BASE MAP #1, SHADED RELIEF, identify the Sea Islands located near South Carolina’s major port cities. Why do you think these islands had a military importance. Why did the Union want to control seaports in South Carolina? Do you think these islands were still major strategic positions in later wars such as the Spanish American War, World War I, World War II, the Korean War, the Vietnam War, or the Gulf War? Why or why not?
14. **Contrast modern drug trafficking with colonial piracy.**

Use a Venn diagram to compare and contrast various characteristics of piracy in the 18th Century versus drug trafficking today. Focus on human characteristics and personalities as well as strategic and geographic descriptions. Include comments related to public opinion. Locate several sites on the **STATE BASE MAP #2, WITH HIGHWAYS**, which might be selected as drop-off points by drug traffickers. Explain your choices.

15. **Write letter describing view of the Battle of Port Royal Sound.**

Experiment with creating historical fiction by analyzing different points of view during the Civil War. In order to understand the conflict of feelings, select one of the following people; write a letter explaining and defending his or her point of view after witnessing the battle of Port Royal Sound.

a) A Confederate soldier defending Port Royal Sound,

b) A Union sailor aboard one of the attacking ships, or

c) A slave having observed the battle, from a distance, including the retreat of the Confederate soldiers and the exodus of planters from the region.
ENRICHMENT

1. **Investigate Coastal Zone Management Acts.**
   Explore recent legislation such as the 1977 Coastal Zone Management Act, the Barrier Island Act, and the 1988 Beach Front Management Act. What is the intent of the legislation and how will it affect coastal development? What have been some of the initiatives people have taken to alter the natural processes of coastal erosion and deposition? Explain the effect of jetties, sea walls, and beach renourishment. What is meant by the "dead zone"?

2. **Identify goods exported and imported through ports.**
   South Carolina is fortunate to have a coastline with many bays and harbors. How have such natural landform features stimulated the development of port cities? What goods are exported and imported to South Carolina? What natural resources within the state have contributed to this thriving shipping economy? Identify spin-off economic business and industries that have benefited from the shipping industry. A large paper mill and a large steel mill are located along Winyah Bay. For each of these industries, list the raw materials needed for production, the reasons each needs accessibility to shipping, and other economic factors that have contributed to the prosperity of the area. What are the environmental issues facing the Winyah Bay area? How can a balance between economic values and environmental concerns be achieved?

3. **Create illustrated timeline for Robert Smalls.**
   Research the story of Robert Smalls, who became a hero both during the Civil War and following the war during Reconstruction. Use a variety of sources so that various perspectives are considered. Find out how ships like the *Planter* figured in the defense of strategically important ports like Charleston. Prepare to discuss the significant ways you believe the story, "Robert Smalls and the Steamer" starting on page 9-10, would be different if it had been told by a descendant of Robert Smalls instead of by a descendent of Captain Relyea. Explain how this illustrates revisionist history. Using a map of the Charleston harbor, research the route of Robert Smalls as he made his historic escape from the Charleston harbor and mark this route on a map of the harbor. Create an illustrated timeline for Robert Smalls including all major events of his life.

4. **Research indigo and dye making.**
   Research the process of making indigo dye. Illustrate the steps in producing and processing indigo. Present your findings to the class in the form of a poster. Is indigo still used as a dye? If so, where is it grown today? Create an illustrated timeline of Eliza Lucas Pinckney's life. Why were her interests and activities unusual for Colonial times?

5. **Research impact of the greenhouse effect.**
   Research the impact of the greenhouse effect on global sea level rise and predict how such changes would effect the three major categories of shoreline along South Carolina's coast.
Long Lost Confederate Sub Found off Charleston

Staff Report

On a February night in 1864, nine Confederate sailors climbed into the submarine CSS Hunley and steered toward a picket line of Union ships blockading Charleston Harbor.

The sub, powered by a propeller turned by a hand crank, rammed 100 pounds of black powder on the end of a wooden spar into the stern of the Union frigate USS Housatonic. A thunderous explosion broke the night and the modern age of submarine warfare dawned.

The Housatonic went down, the first warship in history sunk by a submarine. But the Hunley and its crew never returned, and for more than 130 years, researchers and relic hunters scoured the silty depths off Charleston.

The quest ended when researchers announced they had found the encrusted iron shell of the Hunley in about 20 feet of water a couple of miles offshore. "This is without a doubt the greatest underwater find since the Monitor was located" (in 1973 off the North Carolina coast), said Clive Cussler, a best-selling author who devoted 15 years and $130,000 to the search.

Divers found the submarine, about 40 feet long and 6 feet around, intact, lying on its side and covered in silt. Cussler said the exact location would not be released to the public for fear of souvenir hunters.

Mark Newell, at the University of South Carolina, said, "This is the single most important artifact in the history of submarine warfare. We have nine gallant men in that vessel."

Cussler hopes the state and city will raise and preserve the vessel, which he said would cost about $200,000.

The Hunley apparently did not get blown up in the explosion that sank the Housatonic as some have theorized. Cussler and Newell said that when the sub sank, it was some distance from the Housatonic.

Newell said there were reports from Union sailors that the Hunley signaled Confederate shore batteries on its way back. The submarine was not submerged but was riding with its top just above the water.

Cussler said the explosion might have popped some rivets and the Hunley began leaking, becoming a water-filled coffin. "Perhaps we'll never know," he said.

Rationale

The Charleston Study Site highlights South Carolina's most historic port city. For the greater part of the state's history, politics, commerce, and cultural activity have all revolved around this well known metropolitan hub. Charleston has both prospered and suffered in her role as the Queen City, and later the Holy City. Seven great fires, seven great hurricanes, an earthquake, two occupying armies, and countless boom/bust economic cycles have affected the city since its founding in 1680. Charleston (Charles Towne until 1782) served as the first capital of South Carolina and has always been its primary seaport. It presents an excellent example of the tension that exists between progress, defined as development and industry, and the more picturesque qualities that attract tourists.

The conflict is most visible between people who want to preserve the special atmosphere created by the historical areas and those who desire to profit from that historical quality by building restaurants, hotels and other special attractions.
Land Reclamation

The peninsula upon which Charleston was established was originally a low-lying area with a twisting shoreline broken by many creeks and marshes. In its natural state, the peninsula was divided into a number of smaller peninsulas by tidal creeks that penetrated the area. For instance Water Street was, as its name implies, an actual creek until after the Revolutionary War, and the north end of State Street was still planted in rice as late as the middle of the eighteenth century.

However, as Charleston continued to grow, and demands for space increased, many of the city's numerous marshes and creeks were filled in. Debris generated by the city's local industries as well as wreckage from numerous fires and storms provided a variety of materials for landfill. Large sections of the modern city occupy land built up through a succession of these reclamation projects. For example, as early as 1717, the city filled in the moat that had been in front of part of the old city wall. Land where the City Market now stands was filled in during the early 1800's. Additional land reclamation operations have expanded the shorelines along both the Ashley and Cooper rivers.

Figure 9A-1: Early Map of Charleston, 1680

* Note: The double lines indicate the boundaries of the old city walls.
Market Vultures and the Plantation Era

One unique feature of the City Market was the presence of flocks of buzzards called turkey vultures. These big ugly birds freely roamed the market, eating garbage and keeping walkways clean. They were so highly valued as scavengers that a fine of ten dollars was the penalty for harming them.

Charleston in the American Revolution

During the American Revolution, Charles Towne was the focal point of many significant events. On June 28, 1776, Colonel William Moultrie's colonial troops successfully defended a fort constructed only of Palmetto logs and prevented an invading British fleet from capturing the city. This victory preserved the important trade link with other colonies through which vital war materials entered South Carolina. But British forces again besieged the city and forced American General Benjamin Lincoln to surrender on May 12, 1780. Lincoln's entire army of approximately 5000 troops surrendered, making it the worst defeat for the Patriots in the entire Revolutionary War. Near the end of the war, in December of 1782, the British finally evacuated the city for good. The next year Charles Towne became incorporated and officially changed its name to Charleston.

Charleston's Unique Architecture: The "Single House"

Charleston contains several examples of unique architecture. One example, the so-called Single House, reflects a West Indies influence. These rectangular houses were constructed close to the street, with their narrow gable end facing the street. They were constructed just one room wide in order to allow any breeze which might be present to blow through the entire length of the house. Another reason residents built this style of house was that local property taxes were based on the amount of street frontage. The main entrance was actually on the side of these houses, while a street door opened into a piazza (long porch). These piazzas were usually placed on the south or west sides of the houses to catch the prevailing sea breezes. Later on, houses were built larger and often contained two-story piazzas.

The Battery

At the tip of the Charleston peninsula, where the Ashley and Cooper rivers converge, there was originally a shell beach known as Oyster Point. Eventually, this area became enclosed by the construction of two sea walls and was referred to as the White Point Gardens. The east sea wall was built of ballast rocks carried by trading ships. Ballast rocks were used to weight down the sailing vessels to increase their stability on the high seas. White Point Gardens achieved special notoriety when the infamous pirate Stede Bonnet was executed there. This area acquired the name "the Battery" when cannons were placed there during the War of 1812. During the Civil War, cannons were again placed along the sea wall, and today a collection of artillery from various periods is permanently displayed in the Park.
Free Persons of Color

Contrary to popular belief, not all blacks were slaves in antebellum South Carolina. For many years, there existed a class of free blacks referred to as "free persons of color." It should be noted, however, that these free blacks did not have full civil rights. Charleston had by far the largest community of free blacks in South Carolina. They earned their living in a number of different occupations, including carpenters and coopers (barrel makers). Jehu Jones, one of the best known of these free blacks, ran a very successful hotel in Charleston for many years.

Earthquakes

Although Charleston has experienced numerous fires, floods, and hurricanes throughout its long history, its greatest natural disaster was a single earthquake. On the evening of August 31, 1886, the greatest earthquake ever to be recorded in the eastern part of the United States struck just north of the city. It killed sixty people and caused six million dollars in damages. Clara Barton, who later founded the American Red Cross, assisted in relief efforts. Too poor to replace many of the damaged buildings, Charlestonians repaired many by running long tie rods all the way through the buildings, actually bolting the damaged walls together again. These tie rods are still visible on the exterior walls of a number of historic buildings in the old section of Charleston today.

Harbor Dredging and Spoil Areas

Natural harbors like Charleston are very important to the economy of South Carolina. But as larger and larger ships began to enter Charleston, it became more and more difficult to reach the docks without running aground on sand bars or scraping the bottom in shallow water areas. The United States Army Corps of Engineers was given the task of keeping shipping channels open, in Charleston and other coastal cities, by dredging sediment from the designated shipping channels and dumping it on the shoreline. The dredging must be repeated at regular intervals because sediment from the Ashley and Cooper Rivers tends to accumulate in these channels. Most of the channels in Charleston Harbor are kept clear to a depth of 35 feet. Channels in the Ashley River and the Intra-coastal Waterway seldom exceed a depth of 20 feet. The dumped material is referred to as 'spoil'. Drum Island, just east of the city in the middle of the Cooper River, is a prime example of a spoil area still in use.

Charleston Navy Base

Because of dissatisfaction with its Port Royal Naval Station, the United States Navy relocated its main Navy Yard to Charleston in 1901. This relocation provided a major boost to the economy of Charleston, which had still not fully recovered from the effects of the Civil War. In 1916, the naval base became the headquarters of the entire Sixth Naval District. During World War I, the Charleston Navy Yard's facilities were expanded even further, and the shipyard's first warships were completed.
World War II brought many changes and additional expansions, such as South Yard and the Naval Air Station. As a result, the United States Navy became the state's largest employer. From 1939 to 1945, the Navy Yard constructed a total of 216 vessels and repaired hundreds of other ships. With the end of World War II and the emergence of the Cold War, the Naval Shipyard became the East Coast Submarine Overhaul Complex. In the 1960's, the shipyard serviced and modernized nuclear submarines. With the addition of the Navy Hospital in 1970, Charleston became the home of the nation's third largest naval base.

However, with the end of the Cold War and the downsizing of the United States Navy, activities at the Charleston base were cut back. Finally, in 1993, the United States Base Closure and Realignment Commission recommended the closure of most of the naval facilities at Charleston. Despite strong objections from South Carolina's elected officials, President Clinton accepted the Commission's recommendations. Undoubtedly, the closing of the naval facilities at Charleston will have a long-term impact on both the local and state economy. In 1995, the United States Defense Department made the announcement that a United States Navy Submarine Training Station would be located at the Charleston Naval Facility.

**Charleston Today**

Heritage and tradition have always been important to the people of Charleston. Even though the city endured a long period of economic stagnation from the Civil War until World War II, the people were unwilling to sacrifice their distinctive architectural, cultural, and historic traditions for the promise of a quick profit. When progress threatened this heritage in the 1920's, the city became the first in the country to pass legislation concerning the preservation of its historic buildings. In 1920, Charleston's Society for Historic Preservation was born. It not only inspired other preservationist groups around the country to adopt similar laws and ordinances, but it laid the groundwork for the substantial tourism that is so profitable for Charleston today. Although formerly known as the "Queen City," Charleston today is better known as the "Holy City" because of its great number of churches. Since World War II, Charleston has made a remarkable comeback as a seaport, in addition to its continuing role as a home for numerous military installations.
Activity 9A-1: The Historic District

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| 6 Early Map of Charleston, 1680 |
| Brief Site Description |

| 6 Transparent Grid Overlays |
| 6 Wipe-off Pens |

PERFORMANCE TASKS
(Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts = 

1. **Locate the study site.**  
   Locate the Charleston Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain does this site drain?

2. **Identify famous landmarks and natural features**  
   Identify the following famous landmarks on the CHARLESTON TOPOGRAPHIC MAP or the CHARLESTON LITHOGRAPH. Locate the US Custom House, Market Street, The Battery (White Point Gardens), the Yacht Club, the docks with three cargo ships (one empty and two loaded), the Medical College of SC, The Citadel, The College of Charleston, Charles Towne Landing (Old Town), the spoil area on Drum Island, and the wastewater treatment plant at Plum Island at the west end of Charleston Harbor. Locate and name several rivers and their tributaries. In what direction is each of these rivers flowing? Compare the sediment load of these bodies of water by the differences in the intensity of their blue color on the lithograph. What and where is the highest point above sea level in Charleston? During high tide cycles, sea level is much higher than normal. Speculate as to what might happen to Charleston during times of extreme high tides, especially when these coincide with episodes of heavy rainfall. Identify the ribbon of major highways entering Charleston. Traveling from your school, what highways would you use to enter downtown Charleston?

3. **Analyze changes through time.** 
   On the CHARLESTON TOPOGRAPHIC MAP notice the features shown in purple. These represent new developments or other changes which have occurred between 1958 when the topographic map was first printed and 1983 when the photorevised version was printed. Identify major new features not present on the original map. What section of the map area has experienced the most change? How many of
these changes are manmade? How many have occurred naturally? Why do you think these changes have occurred? How many of these changes can you recognize on the CHARLESTON LITHOGRAPH? In what year was the aerial photograph taken? Circle and explain any additional changes which occurred between the time the map was revised and the time the photograph was taken. Does the difference in scale make it easier to recognize changes on the lithograph or the map? Explain. Take special note of the James Island Connector Expressway, under construction between the City of Charleston and James Island, visible only on the lithograph. Compare the topographic map with the lithograph and document all changes which had to take place along the route to make this highway possible.

4. **Trace boundaries of original walled city of Charleston.**

   Use Figure 9A-1: *Early Map of Charleston, 1680*, on page 9A-2, as a reference to trace with a wipe-off pen on the CHARLESTON TOPOGRAPHIC MAP the approximate location of Charleston's early city wall. Start at East Bay Street and Cumberland (not marked on the Charleston topographic maps). This intersection is located between BM 11 (Benchmark 11) and the letter "C" in the word "Customhouse." East Bay Street served as the eastern boundary of the wall running north-south. Extend the wall south on East Bay Street to Water Street. Even though it is not marked on the map, it can be identified as the street just south of the Yacht Club running northwest. Trace Water Street two blocks to Meeting Street. The wall followed Meeting Street north to Cumberland Street forming the western boundary. Cumberland Street forms the northern boundary. It can be identified as the street just past the area marked by four crosses, the symbol for churches. The intersection of Cumberland and East Bay Streets completes the area enclosed by the wall. As closely as you can, transfer these boundaries of the old Charles Towne city wall onto the CHARLESTON LITHOGRAPH. Use the transparent grid overlay to determine the area enclosed by the Charles Towne wall. How many feet of wall did they have to build to completely enclose the town?

   Why would the people living in Charles Towne feel the need for a wall, when other colonial cities did not have one? What geographic features might have influenced the decision to build a wall around the original colonial town? What new problems did the wall create for the early colonists? How would tearing down the wall solve these problems? All things considered, would you consider the building of the Charles Towne wall a success or failure? Explain.

5. **Compare modern Charleston boundaries with original peninsula.**

   Use Figure 9A-1 "Early Map of Charleston, 1680", for reference as you trace, with a wipe-off pen, the approximate boundaries of the original Charleston peninsula onto the CHARLESTON TOPOGRAPHIC MAP. Transfer this information to the CHARLESTON LITHOGRAPH. By comparing these two maps, identify and list at least ten landmarks on the charleston topographic map where land alterations have made it possible to build these structures. How have such landfill projects dramatically changed land use, landscape, and the geography of the peninsula? How do you think these areas were filled? What materials might have been used? Can you identify any reclamation projects taking place in Charleston today? If so, list them.
6. **Analyze the newspaper article.**

Read the newspaper article found in the Brief Site Description for Study Site 9A, "Long Lost Confederate Sub Found off Charleston." Explain how the story relates to the Coastal Zone Landform Region. Identify on the CHARLESTON TOPOGRAPHIC MAP and the CHARLESTON LITHOGRAPH where the places and events named in the story might be located. Explain why the publisher thought this story might be of interest to newspaper readers. Using the same references and location as your setting, write another newspaper article related to the same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

7. **Determine navigational bearings in harbor.**

Some topographic maps include bathymetric data (contour lines which indicate variations in water depth). Using the CHARLESTON TOPOGRAPHIC MAP, which does have bathymetric information, divide into groups and write out a set of directions for navigating through your assigned channel. Be sure to refer to compass direction and straight line distances relative to your ship when listing bearings. Identify all channels, creeks, and other landmarks you will have to pass through or by to get to your destination. Chart your course with a wipe-off pen on the map. Then exchange your set of navigational directions with a set from another group and try to plot their navigational route based on their list of bearings and other directions. How deep do you think the channel would have to be to get you to your destination safely?

**Group I** You are the captain of a submarine entering Charleston Harbor from the Atlantic Ocean headed to the United States Naval Reservation dry-dock area up the Cooper River.

**Group II** You are the leader of a group of early settlers who have gotten lost in Charleston Harbor off of White Point, now known as The Battery. You need to plot a course back up the Ashley River to Old Town, by Oldtown Creek.

**Group III** You are the captain of a British merchant ship bringing supplies across the Atlantic Ocean to Charleston to support the Confederate cause during the Civil War. You must plot a course up the Cooper River to the docks on East Bay Street.

8. **Determine distance cannonball traveled to Fort Sumter.**

The first shots of the American Civil War were fired from Fort Johnson on James Island to Fort Sumter, the Union outpost. Using the scale bar on the CHARLESTON TOPOGRAPHIC MAP, find the distance that the cannon balls traveled from James Island to Fort Sumter, which is just partly visible at the bottom right corner of the map - look for the word "FORT." Find the distance in both feet and meters.

9. **Evaluate actual cost of earthquake damage.**

Mark on the CHARLESTON LITHOGRAPH, with a wipe-off pen, your best estimate of the city limits of Charleston in 1886. What information did you use to determine the size of the city at that time? The great Charleston Earthquake of 1886 caused a total of 6 million dollars in damages. Since 1886, inflation has increased dramatically and caused the value of the dollar to decline. Assume that $1 in 1886 was worth $100 today. Using this information to set up a ratio, calculate the cost of the 1886 earthquake in terms of current dollars. Assuming that Charleston in 1886 was 50%
as big as today, calculate the total dollar value of the damage expected if another earthquake of similar magnitude were to strike the city. Justify your numbers. Are there any ways you could think of to lessen the damage in the city?

10. **Recreate an interview with hotel owner Jehu Jones.**
   As a “free person of color” residing in Charleston in the early 1800’s, hotel owner Jehu Jones led a unique lifestyle. Locate on the **CHARLESTON TOPOGRAPHIC MAP** where you think Mr. Jones’ hotel might have been. Explain why you selected that particular location. Pretend you are a Charleston newspaper reporter interviewing this successful businessman. In your group, come up with five questions you would like to ask Mr. Jones. Exchange lists with another group and try to answer their five questions from Mr. Jones’ perspective. Conduct a class discussion about which group responses are most authentic and why. Publish the best questions and answers in your school newspaper as an example of historical fiction.

11. **Locate physical features with specific geometric shapes.**
   On the **CHARLESTON LITHOGRAPH** and **CHARLESTON TOPOGRAPHIC MAP**, locate places or features with the following geometric outlines, patterns, or shapes. As you find these shapes, outline them with a wipe-off pen on both the lithograph and the topographic map. Are there any features which are shaped differently on the map than on the lithograph? Explain any examples you find.

   - Triangle
   - Circle
   - Rhombus
   - Perpendicular segments
   - Right triangle
   - Ellipse
   - Trapezoid
   - Parallel segments
   - Obtuse angle
   - Square
   - Pentagon
   - Cloverleaf
   - Acute angle
   - Rectangle
   - Octagon
   - Parallelogram

12. **Measure size of Charleston rivers and Intracoastal Waterway.**
   Divide into groups to determine the size for three Charleston rivers, the Ashley, Cooper, and Wando. Take at least five measurements of your assigned dimension, at five different locations on each river, and calculate the average value for each river. Report back to the class which river is greatest in dimension, which is least, and which is in the middle.

   - **Group I** Length - use **STATE BASE MAP #1, SHADED RELIEF**
   - **Group II** Width - use **CHARLESTON TOPOGRAPHIC MAP**
   - **Group III** Depth - use **CHARLESTON TOPOGRAPHIC MAP**

   Use a wipe-off pen to mark the course of the Intracoastal Waterway on the **CHARLESTON TOPOGRAPHIC MAP**. Which rivers does it use for part of its channel? Where is the Intracoastal Waterway the shallowest? How deep is it there? Where is it the narrowest? How wide is it there? What do you think is the maximum length and width of a ship that would be able to use the Intracoastal Waterway? Explain and justify your answer.
13. **Select suitable location for a commuter bridge to Daniel Island.**

   Developers are planning to build a subdivision on Daniel Island, visible on the northeastern section of the CHARLESTON TOPOGRAPHIC MAP. You have been asked to determine the best location for a new bridge between the Charleston peninsula and Daniel Island to serve the new residents. Outline your plans on the topographic map with a wipe-off pen. Check your route into the city on the CHARLESTON LITHOGRAPH. Consider all necessary information. Be sure to connect your new bridge to existing streets in Charleston. What buildings, if any, would need to be removed or relocated? Be prepared to defend your choice of sites for this new bridge. Compare your selection with the selections of other groups and debate the pros and cons of each plan.

14. **Estimate roof damage to Charleston.**

   In 1989, Hurricane Hugo swept through the city of Charleston causing roof damage to about 80% of all buildings. Use the CHARLESTON LITHOGRAPH to estimate the total number of buildings in Charleston that had to be reroofed after Hurricane Hugo. Limit your estimate to the buildings located south of Interstate Hwy. 26 and US Hwy. 17 all the way to the Battery. Use the transparent grid overlay to determine the number of buildings per square grid inch. Then set up a proportion to estimate the total number of buildings in the designated area. Compare your answer with answers of other groups. Why does each group get slightly different answers? Can they all be correct?

15. **Plan an evacuation route for an approaching hurricane.**

   Charleston's location makes it prone to hurricane damage. Pretend you are a member of a municipal planning commission. Use the STATE BASE MAP #2, WITH HIGHWAYS, to plan a set of evacuation routes for all the people living in the Charleston metropolitan area. Where will you send them? How far away from the city will they have to go? What facilities will you have to prepare for them? When will you let them return to their homes? Compare your routes with the routes of other groups. How many different routes are really needed? Can you have too many evacuation routes? Explain.
ENRICHMENT

1. **Investigate relationship between English Lords Proprietors and the King.**
   Using a South Carolina history textbook or other library resources, find out how each of these men became friends of King Charles. Why did he owe them favors?

   - Sir William Berkeley
   - Sir John Colleton, Baronet
   - Sir George Carteret
   - Sir George Monck, Duke of Albemarle
   - Lord Anthony Ashley Cooper
   - William, Earl of Craven
   - Edward Hyde, Earl of Clarendon
   - Lord John Berkeley

2. **Research and report on Charleston Single House.**
   Research the Charleston Single House by obtaining a floor plan. Identify the piazza (long porch), front door, garden area, and gable end. Note the orientation of the house to take advantage of the sea breeze, and describe its appearance from the street. Use drawings, photos, or a video to learn about the interior and exterior of a Single House. Or, construct a small cardboard scale model of a Charleston Single House. Why would the local Charleston and distant West Indies environments both have an influence on the design of these houses?

3. **Compare advantages of original and present sites of Charleston.**
   Research both the original 1670 site for Charles Towne at Old Town and the later 1680 site at White Point (The Battery). Compare access to ocean and rivers, availability of farmland, probability of disease and other health problems, and protection from enemies. Use a Venn diagram to compare and contrast these two sites relative to the listed factors. Do you think the present site was a good choice? Explain your answer.
Greenville News
September 10, 1989
Myrtle Beach vs. the Sea
by Jenny Munro

A rising Atlantic Ocean is eating away at Myrtle Beach, where coastal development could literally go under during the next century if plans are not made to move it back, according to a new Clemson University study.

By the year 2025 the ocean could be 39 to 89 feet farther inland at Myrtle Beach if the sea level continues to increase at the expected rate, said Jim London, associate professor of planning at Clemson. By 2100, the shoreline could be anywhere from 182 to 960 feet farther inland. That would place the water between Ocean Boulevard and U. S. 17 in some areas. But “Myrtle Beach will still exist if they adjust to the sea rise and adopt some flexible land use policies,” London said.

Although the magnitude of the increase is uncertain, “the atmospheric science community has come close to a consensus that the greenhouse effect is upon us,” London said. As the earth warms, the polar ice caps will begin melting, causing an increase in the sea level, and the ocean water will warm, causing an expansion of the water.

London said, “The options are to fortify the beach with sea walls or to make a gradual retreat.” Different areas along the coast will require different decisions. In Myrtle Beach, where the attraction is the beach, London said retreating from the advancing sea is probably the answer. Sea walls would cause problems. “Eventually, what happens is you lose the public beach,” he said. “We’re going to have to build a little smarter and adapt to a dynamic, moving shoreline. But the planning will not be easy”, said London. “The public probably does not yet realize the sea level is increasing.”

Myrtle beach officials already have begun building smarter, according to Jack Walker, planning director. The city has a mandatory construction setback from the oceanfront, based on a 50-year erosion rate. Also, the city has no sea walls and other hard erosion devices. “Basically, sand is about the only thing we can use in that zone,” Walker said.

“We pushed the ocean away from the city by renourishing the beach with sand,” he said. If the city has to fight a rising sea as well as erosion, “we will not only extend the beach out but raise the beach up.”

**RATIONALE**

Travel and tourism has become an increasingly important component of South Carolina’s economy over the last thirty years. Tourism contributes both directly and indirectly to the state’s economy. About fifty percent of tourist dollars are spent on food service and about twenty percent on lodging. The remainder generates employment in various service related industries, including transportation, recreation, entertainment, and retail trade. Although beaches have always been attractive to tourists, more and more visitors are looking for additional attractions such as amusement parks, theaters, golf courses, campgrounds, and convention facilities. The Myrtle Beach area has expanded to offer many of these extra features while still maintaining the family atmosphere that continues to draw millions of tourists from both in and out of state. Almost forty percent of all tourist dollars generated in South Carolina come from the Myrtle Beach area. Almost one-fifth of all State Park visits are recorded at Myrtle Beach State Park.
Myrtle Beach, 200 Years Ago

Two hundred years ago, Myrtle Beach was separated from pine forests only by sand dunes, sea oats, scrub oaks, and evergreen myrtle bushes (the origin of the name Myrtle Beach). During George Washington's tour of South Carolina in 1791 (refer to pages 1-19 to 1-28), he entered the state on the King's Highway (now US Hwy. 17) and visited with many influential and prominent families living in the Myrtle Beach area. At Little River, he dined with James Cochran and went on to lodge at Jeremiah Vereen's house near Long Beach, as the Myrtle Beach area was called in that day. He gave the beach at Windy Hill its name, because his hat was blown off as he walked along the ocean. From there, he was piloted across Singleton's Swash by Mr. Vereen and traveled south along the road which parallels the ocean. He dined at George Pawley's house just north of present-day Myrtle Beach. While traveling, he was met by Dr. Henry Collins Flagg, who invited him to spend the night at Brookgreen Plantation. George Washington continued on to Georgetown, where he was welcomed by a Salute of Cannons by the local infantry dressed in their most handsome uniforms.

Myrtle Beach, 100 Years Ago

Walking along the Long Beach (Myrtle Beach) a hundred years ago, you would have seen the large expanse of the Atlantic Ocean to the east. Looking north and south, you would see a long crescent-shaped beach covered with beautiful white sand. For miles inland, you would still see sand dunes covered with picturesque sea oats, scrub oaks, and wax myrtle bushes. Franklin G. Burroughs, a Conway businessman, was the first to see the potential for these beaches to become a major resort area. His company, Burroughs and Collins, acquired a vast amount of timberland which included the beach front all the way from Murrells Inlet to Little River.

About the turn of the century, his company started construction of a railroad line to transport tourists from Conway to the ocean. Once the railroad opened, the company built its first resort hotel, the Sea Side Inn. The company later sponsored a contest to select a name for its new resort. A popular suggestion was "Edgewater"; however, the name "Myrtle Beach" won the contest mainly because of the abundance of the evergreen aromatic plant called wax myrtle (*Myricaceae cerifera*) growing along the Grand Strand.

Myrtle Beach, Today

Currently the area is crowded with tourists and their vehicles, heading to and from the many golf courses, hotels, motels, condominiums, specialty shops, and restaurants that have developed along the Grand Strand, as the area is called today. However, a more serious problem than traffic jams or over-development threatens the future of the tourist industry at Myrtle Beach. Beach erosion has become a major concern. Since the late 1970's, when the city first began to study the problem, it has been determined that the ocean encroaches the shoreline at Myrtle Beach by approximately a foot per year due to normal erosion (not including additional damage caused by storms). To combat this problem, South Carolina has carried out several expensive beach renourishment
projects where more sand was added to beaches and dunes. These projects do not halt beach erosion but do slow the effects. Beach erosion will continue to present a threat to coastal development and tourism and will also continue to generate public debate on the best way to maintain and protect coastal development.

A Common Species: Touroid

Touroids, also known as Spuds or Gringos, are people who visit the beach on vacation. Local residents may make up funny stories about Touroids, but locals look forward to their arrival because of the strong boost they provide to the economy of Myrtle Beach and other resorts. Touroids are seasonally abundant on the Carolina coast; they gather in greatest numbers between Memorial Day and Labor Day. No single characteristic absolutely identifies a Touroid, but one or more of the following signs suggests a positive Touroid sighting:

<table>
<thead>
<tr>
<th>Signs of a Touroid Sighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note: The author &quot;freely admits to being a Touroid on many occasions.&quot;</td>
</tr>
</tbody>
</table>

- Walking to the beach overburdened with towels, blankets, beach umbrellas, cookers, rafts, chairs, beach balls, radios, shovels, buckets, etc.
- Letting beach towels get soaked by waves (from placing them too close to the surf during an incoming tide.)
- Spending endless hours walking up and down the beach, collecting worthless shells.
- Wearing loud Hawaiian print shirts, funky shorts, and weird hats.
- Wearing socks with sandals, or socks with any type of shoes during the summer.
- Talking with a foreign-sounding accent; inability to understand local beach dialect.
- Buying or sending multiple sets of postcards.
- Asking directions for the fourth time to the same destination.
- Driving down one-way streets the wrong way.
- Driving 10 MPH (the speed of a turtle) in a 35 MPH zone, gawking at the sights.
- Buying shells, trinkets, and souvenirs in tourist-trap shops.
- Invariably ordering seafood platters in restaurants.
- Appearing in the evening with a lobster-red sunburn (after roasting on the beach all day long.)
Not all touroids are equally well received by the local population or by law enforcement agencies. Large crowds sometimes create lots of noise and traffic, which can disturb residential areas of the city, and generate lots of trash. Conflicts can arise between vacationers who are looking for a good time and who tend to stay up late, and residents who have to go about their normal workday tasks and who have to get up early the next day.

The Myrtle Beach Railroad

In 1901, Myrtle Beach was considered "an uninhabited wasteland." But it had long been the dream of the Burroughs family in Conway to build a railroad to the beach. About that time, an old locomotive called the "Black Maria," which was originally designed to pull logs out of the swamp, began taking beach-goers from Conway to the ocean. At first, the track ran from Conway to Pine Island, the site of a huge lumber mill near present day Waccamaw Pottery (where Highway 501 meets the Intracoastal Waterway). From there the train had to be ferried across the Waccamaw River, which is now part of the Intracoastal Waterway. The tracks extended all the way to 9th Avenue which is the present location of the Myrtle Beach Pavilion parking lot. In 1904, a railway drawbridge was built across the river so regular runs could be made from Conway to the beach without interruption. Shortly after the Burroughs and Collins Company had laid the tracks and welcomed their first vacationers for day trips to the beach, they began construction on the first resort hotel, called the Seaside Inn.

Travel on the wood-burning Black Maria with its shrill whistle and smoke streaming out from the engine must have been quite an adventure. Sparks from the smokestack often set the neighboring woods on fire. Every time this happened the engineer would stop the train so the crew could jump off to put out the fire. That was not the only hazard, however. Cattle and hogs usually had free run of the countryside. Often these animals became confused and frightened by the smoke and noise and would charge the train. Later, after the cows became used to the noise and confusion, they would lay down on the warm sandy track beds. If the train killed the animals, a six dollar per animal fee was charged. To avoid this fine, the engineer would stop the train long enough to shoo the cattle off the tracks. Later, cowcatchers were added to the front of the engine. At top speed, the train hurtled along at twenty-five miles per hour. Passengers felt like they were riding in the wind. After serving beachgoers for four years, the Black Maria was replaced with a coal-burning engine which eliminated most of the cinders and sparks.

Atlantic Beach Set Aside for African Americans

For a long time, in the segregated South, a large percentage of the population, the Black residents of South Carolina, were not permitted to use the beaches in the town of Myrtle Beach. The Atlantic Beach Company wanted to provide a vacation opportunity for African Americans and at the same time boost their own local economy. So they set aside a portion of their oceanfront property, about sixteen miles north of Myrtle Beach, for the exclusive use of Blacks. This beach is currently owned and operated by African Americans. However, the expected influx of tourists never materialized, probably because of the onset of Civil Rights legislation. Once court-ordered integration opened public beaches to all citizens, regardless of race, color, or creed, African Americans had many more choices and were no longer limited to one particular resort.
Activity 9B-1: The Tourist District

Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
<td>1: 500,000</td>
</tr>
<tr>
<td>LAND USE/LAND COVER MAP</td>
<td>1: 500,000</td>
</tr>
<tr>
<td>GENERAL SOIL MAP</td>
<td>1: 594,000</td>
</tr>
<tr>
<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
<td>1: 1,000,000</td>
</tr>
<tr>
<td>MYRTLE BEACH LITHOGRAPH</td>
<td>1: 12,000</td>
</tr>
<tr>
<td>MYRTLE BEACH TOPOGRAPHIC MAP</td>
<td>1: 24,000</td>
</tr>
<tr>
<td>State Map of Major Drainage Basins</td>
<td></td>
</tr>
<tr>
<td>Wipe-off Pens</td>
<td></td>
</tr>
<tr>
<td>Transparent Grid Overlays</td>
<td></td>
</tr>
</tbody>
</table>

PERFORMANCE TASKS

(Icon Key) Overview = ⬤; Science = ⚫; Math = ☐; History = ☐; Language Arts = ☛

1. Locate the study site. ⬤ ⚫
   Locate the Myrtle Beach Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. Identify land use features and the locations of landmarks. ⬤
   Using the MYRTLE BEACH TOPOGRAPHIC MAP and the MYRTLE BEACH LITHOGRAPH, identify the Myrtle Beach Grand Strand, US Hwy. 501, US Hwy. 17, the shopping mall along US Hwy. 17, the Myrtle Beach Pavilion, the Intracoastal Waterway, the Myrtle Beach Air Force Base runway (now part of the Myrtle Beach Jetport), a golf course, Myrtle Beach State Park, the Waccamaw Pottery Shopping Complex at the intersection of US Hwy. 501 and the Intracoastal Waterway, the sewage disposal ponds along the Intracoastal Waterway, the Sewage Disposal Pond along Withers Swash, the Seaboard Coast Line Railroad track, and the power line corridor paralleling US Hwy. 501. Which features are easier to identify on the topographic map? Which features are easier to identify on the lithograph? Why? Which features are not visible on both map products?

   On the STATE BASE MAP #2, WITH HIGHWAYS, locate Myrtle Beach. Give several descriptive names for this area. Explain how each name describes something about the area. Name several other beaches along this coastline.

3. Analyze changes through time. ⬤
   Compare the MYRTLE BEACH TOPOGRAPHIC MAP with the MYRTLE BEACH LITHOGRAPH to discover any features that appear on one and not the other. First, use a wipe-off pen to outline the boundary of the lithograph on the topographic map. Then carefully compare the same area on both and use the pen to mark any features that don't appear on both. Check the dates of both the map and the lithograph. Which one shows newer features? List any new features you find. Why do you think
these changes have occurred? How will these changes affect the environment and the scenic features of the Myrtle Beach area?

4. **Analyze the newspaper article.**

   Read the newspaper article on page 9B-1, "Myrtle Beach vs. the Sea." Explain how the story relates to the Coastal Zone landform region. Identify on the MYRTLE BEACH TOPOGRAPHIC MAP and the MYRTLE BEACH LITHOGRAPH where the events mentioned in the story could have taken place. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same people as characters and the same location as your setting, write another newspaper article related to this incident, but date it either before or after the given story occurred. Choose an appropriate title and draw an appropriate picture to illustrate your main point.

5. **Predict new shoreline position for Myrtle Beach.**

   If beach erosion continues at its present rate, the Myrtle Beach shoreline will move inland a total of two miles during the next 10,000 years. On the MYRTLE BEACH TOPOGRAPHIC MAP, mark with a wipe-off pen the position of this new shoreline. Compare this new position with the pattern of contour lines shown on the map. Will the shoreline still be straight, or will it become more irregular? Refer to contour line information on the map to justify your answer. What is the current erosion rate in feet per year? How many years will it take for the new shoreline to reach the current position of the Intracoastal Waterway if that same erosion rate continues?

6. **Determine nature and extent of non-point source pollution.**

   On the MYRTLE BEACH LITHOGRAPH, trace with a wipe-off pen all the surface drainage for the area. Refer to the MYRTLE BEACH TOPOGRAPHIC MAP as needed. Consider adjacent land uses to predict the type and extent of non-point source pollution which might be found in these drainage areas. Identify places on the beach where drainage enters the ocean. What pollutants would you expect to find here? Where do the fertilizers and pesticides used on the golf courses end up? How do you think this type of pollution can be prevented or reduced? Explain.

7. **Relate landforms to land use.**

   Find a golf course on the MYRTLE BEACH LITHOGRAPH. Use the transparent grid overlay and the scale bar to determine the area of the golf course in square feet. Convert this number to acres. (Recall that there are 43,560 square feet in one acre.) Refer to the MYRTLE BEACH TOPOGRAPHIC MAP to determine what landforms exist at the golf course. Do you think these landforms increase the value of the golf course, or are they more of a problem which had to be solved before the course could be built? Locate the Waccamaw Pottery shopping complex at the intersection of US Hwy. 501 and the Intracoastal Waterway. Calculate its area and analyze the landforms present at this site using the topographic map. Select at least one other example of a tourist-based land use and determine its area and its relationship to underlying landforms. Compare how the developers worked with the existing landforms in the three sites you analyzed. Do you think the landforms in an area are always assets or liabilities to a developer?
8. **Contrast sediment load in different bodies of water.**

   Use the MYRTLE BEACH LITHOGRAPH to locate and mark with a wipe-off pen each of the following bodies of water: The deep Atlantic Ocean, the surf zone along the beach, the Intracoastal Waterway, and the settling ponds north of the Intracoastal Waterway. Compare and contrast the amount of suspended sediment in each, using the infrared blue color signature, and explain what geologic and other factors produced that difference.

9. **Design plan for future use of Air Force Base site.**

   Using the scale on the MYRTLE BEACH TOPOGRAPHIC MAP, find the length of the runway at the Myrtle Beach Air Force Base in feet, then convert your answer to miles (1 mile = 5,280 feet). Myrtle Beach Air Force Base was on the closure list for the United States Department of Defense. The airfield will continue to be used as part of the Myrtle Beach International Jetport. However, this leaves the future use of the area enclosed by the black dotted/dashed line to be decided by Myrtle Beach civic leaders. You and your group have been asked to design a plan for the future use of this land. There are several special interest groups that are very vocal about their desires to influence your decision; therefore, you must consider these groups as you design your plan. These groups are conservationists, land developers, tourism promoters, and business owners. Design a plan and present it to the class. Be ready to defend your plan against attacks by the special interest groups.

10. **Develop a class list of Touroid characteristics.**

    Expand Peter Meyer's list of Touroid characteristics. Make posters illustrating some of the new characteristics and share them with the rest of the class. How do wise sayings such as “When in Rome do as the Romans do” and “One man’s trash is another man’s treasure” relate to the behavior of tourists? Develop a list of helpful hints for Touroids visiting either the Grand Strand or the town nearest your school. Develop a dictionary of local lingo for tourists to use.

11. **Tell a funny story about being a Touroid.**

    Divide into groups. Tell a story to your group about a time when you behaved as a Touroid or sighted a Touroid in your neck of the woods. As a group, select your favorite story and choose a pair of group members to present it to the class. Tell the story together, with one student acting as the Touroid, and one acting as a local resident. Make sure that the story includes a number of specific references to known Touroid habits and characteristics. You may wish to wear Touroid garb while performing the story, and allow classmates in the audience to give a sign, such as the sign of the "T" for Touroid when the story includes a Touroidism. Or you may simply have them count the number of Touroidisms. This will work best if your group determines what sign the audience gives.

12. **Compare Florida and South Carolina tourism and spending habits.**

    In the fall of 1989 and the winter of 1990, a total of 18,400 people participated in a project called Longwoods TRAVEL USA, the largest and most comprehensive study ever undertaken of the United States leisure traveler. Use the top pie chart below to find out how many more people in the survey chose Florida rather than South Carolina as the beach resort area they decided to visit. The bottom pie chart indicates that in 1992, a total of $4.6 billion was spent in South Carolina by travelers. How much was spent in each of the areas of Food Service, Lodging, and Entertainment, according to the chart? Round off each result to the nearest whole-
number amount of money. The average size of a group of visitors to South Carolina in 1993-1994 was reported to be 3.5 people. How can you have a group with 3.5 people? What are some possible combinations of group sizes which could produce this average?

**BEACH RESORTS - TOP DESTINATIONS**

<table>
<thead>
<tr>
<th>State</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>FL</td>
<td>21.0%</td>
</tr>
<tr>
<td>CA</td>
<td>7.4%</td>
</tr>
<tr>
<td>NJ</td>
<td>6.9%</td>
</tr>
<tr>
<td>SC</td>
<td>11.7%</td>
</tr>
<tr>
<td>NC</td>
<td>6.5%</td>
</tr>
<tr>
<td>HI</td>
<td>6.1%</td>
</tr>
<tr>
<td>FOREIGN</td>
<td>18.8%</td>
</tr>
<tr>
<td>OTHER U.S.</td>
<td>21.6%</td>
</tr>
</tbody>
</table>

**SOUTH CAROLINA EXPENDITURES BY TRAVELERS - 1992**

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Service</td>
<td>32%</td>
</tr>
<tr>
<td>General Retail Trade</td>
<td>11.2%</td>
</tr>
<tr>
<td>Entertainment</td>
<td>7.5%</td>
</tr>
<tr>
<td>Lodging</td>
<td>21.8%</td>
</tr>
<tr>
<td>Auto Transportation</td>
<td>17.2%</td>
</tr>
<tr>
<td>Public Transportation</td>
<td>10.3%</td>
</tr>
</tbody>
</table>

13. **Estimate capacity for tourists and parking.**

Divide into groups and locate Ocean Boulevard on the MYRTLE BEACH TOPOGRAPHIC MAP. Mark this road on the MYRTLE BEACH LITHOGRAPH with a wipe-off pen. Choose a four-inch segment of land between Ocean Boulevard and the beach and count the buildings in this area. Estimate the number of tourists vacationing on your chosen area. In order to do this, assume that 90% of the buildings are hotels or motels, that the average number of rooms per hotel is 100, and that an average of three people stay in each room. Then estimate the capacity of parking lots on your chosen segment by using the transparent grid overlay. Assume that each car needs 100 square feet to park. Compare the number of
people to the number of parking places. Are there enough spaces to accommodate the tourists? Next, use the lithograph and grid overlay to determine the maximum number of cars that could be parked at the Myrtle Beach Mall (in the northeast corner of the lithograph). Also estimate parking capacity at the Waccamaw Pottery Outlet Park (intersection of US Hwy. 521 and the Intracoastal Waterway). How do you think an architect plans the size of a parking lot?

14. Design a brochure for a Myrtle Beach resort.
Find a vacant lot somewhere on the MYRTLE BEACH LITHOGRAPH where your group would like to construct a tourist business, such as a hotel, restaurant, amusement park, etc. Design and produce a brochure to advertise your business as outlined in the procedure below. Divide up the responsibility within your group so that each person is in charge of a specific task; but be sure to consider suggestions from all group members. Display your results on a bulletin board.

First, name your facility and write an exciting description of the facility that will make tourists want to visit. Then draw a simple map and write easy to understand directions so that tourists will know how to get there and where to park their vehicles. Next, determine how much your facility will cost to construct. What prices must you charge to insure a fair profit without being much higher than your competitors? Finally, organize all the parts into an attractive format and add the necessary artwork to make your brochure one that people will notice, pick up, and read.

15. Estimate time of day by angle of shadows.
Locate several tall buildings on the MYRTLE BEACH LITHOGRAPH and outline the position of their shadows with a wipe-off pen. Assume that the shadows will point exactly north at 12:00 noon, and that north is toward the top of the lithograph. Estimate as closely as possible the time of day the photograph was taken. Explain how you determined that time. How accurate do you think your answer is?

16. Analyze impact of Myrtle Beach railroad line.
The railroad line that used to bring vacationers to Myrtle Beach from all over the country can be seen, running along the northern side of U.S. Highway 501, on both the MYRTLE BEACH LITHOGRAPH and the MYRTLE BEACH TOPOGRAPHIC MAP. How close to the ocean could you get if you traveled by train? Why was the train station not located right at the beach? Locate the turnaround track on the lithograph near the intersection of Harlem Street and 8th Avenue North. Railroad workers call this track configuration a "wyne" (pronounced like the letter "Y"). How do you think it got that name (Hint: look carefully at the shape of the track)? Assume that each railroad car, including the engine, is 100 feet long. What is the maximum length of a train that could turn itself around by using the Myrtle Beach wye, without uncoupling any cars? How many cars would such a train be pulling?

Passenger train coaches can hold different numbers of passengers depending on the size of the coach and the spacing of the seats, but a typical carrying capacity is 80 passengers per coach. On a typical summer weekend in 1940, approximately 2,000 vacationers arrived at Myrtle Beach and about half of these traveled by train. How many coach loads of passengers does this number represent? Do you think they all arrived at the same time on the same train? How many trains per day do you think would be needed to transport that many passengers economically?
What impact do you think the railroad had on turning Myrtle Beach into a prime tourist destination? If passenger rail service to Myrtle Beach were to start up again, how many people do you think would use it on an average summer weekend? What are some advantages of traveling to the beach by rail? What are some disadvantages? Refer to the paragraph titled "The Myrtle Beach Railroad," on page 9B-4 for ideas.

ENRICHMENT

1. **Research pros and cons of resort development.**
   - There are always pros and cons to be considered when developing beach resorts. Divide a piece of paper into two columns. Label one column Pros and the other Cons, under the major heading Developing Beaches. Refer to a variety of library resources in addition to your own opinions to fill in the chart.

2. **Research beach erosion and implications for tourism.**
   - Research the problems associated with beach erosion. Discuss the implications of beach erosion on tourism. Brainstorm possible solutions to this problem.

3. **Collect brochures from tourist attractions.**
   - Collect brochures from tourist attractions at a variety of beach resorts. These are usually easy to obtain from the lobbies of restaurants or by mail from the city's Chamber of Commerce. Select one of these brochures and plan a fictional group vacation to that resort or attraction. Group members should each make up a story about how they spent their vacation time. Read your story to the rest of your group and decide whether the attraction is a tourist trap or not.

4. **Locate other tourist beaches in South Carolina.**
   - Locate other resort beaches that contribute to the state's flourishing tourist trade. Estimate the quantity and quality of tourist attractions found in these areas, compared to those of the Grand Strand area. What information did you use to make your estimation? Locate as many State Parks as you can in the Coastal Zone area. List those you or someone in your group has visited which have beaches.
Uncovering a Piece of History:  
Archeologists Excavate 16th Century Spanish Settlement 
Colony Founded as Spanish Florida Capital 

by John C. Williams  

At Parris Island, where Marine Corps recruits learn survival skills today, archeologists are learning how New World settlers survived more than 400 years ago at the 16th century Spanish capital of Santa Elena. Pedro Menendez de Aviles founded Santa Elena in 1566 as the capital of Spanish Florida, a claim that extended from the Florida Keys to Newfoundland. Menendez is credited for the 1565 killing of Jean Ribault, a Frenchman who founded Charlesfort in the Beaufort County area probably near the modern-day town of Port Royal, in 1562.  
The Spanish occupied Santa Elena and its two forts, San Marcos and Fort San Felipe, from 1566 until 1587 with 100 to 300 people, most of them soldiers, said Chester DePratter, an archeologist and co-director of the excavation. After years of attacks by Indians and Sir Francis Drake's raid on the Spanish colony at St. Augustine, Fla., the Spanish decided in 1586 to abandon Santa Elena to consolidate their forces at St. Augustine.  
The Santa Elena settlement was known only through historical accounts until 1979, when Stanley South, an archeologist with the South Carolina Institute of Archeology and Anthropology, rediscovered the forts and town on Parris Island. Work in this phase of the excavation concentrates on a 24-foot room - with a center post, thought to have been part of a house because of the nearby garbage remains. Garbage pits provide important clues to the past, DePratter said, such as what the residents ate, what they ate it in, and what they wore, because at some point most of those items were thrown away. "By studying the garbage, we can tell if it was somebody important living there because if it was, there may be Ming porcelain (shards)," he said. "If it was a soldier or a servant, the pottery probably was Indian."  
Other items recovered include Spanish brass and copper ball buttons, tools, bullet molds, pieces of crossbows, brass thimbles and jewelry, he said. 

RATIONAL

The ACE Basin area has been designated a high-priority habitat under the North American Waterfowl Management Plan because of its importance to migrating birds and a variety of threatened and endangered animal species. In addition to the ecologically significant features of the ACE Basin, which include both freshwater and saltwater marshes, a rich historical tradition is still preserved which includes old plantation homes, Civil War forts, historic graveyards and churches, and a thriving Low Country culture. The coast around the ACE Basin preserves remains of the earliest settlements in the state and highlights the significant contributions of the black culture which dominated the area in the past and continues today as an influential part of South Carolina society.
Brief Site Description

The ACE Basin as an Important Ecological Site

The ACE Basin derives its name from the Ashepoo, Combahee, and Edisto rivers, which all empty into the Atlantic Ocean along St. Helena Sound. It consists of a 350,000 acre estuarine wetland which is mostly undeveloped. The area teems with wildlife and offers a diversity of habitat types, including upland pine forest, bottomland hardwoods, freshwater wetlands, and tidal salt marshes. Although it is managed primarily as a waterfowl preserve, many other animals, in addition to ducks and geese, take advantage of this largely undeveloped estuarine system. Loggerhead turtles lay their eggs on local beaches, bald eagles and osprey nest in the tall pine trees, and wood storks have returned to the area, for the first time since the 1800's, to establish rookeries and raise their young.

A coalition of agencies, including the South Carolina Department of Natural Resources, the United States Fish and Wildlife Service, the Nature Conservancy, and Ducks Unlimited, has joined with private citizens to protect and enhance the traditional uses of the ACE Basin. The area is owned primarily by private citizens who manage their property for agricultural, forestry, and wildlife purposes. It would be prohibitively expensive to purchase such a large area for public ownership, so instead the partnership with landowners encourages private ownership while protecting the area and enhancing current, environmentally sound, land use practices.

Sea Island Cotton

The search for a new cash crop led to the introduction of a particular type of cotton cultivation--so-called Sea Island cotton. The early variety of Sea Island cotton, called black seed cotton, produced a long staple fiber measuring 1.5 to 2.5 inches. It required a long growing season and drier conditions than some other varieties, which limited cultivation to the Coastal Zone of South Carolina. Sea Island cotton bolls tended to rot in the moister inland areas, but thrived in the salt air along the coast. About the end of the 18th century (1700's), green seed cotton, a shorter staple cotton measuring 0.5 to 0.75 inches, was introduced. It had a much shorter growing season and could be cultivated in the interior of the state. Consequently, cotton cultivation spread rapidly across South Carolina. Several factors influenced the increase in cotton production. The plantation system, already in place with indigo and rice, provided the necessary labor. The Industrial Revolution in England encouraged textile manufacturing resulting in a ready market for cotton. Eli Whitney invented the cotton gin, eliminating the old problem of separating seed from the cotton fibers. Internal improvements in transportation allowed cotton bales to be brought quickly to the Charleston market, where there was a successful marketing system already in place. Over the next century cotton became known as "King Cotton," and a one-crop agriculture economic system spread over much of South Carolina.
The Gullah Language

In the rice fields of South Carolina, a creolized African-American folk culture developed as the expanding rice culture caused a great increase in the importation of slaves from West Africa. These enslaved Africans spoke diverse languages and were under great pressure to understand their white masters as well as to communicate with each other. This situation forced the slaves to develop an alternate language called Gullah. This language, still spoken by some modern residents of the Sea Islands, is called a creole language because it is a blend of English and several languages used in West Africa, and is very similar to other creole languages which have developed along the West African Coast. A number of Gullah words have entered the everyday vocabulary of South Carolinians: tote: to carry; chigger: small flea; goober: peanut; and, nana: grandmother. In addition to words and phrases, many interesting beliefs and practices, such as the examples that follow, were handed down in Gullah folklore.

Gullah Beliefs and Folklore
Adapted from Reminiscences of Sea Island Heritage
Legacy of Freedman on St. Helena Island, by Ronald Daise.

The palmetto branch was used to discern whether a person had spoken untruthfully about theft. With two palmetto leaves placed on either side of the accused’s neck, the person performing the ritual would command the fronds to “Tie, palmetto, tie” if a lie had been told. According to lore, the green blades would entwine around a liar’s neck, beginning to choke him.

Whenever a family member died, survivors would mourn the death for a year by dressing only in black when appearing in public. Some dressed in black even in their homes. If a deacon died, a black bow was affixed somewhere in the church for one year. A deceased preacher’s chair in the church was draped in black cloth. No one could be seated in it for a year.

The expression “let mornin’ star greet you on yo’ prayin’ groun” began during slavery. Because they weren’t allowed to worship openly, slaves sneaked to their “prayin’ grounds” in the woods late at night. The morning star was their timepiece. When it started twinkling, slaves knew morning would soon follow. They then returned home before they were missed, to escape being whipped.

A fireplace at night was a common site for reliving local ghost tales. One favorite tale was about “the hag,” which supposedly sat on people’s faces at night as they slept, disorienting and terrorizing them.

Another popular belief among the Gullah peoples on St. Helena’s Island is that the second belt a woman wore beneath her waist, to raise the level of her long skirts when working in the field, gave her extra strength. Students will recognize in this belief similarities with other notions of the source of personal strength including those popularized today with the icons of cartoon heroes.
Stories from the Sea Island Gullah Tradition

A long-standing tradition in the Sea Islands involves the practice of placing highly personal objects and favorite possessions on the graves of the departed at the time of burial. Practitioners also believed in the power of graveyard dirt to wreak havoc on the house of anyone who accidentally took it home with them. In this tradition, which can be traced to West Africa, it is considered extremely unwise and improper to tamper with possessions placed on the graves of the dead. It is believed that these possessions are needed by the departed in order to peacefully enter and live in the afterworld. Disturbing a grave will result in the tamperer’s being pursued by a haint, the departed’s angry, retaliatory spirit. The following story is a part of this tradition.

The Precious Brooch
Based loosely on a story shared by Mary Holmes

A so-called “friend” of my family was this lady named Mary Jane. Now Mary Jane used to visit my grandmother all the time and she always admired a beautiful brooch, a jeweled pin my Granny loved to wear. One day when Granny was very old and sick this lady, Mary Jane, came to visit her at her bedside. Soon after her visit, Granny passed away. Even before the undertaker got there Mama realized that the pin was missing and she was sure that Mary Jane had taken Granny’s precious brooch. The years went by, but Mama never stopped worrying about the loss of Granny’s precious brooch that should have been placed on her grave.

One day years later, after Mary Jane had died too, my brother and I were cleaning in the cemetery around our family members’ graves when ‘cross the way we spied this precious brooch in a box on Mary Jane’s grave. We decided to take this brooch which we knew for sure was the very one that had been stolen from Granny.

We used our pitchfork so as not to pick up any graveyard dirt. You had to be sure NOT to take up any graveyard dirt back home with you! So slo-o-oo-owly --slo-o-oo-owly, nervous, we balanced the fancy little box the pin lay in on the tines of our pitchfork. Carefully, carefully, carefully we placed it in a cotton sack we’d brought along and we took it on home with us in the trunk of the family car.

At suppertime that night we were scared that what we’d done would get us a beating. My brother and I looked back and forth at each other--scared to death to say what we’d done—that we had the box with Granny’s pin in it. Mama knew right away from our faces that something was wrong. She said, “What’s the matter with ya’ll?” That’s when we showed her the box. She opened it. She didn’t let on to us that it was the pin that was missing.

My daddy stared at it and said, “Dog, ya’ll done been to that graveyard!” That was all he’d say ‘cause he always said Mama’s side was crazy. Daddy didn’t get into our family’s attachment to this object.

Nevertheless, it would continue to trouble us for years to come, especially after it was returned to Granny’s only son and then mysteriously disappeared again. To this day I still think about that brooch and wonder what really happened to it. It’s a shame that such a precious thing could be lost again! What do ya’ll think happened to my Granny’s brooch?
For a wonderful description of the African tradition of grave decorating, refer to Chapter 9 of *African-Americans and the Palmetto State*, a large, green, paperback volume to be found in all South Carolina middle school media centers and eighth grade social studies classes. It is advisable to use discretion and sensitivity in making assignments about graves, graveyards, burial practices, etc. Some students may be a part of a tradition which considers these topics taboo. Alternative assignments may be given to students who find these subjects objectionable.

### The Port Royal Experiment

When Confederate defenders and planters abandoned the Port Royal area during the Civil War they left approximately 10,000 slaves. These ex-slaves (or freedmen) soon became part of an *abolitionist* effort that came to be known as the Port Royal Experiment, an experiment in educating ex-slaves so that they could be self-sufficient. Missionaries, dubbed “Gideon's Band,” arrived to establish several schools and “to raise up the slaves of the Sea Islands.”

A major issue that arose during the early days of the Port Royal Experiment was the struggle of the freedmen to obtain their own land. The Federal government decided to sell the abandoned land on the Sea Islands for nonpayment of a special federal tax passed in 1861. Some of the freedmen were able to purchase some small tracts of this land, but most of the land offered was purchased in large tracts by Northern whites. In addition, General Sherman issued Field Order 15 in January, 1865, which set aside all the Sea Islands from Charleston to Port Royal, including all land within a distance of 30 miles from the coast, for the freedmen.

Later, during Reconstruction, President Andrew Johnson ordered all lands not sold directly by the Federal Tax Commission to be returned to their prewar owners. The only postwar land claims upheld were those purchased as a result of the tax sales on St. Helena and other islands in the Port Royal area. The United States Supreme Court later upheld the legality of these sales. In the end, the Port Royal Experiment was considered a failure because many of the freedmen were left without land and few had the means to be economically self-sufficient, despite being better educated.

### The Penn School and Penn Center Resource Site

An enduring feature of the Port Royal Experiment is the Penn Center, located five miles from Beaufort on St. Helena Island. This island was captured at the beginning of the Civil War by Northern troops resulting in the freeing of 10,000 slaves who had worked on the local plantations. A year later, Laura Towne and Ellen Murry, northern missionaries, arrived on St. Helena Island from Philadelphia, supported by the Pennsylvania Freedman's Relief Association. Together they established the Penn School, taking its name from their support organization. Shortly afterwards, Charlotte Forten, the first black teacher, arrived from Massachusetts. On donated land, a prefabricated building from Philadelphia was erected as their first school house. These three ladies worked diligently the rest of their lives teaching the local families basic skills in reading and writing.

About the turn of the century, the emphasis of the Penn School shifted toward a more industrial education, and the name was changed to the Penn Normal Industrial
and Agricultural School. The school continued to be a private institution until 1948, when the Beaufort County School District extended public education to this remote island. In 1953, when it was no longer part of the county school system, the Penn Center, as it now is called, shifted its focus to community service.

During the 1960’s, the Penn Center facilities were used by civil rights workers as a training center. Dr. Martin Luther King, Jr. and his Southern Christian Leadership Conference staff, including Andrew Young, Ralph Abernathy, John Lewis, and Jesse Jackson, held retreats at Penn Center while planning their civil rights strategies. Many conferences continue to take place on the Penn School Campus, which, in 1974, was designated a National Historic Landmark District.

The scope of the Penn Center now includes, day care services, establishing and maintaining a rural water system, organizing a cooperative marketing system, helping land owners to understand their rights, and advocating better health care practices. Today, Penn Center serves as a cultural and environmental center for preserving Sea Island history and establishing sound conservation practices. The Penn Center’s Mission Statement declares its goal “to preserve the Sea Islands' history, culture, and environment through serving as a local, national, and international resource center, and by acting as a catalyst for the development of programs for self-sufficiency.”
Activity 9C-1: The Wildlife District

Materials

<table>
<thead>
<tr>
<th>Item</th>
<th>Scale</th>
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<tbody>
<tr>
<td>STATE BASE MAP #1, SHADED RELIEF</td>
<td>1: 500,000</td>
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<tr>
<td>STATE BASE MAP #2, WITH HIGHWAYS</td>
<td>1: 500,000</td>
</tr>
<tr>
<td>LAND USE/LAND COVER MAP</td>
<td>1: 500,000</td>
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<tr>
<td>GENERAL SOIL MAP</td>
<td>1: 594,000</td>
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<tr>
<td>GEOLOGIC AND MINERAL RESOURCE MAP</td>
<td>1: 1,000,000</td>
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<tr>
<td>COASTAL SATELLITE IMAGE</td>
<td>1: 332,640</td>
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<tr>
<td>ACE BASIN TOPOGRAPHIC MAP</td>
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<tr>
<td>Transparent Grid Overlays</td>
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<td>Wipe-off Pens</td>
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PERFORMANCE TASKS

(Icon Key)  Overview =  Science =  Math =  History =  Language Arts =

1. Locate the study site.  
   Locate the ACE Basin Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC MAP AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain?

2. Describe river systems draining through ACE Basin.
   On the ACE BASIN TOPOGRAPHIC MAP identify St Helena Sound and Port Royal Sound. Use the STATE BASE MAP #1, SHADED RELIEF, to compare the two sounds and trace the Coastal Zone rivers flowing through this region. St Helena Sound serves as the mouth of the ACE Basin (which is an acronym for Ashepoo, Combahee, and Edisto rivers). Port Royal Sound is the mouth for the Beaufort, Coosawatchie, and Colleton rivers. Using the wide point wipe-off pen, outline the watershed area for each of these river basins. Use the transparent grid overlay to compare the relative size of watershed areas. Which river has the largest watershed area? Examine the drainage patterns on the map to fill in the information requested on the chart. Notice how the extensive floodplain areas, shown on the satellite image, affect the placement of highways. Towns and cities appear blue on infrared satellite images. Identify the counties, towns, and cities drained by these rivers. Are there many towns located along any of these rivers? How do you account for this fact?

<table>
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<tr>
<th>ST. HELENA SOUND</th>
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<td>NAME OF RIVER</td>
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3. **Analyze changes through time.**
   First, use a wipe-off pen to outline the boundary of the **ACE BASIN TOPOGRAPHIC MAP** on the **COASTAL SATELLITE IMAGE** and the **STATE BASE MAP #2, WITH HIGHWAYS**. Then compare the study region on the coastal satellite image with the base map to discover any features that appear on one and not the other. Use the wipe-off pen to mark any features that don't appear on both. Check the dates of both the map and the satellite image. Which one shows newer features? List any new features you find. Why do you think these changes have occurred? How will these changes affect the environment and the scenic features of the ACE Basin area?

4. **Analyze the newspaper article.**
   Read the newspaper article found in the Brief Site description for Study Site 9C, "Uncovering a Piece of History: Archeologists Excavate 16th Century Spanish Settlement Colony Founded as Spanish Florida Capital." Explain how this story relates to the Coastal Zone Landform Region. On the **ACE BASIN TOPOGRAPHIC MAP**, locate the places where the events mentioned in the story might have happened. Explain why the publisher thought this story might be of interest to newspaper readers. Using the same references and location as your setting, write another newspaper article related to the same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose an appropriate title (headline) and draw an appropriate picture to illustrate your main point.

5. **Develop criteria for picking Spanish landing site.**
   You are part of a group of Spanish officials in the mid 1500's who have been given the task of selecting a site for a settlement in the Santa Elena (Beaufort) region. Develop appropriate criteria you would use for selecting a site. Use the **ACE BASIN TOPOGRAPHIC MAP** to find and mark, with a wipe-off pen, a suitable location that best meets your criteria. Prepare a statement explaining and defending your choice. Present your criteria and site selection process to the class.

6. **Locate position of two forts protecting Port Royal.**
   On the **ACE BASIN TOPOGRAPHIC MAP**, identify and mark the approximate location of the two earthen forts that protected Port Royal Sound before the Civil War. One was Fort Walker, which was constructed on Hilton Head Island, near the present site of Hilton Head Airport. The other earthen fort was called Fort Beauregard and was constructed on the end of Bay Point Island. Use the scale bar on the map to determine the approximate distance between these forts. Geography played a major role in the Civil War as both sides planned battle strategies for defending their own posts and attacking the enemy forces. In your group, discuss how geography might
have presented possible defensive problems for the Confederate forces and how
gEOGRAPHY might have influenced the Union invasion plans for Port Royal Sound.

On the same map, locate St. Helena Island and the community of Frogmore, where
the Penn Center is located. Describe the terrain of this island. How would you get to
the Penn Center (Frogmore) from your school? Is it on a barrier or remnant island?
What is its height above sea level? Find as many of these features as you can on
the COASTAL SATELLITE IMAGE. Can you find Penn center on the image? Why
or why not?

7. Identify where long staple black seed cotton could grow. To
Use the ACE BASIN TOPOGRAPHIC MAP to identify possible areas where long
staple black seed cotton could be planted in the Beaufort area. Refer to the section
titled “Sea Island Cotton” in the Brief Site Description for Study Site 9C. What
landform characteristics were necessary for this particular type of cotton to have
bountiful harvests? Outline possible cotton growing areas and use the transparent
grid overlay to estimate the total possible cotton growing area in square miles.
Estimate the percentage of the map area which is suitable for long staple black seed
cotton production.

8. Write follow-up to "The Precious Brooch." N
Write a follow up story to "The Precious Brooch" explaining the second time it
disappeared. Locate a cemetery on the ACE BASIN TOPOGRAPHIC MAP where
you think the events of this story could have taken place. Justify your selection.
Make sure your follow-up story uses the same cemetery. Make a list of the objects
you would like placed on your own grave and share the list with your group. Tell
about any prized possessions, celebrations or remembrances of ancestors that are
traditions in your family.

9. Tell story about a Gullah tradition and relate to historical context. T
Read through the background information section "Gullah Beliefs and Folklore";
select one of the listed Gullah beliefs/practices and develop a short story based on
that tradition. Use several landscape references in your tale, being sure to be
consistent with landform data and historical context. Conclude your tale with one of
the following Gullah proverbs. Have someone from your group read your story to the
class. Select the best stories to be printed as an anthology and published in your
school newspaper.

Group I  A ounce of mough (mouth) shut, worth pound explainin’.
Group II  Empty sack can’t sand upright alone.
Group III  Heart don’t mean every thing mough say.
Group IV  Sad we got to burn fore we learn.
Group V  Ompossible to get straight wood from crooker (crooked) timber.
Group VI  Most (almost) hook fish don’t help dry hominy.
10. **Explain contour interval anomalies on map.**

Examine the **ACE BASIN TOPOGRAPHIC MAP** carefully and identify several obvious differences between the top half and bottom half of the map (note from the legend that the Ace Basin map is really a composite of two different USGS maps). Look specifically at the contour lines where the two maps join, on Port Royal Island just north of the Naval Reservation, Marine Corps Air Station (western edge of the map). What is the contour interval for the upper half of the map? What is the contour interval for the lower half of the map? Why do you think the mapmakers used different contour intervals in this area?

**ENRICHMENT**

1. **Research current wetlands legislation.**
   Wetlands include the state’s marshes, swamps, bogs, and Carolina Bays. Wetlands legislation has been a prime issue for groups desiring to protect these fragile areas from development, agriculture, and forestry. Wetlands provide flood control, ground water recharge, wildlife shelter, recreation opportunities and a breeding ground for a diversity of organisms. Research recently passed legislation and monitor the progress of pending wetlands legislation.

2. **Research wildlife habitat and seafood industry.**
   Research the ACE Basin’s role in wildlife habitat, the seafood industry, and recreation in the Coastal Zone Region of South Carolina.

3. **Research wood duck habitat.**
   The wood duck is a colorful native bird inhabiting the wooded swamps and rivers of South Carolina. The type of habitat required for wood ducks is decreasing due to logging activities, creation of open water reservoirs, and conversion of forested wetlands to agriculture. Research the habitat requirements for wood ducks, including food, nesting habits, and protection from predators. Make a list of recommendations to protect their habitat. Have these recommendations printed in your school or local newspaper. Note that Ducks Unlimited, South Carolina Water Fowl Association, and the South Carolina Department of Natural Resources all have programs protecting and enhancing native wood duck populations. In many cases, you can request a speaker to come to your school to give a program.

4. **Research origin of Gullah language and culture, relate to own family.**
   Research the origin of the Gullah language and culture in South Carolina. Illustrate on a posterboard various Gullah cultural contributions such as crafts, language, folklore, and tales. Report your findings to the class in an oral report.

   Research Charles Joyner’s book, *Down by the Riverside: A South Carolina Slave Community*, to find out how tales and superstitions of the Low Country played a part in the beliefs and practices of the families who lived there.

   Have students share any favorite proverbs used or quoted by their parents or grandparents. Relate a family story to its historical context. Do some independent research to check the facts of the story as they have been told to you. Share the story using the original voice or voices in which the story has been told to you and then again in your own voice. Try to highlight any differences between and among the different versions of your story.
## Index Map to Study Sites

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<td>5B Santee Cooper Project (Engineering &amp; Canals)</td>
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<td>2B</td>
<td>Lake Jocassee Region (Energy Production)</td>
<td>6A Congaree Swamp (Pristine Forest)</td>
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<td>Forty Acre Rock (Granite Outcropping)</td>
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<td>5A</td>
<td>Savannah River Site (Habitat Restoration)</td>
<td>10B North Inlet (Hurricanes)</td>
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### Section 10

**COASTAL ZONE REGION / ESTUARIES AND TIDAL FLATS**

**BLUE RIDGE**
- 2A Table Rock (Mountains)
- 2B Lake Jocassee Region (Energy Production)
- 3A Forty Acre Rock (Granite Outcropping)
- 3B Silverstreet (Agriculture)
- 3C Kings Mountain (Historical Battleground)

**PIEDMONT**
- 4A Columbia (Metropolitan Area)
- 4B Graniteville (Mining Area)
- 4C Sugarloaf Mountain (Wildlife Refuge)

**SANDHILLS**
- 5A Savannah River Site (Habitat Restoration)
- 5B Santee Cooper Project (Engineering & Canals)
- 6A Congaree Swamp (Pristine Forest)
- 7A Lake Marion (Limestone Outcropping)
- 8A Woods Bay (Preserved Carolina Bay)

**COASTAL PLAIN**
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SECTION 10
COASTAL ZONE REGION / ESTUARIES AND TIDAL FLATS

POWER THINKING ACTIVITY - "Pirate Pursuit"

You are the first mate on board the pirate ship Queen Anne's Revenge under the command of the notorious pirate, Blackbeard. You have just attacked and robbed two ships moving trade goods into the rice port of Georgetown. You want to leave Winyah Bay as quickly as possible, before the British Navy can assemble to pursue you, but, as you are leaving Winyah Bay, a big storm comes up. You can't go out into the open ocean because of the storm, but you can't return to Georgetown, where the British Navy is gathering its forces. Where can you go, close by, to wait out the storm and to hide from the navy? Use the NORTH INLET TOPOGRAPHIC MAP and the WINYAH BAY LITHOGRAPH to help you determine a specific place to hide. Consider the size of your ship and the geometry of the landform features in the area. Remember that you have to get your boat out of the naval forces' view at Georgetown to make them think you have left the area.

PERFORMANCE OBJECTIVES

1. Describe the ecological significance of estuarine environments and assess the short and long-term effects of draining these wetlands.
2. Relate requirements for the cultivation of rice to the development of the plantation system and the resulting widespread alteration of the estuarine landscape.
3. Outline and assess contributions made by African Americans in the Coastal Zone throughout South Carolina history.
4. Explain how trickster tales developed and changed through time and were used to convey hidden meanings to specific groups of listeners.
5. Interpret and retell Pourquoi Tales, legends, and stories from Low Country folklore.
6. Determine the economic and social impact hurricanes have had on South Carolina's Coastal Zone Region.
7. Compare and contrast changes in shoreline features, land cover, and land use patterns resulting from Hurricane Hugo.
8. Determine dimensions of rice impoundments, height of tidal range, and average crop yields using appropriate mathematical models.
9. Plot paths of major hurricanes and associated storm surge high-water marks on topographic maps and lithographs.
BACKGROUND INFORMATION

Description of Landforms, Drainage Patterns, and Geologic Processes

Characteristic Landforms of Estuaries and Tidal Flats

Estuaries consist of small islands of high ground and expansive salt marshes, cut with winding tidal creeks. The deeper creeks hold water even at low tide while only the peak of the six-hour tidal cycle floods the marsh surface. Most South Carolina rivers enter the ocean through estuaries, which represent former river channels that have been flooded because sea level has gradually risen. Most pre-existing landforms are hidden below the water line, leaving only shallow marshy areas visible along the boundary of the estuary. They are essential wetland areas, where fresh water from inland sources joins incoming salt water from the oceans. They develop extremely dynamic ecosystems that are constantly changing in response to tidal action and to the varying amounts of fresh water, governed by seasonal and meteorological changes. Rivers, creeks, and smaller tributaries serve as arteries for transporting nutrient-rich material eroded from upstream. This material, along with nutrients brought in by the tides, nourishes many forms of marine life, especially the larval stages of invertebrate species that flourish in this protected environment.

Tidal flats are mostly flat, low-lying areas flooded by seawater part of the time and exposed to the air part of the time. The total amount of land flooded depends on the tidal range and the effects of storms. In many ways tidal flats are similar to river floodplains. Tidal channels drain the higher portions of the mostly featureless plains covered with marsh grass. The channels meander widely across muddier areas forming occasional tidal channel levees and sandy point bar deposits. The channels often interconnect, especially near the tidal inlet, which provides access to the open ocean. Some tidal flat systems are dominated by a very strong incoming tidal current. Sediments are pushed landward by these currents to form flood tidal deltas. If the outgoing tidal current is stronger, sediments will often be carried out into the open ocean, through the tidal inlet, to form ebb tidal deltas. The relative amount of erosion and deposition on any portion of the tidal flat depends on the height of that land above or below average sea level (mean sea level).

Geographic Features of Special Interest

All major South Carolina rivers, except for the Santee, have been recently flooded by rising sea level to form estuaries surrounded by marshy wetlands. The Santee River System has brought enough sediment to the coast that it has been able to keep pace with rising sea level and maintain its delta. This low lying area also contains extensive salt marshes. Other coastal embayments, such as Bull's Bay, St. Helena Sound, and Port Royal Sound, are likewise surrounded by vast expanses of salt marsh. Several prime areas of salt marsh habitat have been preserved as wildlife refuges, such as the Cape Romain National Wildlife Refuge adjacent to Bull's Bay in Charleston County, and the Pinckney Island National Wildlife Refuge near Hilton Head Island in Beaufort County. Hobcaw Barony, designated for teaching and research, is located just across Winyah

10-2
Bay from the city of Georgetown. It contains abandoned rice fields, old beach ridges, and a diverse tidal flat environment, along with a lookout tower that provides spectacular views of the coastal landscape. Several state parks with excellent examples of tidal inlets and tidal flats include Hunting Island State Park in Beaufort County and Edisto Beach State Park in Colleton County. Almost all barrier islands along the coast exhibit well formed tidal inlets and tidal flat drainage systems.

**Types of Estuaries**

Several types of estuaries are found within the Coastal Zone, ranging from predominantly saltwater estuary systems, to a mix of fresh and saltwater (brackish water), to isolated freshwater estuaries. Salt marshes occur along most saltwater estuaries found in the Coastal Zone. These marshes are highly saline and primarily support spartina grass. North Inlet and Pawleys Inlet marshes are excellent examples of ecologically important salt marshes.

A second type of coastal estuary contains the brackish water marshes that are located in the less salty reaches of tidal rivers and marshes. They have a mixture of both salt and fresh water characteristics. It was these estuaries which were used as rice field impoundments during the rice planting era. Examples can be easily recognized on the Winyah Bay lithograph because of the rectangular block patterns of the dikes and ditches dividing the fields.

Excess rainwater drained from upland areas forms a third type of estuary containing only fresh water. These freshwater estuaries are also known as coastal swamps and are mostly found in low-lying depressions or river tributaries. The North Inlet Topographic Map contains excellent examples of fresh water estuaries. These areas are mostly vegetated by deciduous water-tolerant tree species such as gums, cypress, and oaks.

**Processes Shaping South Carolina’s Coast**

Viewed in geologic time, South Carolina’s coastal region developed slowly by deposition of sediment eroded from the Appalachian Mountains and carried to the sea by rivers. These sediments gradually built out into the ocean and have been reworked and sculpted into the landform structures visible on today’s Coastal Plain. The present system of Coastal Zone landforms however, including modern barrier islands and beaches, is geologically much younger than most other South Carolina landforms. During the Pleistocene ice ages, sea level rose and fell several times, causing shoreline features to advance and recede. Sand dune remnants in the Coastal Plain Region and a series of escarpments and terraces are evidence that the shoreline was once farther inland. Still present on the Continental Shelf off our coast are additional remnants of terraces, showing that sea level was once lower than it is today. These processes, over geologic time, have created parallel rows of dune ridges behind the active shoreline. These ridges can easily be seen along many portions of the Coastal Zone, particularly on aerial photographs and satellite images. These dune ridges were once active barrier islands typical of the South Carolina coast and the tide-dominated Coastal Zone in general. Older dune ridges have become vegetated by mature maritime forests, but younger sand ridges closer to the beach front are dominated by sea oats and other salt-tolerant shrubs and grasses.
From 20,000 years until about 10,000 years ago, the world's glaciers were melting rapidly, causing the sea level to rise several feet per century, for a total of more than 350 feet. Beaches migrated inland to near their present position to keep pace with the rising sea. South Carolina's present-day barrier islands and beaches began to grow, and the wetlands and estuaries behind the outer beaches began to develop, when sea level finally stabilized some time after the most recent of the Pleistocene ice ages. River sediments, a mixture of sand, silt, and clay, began to accumulate on the bottoms of drowned river valleys, which were flooded as sea level rose because of the water released by melting continental glaciers. The type of sediment deposited at any particular location depended primarily on the intensity of wave and current energies at that location. High energy levels caused sands to be deposited along beaches, while finer silts and clays were able to settle in marshes and as offshore mud deposits because of the lower energy of these environments.

In the long run, both subtle changes and sudden dramatic storm events have been important factors in shaping Coastal Zone landscapes. In recent times, however, the most dramatic Coastal Zone changes have occurred as the result of human engineering. Far more than natural processes, the shapes and characteristics of shorelines have been affected by the building of dams which reduced the sediment load transported by rivers, the draining and filling of marshes and other wetlands, increased shoreline development, beach renourishment projects, and the construction of jetties, groins, and sea walls.

**Movement of Sand**

Beach sand is transported parallel to the coast by longshore movement and from offshore sand bars into the surf zone by wave and tidal action. All of South Carolina's Coastal Zone is influenced by the rise and fall of tides, an effect that extends approximately ten miles inland, affecting all of the major bays, sounds, and inlets. Waves seldom strike the beach from directly offshore; rather they usually come in at an angle. This angled approach helps to develop a current moving parallel to the coast that is familiar to anyone who has played in the surf for a while and noticed that they have been gradually moved relative to the beach, sometimes for as much as several hundred yards. This same current moves huge amounts of sand along South Carolina's coast each year.

Seasonal differences in wave direction and wave strength can move sand from offshore sand bars into the surf zone. In general, winter storms tend to move sand offshore, while more gentle summer waves tend to return the sand and build up the beach face. Where beaches are built up by deposits of sand from the ocean, wind often carries the loose particles higher up the beach. A variety of debris then breaks the force of the wind and the sand is deposited, forming rows of sand dunes. Sea oats and other beach front grasses take root and provide more wind-breaks for further sand accumulation and greater dune stabilization. The slow movement of sands and sandbars through time is easily seen in a time sequence of aerial photographs and satellite images. Ancient dune ridges built by this same process are also obvious features on both types of cartographic products.
Rice Plantation Era

The Rice Plantation Era originated in South Carolina in the early 1700's when the river basins around Charleston and Georgetown became major tidewater rice cultivation areas. Georgetown, at the head of Winyah Bay, was strategically located at the confluence of the Waccamaw, Pee Dee, Sampit, and Black rivers, and it became the major port for exporting rice to England and the West Indies. The extremely labor intensive cultivation of rice created a planter's aristocracy of great wealth and power, made possible by the hard work of thousands of slaves. Evidence indicates that rice seeds were first brought to the state by Africans from Madagascar, a large island off the east coast of Africa.

The first rice crops were grown in open fields, but keeping the weeds from choking the young plants and insects from devouring the crop were major problems. However, early in the eighteenth century it was discovered that tidewater cultivation of rice, on reclaimed swamp lands, solved most of these problems. In the tidewater model, rice plantations were located just above the level of the incursion of salt water and just below the upper limit of the tidal effect. In the brackish-water estuaries or marshes, strategically placed gates, dikes, ditches, and canals, allowed the rice planters to make use of the rising and falling tides, which provided the energy to move water back and forth between the rice field and the canal or river. This tidal flushing action provided the proper agricultural conditions for rice cultivation. Even though the Savannah, Combahee, Ashepoo, Edisto, and Cooper rivers all became important tidal rice cultivation areas, it was the Waccamaw, Santee, Sampit, Black, and Pee Dee rivers that combined to make the Georgetown area the major rice producing region in South Carolina and one of the largest producing areas in the world.

Rice Became a Culture as Well as a Crop

It was slave labor that cleared the cypress swamps and constructed dikes with sluice gates to flood and drain the fields, but slaves also provided much of the knowledge necessary for the cultivation of rice, since none of the Europeans had much experience with rice cultivation at that time. In fact, the rice planters of South Carolina preferred to import slaves from Sierra Leone, along the West African coast, where Africans had years of experience with rice cultivation. During the Plantation Era, in South Carolina, these slaves continued to use the traditional African methods of planting, hoeing, winnowing, and threshing rice.

Many slaves were able to maintain and transmit some of their African heritage through development of the Gullah language, crafts, and folk tales. For example, in the rice-growing regions of South Carolina, basketry flourished and found practical application in the production of baskets for both storage purposes and the winnowing of rice. These baskets used distinctive West African construction techniques, although they utilized local materials, traditionally coils of sweetgrass stitched together with dried palmetto fronds (leaves).

Legends are an outcome of people's efforts to explain events in history about which accurate information is unavailable to them. Sometimes, however, legends provide a
way for people to romanticize and thereby tolerate the truth about difficult aspects of history such as the enslavement of labor populations. The following romantic legend has been told to explain how colonial Europeans became successful rice planters in the days when rice cultivation was a difficult and labor intensive process not familiar to most Europeans.

How Rice Came to the Carolinas
Adapted by Christy Clonts from South Carolina Legends, by Beth Causey

Long ago, on an island called Madagascar, just off the southeastern coast of Africa, a Malaysian princess fell in love with one of her father's leading warriors. It was an ill-fated love because according to custom she could only marry someone chosen for her by her father, the king.

The king discovered that his daughter had been seeing this soldier, and he set out with his sword to be rid of the man. The princess ran to warn her lover, and by the time the king arrived, they had run away together.

The young couple traveled through forest and jungle. On the side of a hill overlooking the Indian Ocean, they built a hut and survived on the fruits of the jungle until the young man was able to dam a stream and plant rice. They worked long and hard.

Meanwhile, the king was still looking for them. After many months, two of the king’s searchers saw the hut, the little rice field, and the young couple. The princess was tending the rice and the young warrior was hollowing out a canoe. The searchers returned to the king and reported that his daughter was safe.

The king traveled with his warriors under cover of night and captured the young man and bound him with strips of bark. He put his daughter in the hut with a guard posted at the door. As the king contemplated how to kill the traitorous young warrior, an Arab sailing vessel filled with beautiful goods to trade came ashore. The king had brought neither spices, rice, nor slaves with which to trade on this fast trip. Upon seeing the young man who lay bound, the Arabs offered to buy him. He was traded for a short heavy sword and five yards of cloth.

When the ship was far out to sea the king released his daughter. As she cried out for her lover, her father told her to forget him.

That night when everyone was asleep, the princess slipped out of the hut, took the small bag of unhusked rice which the warriors had brought for their provisions, and a gourd filled with fresh water. She loaded these things in the canoe that her love had made and paddled herself out to sea in pursuit of her true love.

She had no idea how large the sea really was. Not knowing which way to go, she floated at sea for two nights and a day. On the second day she sighted the hull of a large ship. Thinking it must be the Arab ship, she began to paddle towards it.

She was brought aboard the ship with her little bag of rice, but the men were white, not Arab, and she could not understand what they were saying. She was assigned to assist the ship’s cook throughout the long journey around the tip of Africa and then northwestward.

Before they could reach land, they were forced to ride out a hurricane. The captain stopped at Charles Towne on the Carolina coast for repairs. The ship had to be unloaded to be repaired. Therefore, the captain went into Charles
Towne to hire workers to unload the cargo, for his sailors were too weary after their battle with the storm.

There he met Dr. Woodward who had fascinating stories to tell about living with Indians and sailing as a pirate's prisoner. He told of a strange man that was neither Negro nor Indian whom he had recently bought from a Portuguese slaver. The captain told him of a woman of similar appearance whom he had picked up from a canoe in the Indian Ocean. He also told of the little bag of rice that she carried.

Dr. Woodward had been wanting to try to grow rice, but had been unable to get seed or someone who knew how to grow it. The captain sold Dr. Woodward both the woman and her bag of rice. Because their looks were so similar, Dr. Woodward brought the pair face to face. They fell into each other's arms and Dr. Woodward understood their feelings. He offered them a hut and a plot of land of their own, if they would plant and grow the rice together as it was done in their country and then teach others how to grow it.

They took the little bag of rice and planted it, and it grew well. The people of Carolina saw how it was done. Dr. Woodward gave the people rice seed, and rice brought great wealth to the people of Carolina.

The young man and the brave princess lived many years on the land that Dr. Woodward had given them.

Figure 10-1: Comparison of State Agricultural Production, 1860

<table>
<thead>
<tr>
<th>STATE</th>
<th>RICE (LBS)</th>
<th>STATE</th>
<th>RICE (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>2,312,252</td>
<td>Missouri</td>
<td>700</td>
</tr>
<tr>
<td>Arkansas</td>
<td>63,179</td>
<td>N. Carolina</td>
<td>5,465,868</td>
</tr>
<tr>
<td>Florida</td>
<td>1,075,090</td>
<td>S. Carolina</td>
<td>159,930,613</td>
</tr>
<tr>
<td>Georgia</td>
<td>38,950,691</td>
<td>Tennessee</td>
<td>258,854</td>
</tr>
<tr>
<td>Kentucky</td>
<td>5,688</td>
<td>Texas</td>
<td>88,203</td>
</tr>
<tr>
<td>Louisiana</td>
<td>4,425,349</td>
<td>Virginia</td>
<td>17,154</td>
</tr>
<tr>
<td>Mississippi</td>
<td>2,719,856</td>
<td>U.S. Total</td>
<td>215,313,497</td>
</tr>
</tbody>
</table>
Decline of Rice Exports After the Civil War

Rice never recovered its role as the major export staple of the coastal area after the Civil War. The rice plantation system used in the state required a stable, disciplined labor force. After the war, there was major unrest among black rice workers. The full-scale renewal of rice production would have required a vast amount of capital, money not available in South Carolina due to the war. Also, new, more productive lands farther west in Louisiana, Texas, and Arkansas were being opened to large-scale rice cultivation.

Nature dealt South Carolina's commercial rice production industry the final blow. Between 1883 and 1913, a series of hurricanes struck the coast of South Carolina and destroyed or heavily damaged the remaining rice fields, dikes, and flood gates. The September 14, 1904 hurricane hit the coast along the Charleston-Georgetown area with high wind and heavy rains, causing $1.5 million in damage. Two years later on September 17, 1906, another hurricane hit Georgetown, causing considerable damage to the port. After the 1904 hurricane, a lady from Saratoga, New York, told Elizabeth Alston Pringle, a rice planter in the Georgetown area, that "the Lord does not have much respect for you rice planters." On September 19, 1906, Mrs. Pringle observed extensive damage "where the rice field should be, which looked like a great lake, no banks being visible."

The last of the commercial rice planters gave up after 1906 and turned to other crops. Afterwards, many of the old rice plantations were purchased by wealthy northern industrialists who turned the homesites into winter retreats and the old rice impoundments into hunting land. One of these wealthy plantation owners was George Vanderbilt, who owned many mansions across the country but reportedly preferred his Arcadia Plantation near Brookgreen Gardens, which was in the heart of the old Georgetown rice-producing area. The following story concerns George Young, a black Carolinian who was born on one of these plantations and later became a successful Low Country businessman. He runs a catering service on US Hwy. 17 near Pawleys Island appropriately named Young Yum Barbecue.
The Man of the House of Vanderbilt
Adapted from Plantation Tales, by Nancy Rhyne

George Young remembers how, and even precisely when, he first began to learn the mannerisms, traits, and disposition that would take him to the top in George Vanderbilt's Arcadia Mansion. Annie Young, George's mother, was a cook at Arcadia. Annie's dark hands moved swift and sure, as she prepared the foods so desired by Vanderbilt and his wealthy visitors.

George recalls how his mother's rare learning and her low musical language made their way into his heart as he watched her work in the large kitchen. Annie's husband took care of the Vanderbilt horses and dogs, a strenuous task. But George portrays the quiet ease of his mother as he speaks of her poise and the lightness of her footfalls as she came and went from the Vanderbilt kitchen.

As a child, George began to perceive that he could be like his mother and could even learn to cook like her. She would be his model and perhaps someday he, too, could cook in that kitchen. One day Mr. Vanderbilt asked George if he would set up the tables for a dinner after a deer hunt at Debordieu, Vanderbilt's seashore portion of his estate. George considered the request a great honor. But all the while that George was getting the tables ready for the dinner, he was watching the man who was barbecuing meat.

"He didn't know I was watching him, but I wanted to learn how to cook meat by barbecuing it just like I'd learned to cook by watching my mother. Every now and then, when they'd killed a deer, they would bring a quarter of the meat to the barbecue pit. The cook would baste the meat with sauce and cook it on the grill.

George Young was adept and learned almost every facet of running the plantation. "When I first started working in the house, I was bringing in wood, scrubbing the floor and washing dishes," he said. "Finally I learned to do about everything the other household help did." Mr. Vanderbilt employed people from all over the world and sometimes they didn't agree on how things should be handled. One day Mr. Vanderbilt called George Young upstairs and said, "George, I can't stand this arguing all the time. You must learn how to run this house because I'm going to get rid of them and give the whole job to you!"

George pointed out that he had had no schooling for being a butler or running such a magnificent, huge house. After all, a good butler was a status symbol, like a Rolls Royce. Mr. Vanderbilt insisted that he thought George could do it and told him to take over the mansion. Twenty-five people would report to him. Everything progressed wonderfully and Mr. Vanderbilt was pleased with the work of George Young, the man who had been born on the plantation and attended the little plantation schoolhouse.

Later, George Vanderbilt took George Young with him to act as a supervisor for several of his other houses around the country. He told him "George, you have all those people working for you and I've never known you to have the slightest argument with a single one of them. You are the best I've ever had at running a big house." Vanderbilt later gave George Young the deed to five acres of land adjoining Arcadia Plantation and helped him build a house there.

Today George runs a barbecue business on his property. He has a bad hip and the arthritis in his knees is a nuisance, but he cooks in the same way as he did at the house of Vanderbilt. In an interview, George summed up his feelings about the late George Vanderbilt. "I tell you, Missy, I miss him like I miss my mother."
Soils of Beaches and Salt Marshes

Beach sands, old sand dunes, and salt marshes represent the youngest soils in the state. All are formed from parent material deposited by the ocean, yet they are very different in character for two principal reasons. First, the beach and dune soils are composed of coarse, sandy, material, while salt marsh soils consist of clay, silt, and fine sand sized particles. Secondly, their position in the landscape, and therefore their elevation, is different enough to affect soil moisture content and water holding capacity. The elevation of marsh soils is essentially sea level, although during very high tides, they can be completely covered with seawater. The chemical effect of salt in the soil plays a significant role in the types of plants that a soil can support.

Ecological Significance of Estuaries and Salt Marshes

Coastal vegetation can be grouped into four zones - fresh marshes, maritime forests, salt marshes, and sand dunes. Fresh marshes are inundated by fresh water and are protected from saltwater intrusion by old beach ridges. They support a marsh-type vegetation dominated by rushes, and in contrast to swamps, contain no trees or shrubs. The vegetation is composed primarily of bulrush, cattail, and black needlerush. Beach ridges were once active sand dunes that are now separated from the shore and have a distinct maritime forest vegetation. Maritime forests are dominated by trees and shrubs that are tolerant of sea winds and salt spray. The live oak and the palmetto palm are particularly tolerant of these conditions. Other trees and shrubs of the maritime forest include the slash pine, magnolia, holly, waxmyrtle, and wild olive. On the shoreline itself are the sand dunes, created by the interaction of land, waves, and wind. Nearest the ocean, the fore dune is dominated and anchored by sea oats. Also common on the fore dune is the marsh elder and on the dune's protected backslope the pennyworth and sandspurs are found. In the depressions behind the fore dune is an area protected from salt spray. It is here that yaupon, waxmyrtle, dwarfed live oak, Spanish bayonet, and other similar plants thrive. Secondary dunes, though somewhat protected by the fore dune, have a similar arrangement of vegetation.

Closer to the ocean and inundated at high tide are the salt marshes. With ample sunlight, plentiful nutrients provided by inland rivers, and periodic tidal flushing, the salt marsh provides an ideal environment for plant production. However, the high salinity of the water limits plant life to one dominant species called cord grass, or *spartina*. This single species dominates the entire salt marsh, growing tall along creek banks, and somewhat shorter on the expansive flats. As *spartina* growth slows during the winter months, wave action and bacteria break down the stalks to form a rich soup called *detritus* which provides a source of energy for zooplankton (microscopic aquatic animals) and phytoplankton (microscopic aquatic plants) and represents the base of the estuarine food chain.

Few animals can survive the sudden and drastic environmental changes of the twice daily tides which alternately flood and drain much of the salt marsh. Marine animals, such as fiddler crabs, periwinkle snails, ribbed muscles, oysters, and clams, are especially adapted to deal with such rapid change by burrowing into the soft mud, called
pluff mud, or closing their shells to provide protection from predators and desiccation when tides are low. The only vertebrates that live year round in the salt marsh are diamond back terrapins, clapper rails, and a few small fishes. Many species of vertebrates and invertebrates, however, visit the salt marsh with the rising tide to prey on resident animals and on each other. Life in the salt marsh is therefore intimately connected to life inland and even the open ocean.

The food web includes grazers such as the salt marsh grasshopper and marsh periwinkle, while animals like shrimp, fiddler crabs, and mullet feed directly on detritus. Less mobile organisms such as oysters, clams, and mussels filter nutrients directly from the murky water, and scavenging crabs clean up dead organic matter. Predators at the top of the food chain include such birds as clapper rails, oystercatchers, pelicans, herons, and egrets, as well as many species of fish, notably red drum, spotted seatrout, and flounder.

Three-quarters of all recreational and commercially important fish and shellfish spend all or part of their lives in estuarine waters in and around salt marshes. Many species of shrimp, crabs, and fish utilize the marsh's narrow, shallow creeks as nurseries for their early larval stages. In addition to providing food and shelter for so many marine organisms, the salt marsh also filters pollutants and silt from coastal waters, and buffers adjacent highlands from wind and waves. Recent development activities, however, pose an ever-increasing threat to the well-being of these unique South Carolina features. Destruction of wetlands by housing and recreational developments, water quality changes due to pollution from industries, and overuse of natural resources are three major threats to this ecosystem.

**Non-Point Source Pollution in Coastal Waterways**

Wetland ecosystems have a unique ability to remove certain non-point source pollutants. Poisonous to fish and baby mammals, including human babies, nitrates from over-fertilization drain into a wetland soil. Due to the wetness of the soils, the soil microorganisms need a substitute for oxygen. So the microorganisms take the nitrates and break them down to release harmless nitrogen gas or nitrous oxides into the atmosphere. In addition, the active chemical nature of the organic matter that is abundant in wetland soils chemically traps many organic contaminants such as gasoline, oils, benzene, and PCB's.
Summary

The South Carolina Coastal Zone offers a diversity of landforms from white-sand beaches to estuaries floored with black mud. Every morning the sun rises over the Atlantic ocean to the east, and every evening it sets over the land to the west. In between it shines down on a rich, varied, and sometimes mysterious coast. Although it is a cliché to say it, change is a constant along the coast of South Carolina. Changing sea levels, currents, winds, and seasons all have their effect on the beaches of the Coastal Zone. Former beach locations are shown by parallel ridges of sand inland from the current beach. Movement of sand onto the beach and off, as well as along it, reshape the beaches themselves and the coast in general, making South Carolina’s beaches a dynamic as well as intriguing environment. Coastal areas are hit from time to time by massive storms called hurricanes. The combination of high winds, vast amounts of rainfall, and high water storm surges alter coastal landforms to a degree exceeded only by human engineering.

Between the beaches, the numerous bays, inlets, and estuaries are a different, but perhaps even more vibrant part of the Coastal Zone. They are breeding and feeding grounds for many sea creatures and much bird life, and, historically, these mixing grounds of fresh and salt water have also provided the means of support for numerous people. One may think naturally of fish and shellfish as the foodstuffs for early settlers living along the coast. From 1700 until the Civil War, rice was the basis of the economy of much of the Coastal Zone, and the foundation of a culture. Many who labored to grow the rice and to support the culture were slaves, brought to the South Carolina coast primarily from West Africa. Slaves provided not only a labor force but also the experience needed to grow and process rice, a labor-intensive crop common in some coastal areas of Africa. Without their skills and efforts the Carolina rice culture could not have existed, and without their traditions of crafts, such as basket making, and oral tales the culture would have been poorer.

Although rice has not been an important crop in the Coastal Zone of South Carolina this century, the richness of the area still affects its culture. Anglers, hunters, pleasure sailors, artists, vacationers, and others who appreciate this region where land and sea mingle, where fresh and salt water mix, are drawn to the Coastal Zone in huge numbers. Allowing access while protecting this region for the future is a serious challenge. Development and increased tourism are mixed blessings. Pollution, including non-point source pollution, is no blessing at all, but it is a problem that must be overcome. Education about the importance of these areas and their delicate balance is the best defense.
PLACES TO VISIT


Brookgreen Gardens. Located on Highway 17 three miles south of Murrells Inlet. For information call 803-237-4218.

Huntington Beach State Park. On Highway 17 across from Brookgreen Gardens. For information call 803-237-4440.

Rice Museum. In Georgetown on the river front area. For information call 803-546-7423.


REFERENCES AND RESOURCES


STUDY AREA 10: ESTUARIES AND TIDAL FLATS

Activity 10-1: Overview

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PERFORMANCE TASKS

(Iron Key) Overview = ; Science = ☀; Math = ☐; History = ☐; Language Arts = ☐

1. **Describe topography of estuarine environment.** 
   Use the WINYAH BAY LITHOGRAPH and the NORTH INLET TOPOGRAPHIC MAP to compare the appearance of as many natural features as you can distinguish. Locate and identify bays, beaches, creeks, estuaries, inlets, rivers, and swamps. Using the STATE BASE MAP #1, SHADED RELIEF, determine what distinguishes a bay from an inlet, a creek from a river, and an estuary from a swamp. Identify the direction and path of the water flowing through the Waccamaw River.

2. **Determine land use in estuarine environment.** ☀
   Use the NORTH INLET TOPOGRAPHIC MAP and the WINYAH BAY LITHOGRAPH to locate and identify cultural features such as rice impoundments (canals and dikes), ditches, roads, highways, houses, churches, and plantations. How are each of these cultural features related to the natural features described in Performance Task #1? Make as many correlations as possible and be prepared to compare and defend your answers with other individuals or groups.

   Also examine the LAND USE/LAND COVER MAP. What land uses are specified for the region around Winyah Bay and North Inlet? Does the stated land use fit the type of cultural features you located? Explain your answer.

3. **Distinguish among three categories of estuaries.** 
   Use the STATE BASE MAP #1, SHADED RELIEF, to locate all marsh areas in the Coastal Zone. Use information on the map and refer to the Background Information on page 10-3 to distinguish salt marshes from brackish marshes from freshwater. Mark the locations of these features on the map using a different color wipe-off pen for each category. What map evidence did you use to make your determination? What general conclusions can you present to be able to distinguish these types easily?
4. **Describe influence of geological events on coastal landforms.**

Describe the sequence of geological events which helped shape South Carolina's coastline. Explain the influence of the glacial era on present-day beach ridges and terraces, both on the Coastal Plain and off the coast on the continental shelf. What is the geologic age of the coastline of South Carolina compared to the rest of the state? In what general direction is South Carolina's coastline oriented?

5. **Recognize "chicken drumstick" shape of barrier islands.**

On the NORTH INLET TOPOGRAPHIC MAP and the WINYAH BAY LITHOGRAPH, observe the characteristic chicken drumstick shape often formed by barrier islands, which are constantly being reshaped by marine geologic processes. Some barrier islands show this drumstick shape more than others. For example, Debidue Beach (nearly an island) illustrates this shape. The north end at Pawleys Inlet is the bony narrow end of a drumstick, while the southern end of Debidue Beach is the rounded end. Look at the island just south of North Inlet. Which end of the drumstick is represented by the northern end of this island? Which end of Debidue Beach do you think is growing more rapidly? In general, which end of a South Carolina barrier island should exhibit evidence of beach erosion?

6. **Write historical fiction about the first rice crop.**

Read the story, "How Rice Came to the Carolinas," on page 10-6. Then write a new story that picks up where the original story left off. Write from the point of view of either Henry Woodward or the prince or princess. Use place names from the STATE BASE MAP #2, WITH HIGHWAYS, to add realism to the events in your story. Remember that the events took place in the 1680's.

7. **Identify counties where rice was planted.**

Rice became an important crop in the Coastal Zone during the colonial period. Using Figure 9-1, "Map of Colonial Agriculture," indicate with a wipe-off pen on the STATE BASE MAP #1, SHADED RELIEF the counties where rice was planted. Make a list of rice growing counties. What type of topography do these counties have in common? Why do you think rice was grown only in this region of South Carolina? Look at the LAND USE/LAND COVER MAP. What is the major land use in this region today? Why do you think rice is no longer grown in South Carolina?
ENRICHMENT

1. **Use tide tables to explain tidal range along coast.**
   The intertidal zone has played an important role in the shaping of South Carolina's coast. Illustrate with a diagram the effect of the Moon and the Sun on the tides. Show the position of the Sun, Moon, and Earth during each phase of the moon. Explain how these positions affect daily tidal changes along South Carolina's coast. What position of the Moon and Sun causes the most damage to occur during a hurricane? At most South Carolina beaches, tide charts are available. Why are people interested in knowing when high and low tides will occur?

2. **Find out how people lived and worked on plantations.**
   In the early 1900's, many years after the Civil War had virtually ended the Rice Plantation Era, Elizabeth Allston Pringle struggled to keep her plantation together by cultivating rice. Named Chicora Wood, her plantation was located up the Pee Dee River from Georgetown. Through two books, *A Woman Rice Planter* and *Chronicles of Chicora Wood*, Mrs. Pringle gives a vivid account of the rice plantation era. Find out how the people lived, worked, and played on a plantation in that period of time.

3. **Research how estuaries serve as filtering systems.**
   How do estuaries serve as filtering systems for pollution and storm water? Is there a limit to the ability of estuaries to serve as filtering systems? Explain.

4. **Model the effects of longshore drift.**
   This activity must be performed outdoors or in a large room with no obstructions. Divide the class into two groups. Students in the first group will represent individual sand grains on a beach. Students in the second group will represent ocean waves. The groups should line up in two parallel rows about two feet apart, facing each other. At a teacher's signal, each student in the "wave" group should step forward and gently push a student "sand grain" backwards. The "wave" students should retreat and the "sand grain" students should return to their original position. Longshore drift can be modeled by having "wave" students approach and push "sand grains" at an angle. Regardless of the push angle, "sand grains" must always return in a path perpendicular to the "shoreline".

5. **Diagram a typical food chain for salt marsh.**
   Construct a food chain diagram for a saltwater marsh on Winyah Bay. Next construct a similar food chain diagram for the freshwater marshes along the Santee River. Compare the results, noting the similarities and differences in the following areas: animal and plant life, microscopic organisms, soil composition, and environmental benefits. Why must we protect our South Carolina estuaries?

6. **Research story of Henry Woodward.**
   The legend of "How Rice Came to the Carolinas" (found on page 10-6) has little basis in fact except for the role that the Englishman Henry Woodward played. Yet the true life story of this rice planter who used the expertise of enslaved African laborers to begin the first successful rice plantation in South Carolina is almost equally as fantastic as this romantically Eurocentric tale of a princess from Madagascar and her beloved warrior.
Research the factuality of each of the following statements, as they relate to Henry Woodward’s life.

a. In 1666 Woodward booked passage on an English ship sent to explore the coast of South Carolina for the purpose of establishing an English colony.
b. After months at sea, the ship landed near modern-day Beaufort, SC.
c. When the ship was ready to return to England, Woodward volunteered to stay behind as a good-will ambassador to the Native Americans.
d. Soon after the ship left, he was captured and imprisoned by the Spanish.
e. He escaped and joined the crew of an English privateer engaged in acts of piracy against the Spanish merchant ships in the Caribbean.
f. Woodward was then shipwrecked on a Caribbean island during a hurricane.
g. He was rescued by a passing English ship which happened to be carrying the colonists he was supposed to be waiting for back in the Carolinas.
h. In 1670 the colony was established near modern-day Charleston.
i. In the 1680’s, a sea captain gave Woodward a bag of rice seed.
j. Experimenting with the rice, Woodward found it would grow abundantly in the Carolina marshlands.
k. By the time of the American revolution, South Carolina was one of the largest producers of rice in the world.
l. The heart of the rice empire was Waccamaw Neck, the narrow peninsula created by the Atlantic on the east and the Waccamaw River on the west.
The State
October 28, 1994
Scuba Divers Find Evidence of Ancient Forests Off S.C. Coast

Scuba divers exploring off the South Carolina coast have found evidence of an ancient underwater forest—a find that should provide new understanding of the evolution of the sea off the Southeast.

The site, in 55 feet of water about 15 miles offshore, has eight stumps from what are believed to be cypress trees about 10,000 years old. “Research will provide valuable geological data in an area where little has existed,” said Paul T. Gayes, a geologist from Coastal Carolina University.

It should also give scientists better information for predicting any future rises in sea level.

Jackie Epperson of Murrells Inlet and three fellow divers found the site last spring but didn’t tell anyone immediately. "It's kind of like seeing a UFO—you don't tell everybody," Epperson said. Finally the divers alerted Gayes.

"Basically what you have is old forest floor," Gayes said. Radiocarbon dating of soil samples indicates that the sea was at least 15 miles further east 10,000 years ago.

But the present rate of erosion at Myrtle Beach—about a foot a year—translates into only two miles every 10,000 years. Gayes says the rate slowed about 6,000 years ago, although the ocean’s landward migration continues.

He said the sediment from the forest floor is similar to that found in salt marshes, but peat also indicates freshwater vegetation. Pollen and fossils from the sediment have been sent to researchers to determine the types of vegetation, climate and environment of the ancient forest.

RATIONALE

The coastal bays, inlets, salt marshes, and estuaries of South Carolina have become an ever-increasing attraction to vacationers, photographers, anglers, hunters, and naturalists, because the landscape is so different from the inland areas. The Winyah Bay area contains examples of pristine tidal flat and salt marsh environments as well as the remnants of rice fields and other historical land uses. The remnants of once-thriving plantations provide an understanding of a long discarded way of life. The estuary itself is a breeding ground for many sea creatures. Estuaries provide an abundant food supply for fish and shellfish, offer excellent habitat for waterfowl and other wildlife, serve as a filter for pollution, and furnish a protective barrier against storms from the ocean. Winyah Bay also borders the port city of Georgetown, which even today plays a major role in the economy of the Coastal Zone.
**Brief Site Description**

**Old Beach Ridges**

Throughout the Coastal Zone, the distribution of wetlands, tidal flats, and even estuaries, to some extent, is influenced by the position of elongated, linear or arcurate (curved) beach ridges. These landforms are higher in elevation than the surrounding land and provide a very different habitat from tidal flat and marshland environments. As remnants of former shoreline positions, the ridges are mostly composed of coarse, well-sorted sand, characteristic of sand dunes or barrier island beachfront deposits.

As sea level changed, these beach ridges were alternately flooded and drained dry. Some ridges can be traced from land out into the ocean, indicating that shoreline positions of the past were not always exactly parallel to present positions. Where several beach ridges occur close together, they tend to form a wide band of raised **topography**, where most Coastal Zone development is concentrated. Because of their high sand content, beach ridges do not hold moisture well and can become very dry. Some of the plant communities characteristic of beach ridges are closely related to those of desert ecosystems, and are significantly different from the wet, muddy environments of estuaries, marshlands, and tidal flats.

**Bellefield Nature Center**

One of the foremost private nature preserves in South Carolina is Hobcaw Barony, 17,500 acres of land formerly acquired by the statesman Bernard Baruch. The land is now entrusted to the Belle W. Baruch Foundation to carry out studies in forestry, wildlife management, and marine science by South Carolina colleges and universities. The Baruch family initially purchased the property, including the rice fields and surrounding acreage around Winyah Bay, as a hunting retreat and vacation home. The original wood mansion burned nearly to the ground and was replaced by the present almost all-brick construction that faces Winyah Bay. For many years, the boat dock provided the only access to this plantation, even for visitors from nearby Georgetown. Famous visitors included President Franklin D. Roosevelt and British Prime Minister Sir Winston Churchill.

Today, the Hobcaw Barony mansion is preserved as a museum, and most of the grounds are devoted to nature study and to research in forestry and marine science. The Bellefield Nature Center, named for Baruch’s daughter, provides a variety of marine environmental programs for school groups as well as tours through the mansion and the nearby remains of the village of Friendfield, quarters for slaves who worked the plantation. The relatively pristine complex of estuary, tidal flat, beach ridge, and salt marsh habitats provides an important comparison to the more highly developed and altered environments of Debidue Beach immediately to the north. Unfortunately, Hurricane Hugo destroyed the Marine Laboratory on the site and killed many trees by saltwater poisoning during the storm surge.
Rice Cultivation

Most plantations in the Winyah Bay area specialized in rice cultivation. Along the rivers, plantation boundary lines were usually marked with ditches. Many of these ditches are still clearly visible on infrared aerial lithographs and topographic maps. In Waccamaw Neck, plantations were usually laid out as narrow strips of land running west to east between Winyah Bay and the Atlantic Ocean. The banks of the local rivers provided an excellent environment for tidewater rice culture because of the predictable ebb and flow of the tides. High tides naturally raised the level of the fresh water in streams, flooding the rice fields, while the low tides that followed dropped the level of the streams, draining the fields. The more dense salt water moving in with the tide caused the less dense fresh water to remain on top of the river. Dikes, levees, and other impoundments were constructed in such a way as to allow the upper, less dense fresh water layer to enter the fields while preventing the more dense salt water from contaminating the crops.

Once the dikes, ditches, canals, and banks were constructed and the fields cleared, rice trunks were built to allow water to pass over the rice fields. A rice trunk is simply a confined passageway in which the flow of water can be controlled connecting the rice fields with the river. Each rice trunk had a hanging gate at each end of the passageway. These gates could be opened manually by lifting or could swing open when pushed by floating water. To flood a field, the gate on the river side was raised during high tide, and river water rushed through the rice trunk, pushed open the swinging field gate, and washed over the rice fields. As the tide began to ebb and the river level began to fall, the field gate slammed shut to prevent any backflow of water into the river. When planters wished to drain the fields, the process was reversed. The field gate was raised during low tide, allowing the field water to wash through the rice trunk, push open the swinging river-gate, and discharge into the river.

The tools used to cultivate rice were crude by today's standards. Most of the work of rice culture was drudgery and took an immense amount of time and hard labor. The principle tool was the hoe. Other tools included the open-ended gourd for sowing the seed, sickles for harvesting the grain, wooden flails for threshing, and mortars and pestles for separating rice grains from the chaff.

Rice cultivation required a large number of slaves with year-round duties. Each month brought on different chores. In December and January, the stubble was burned from the previous year. Next, the fields had to be prepared by hoeing. Trunks, canals, and ditches had to be cleaned and repaired. Planting the crop, by dropping seed rice into shallow trenches, began in March and continued through April. Often a ball of clay was placed around each seed so that it would not float. Phases of the Moon were closely monitored so that the flooding of the fields at full Moon spring tide, the period of highest tides, would coincide with the sprouting of the rice. Water covered the rice fields for five days during this so-called "sprout flow." The fields were slowly drained during the next couple of weeks as the Moon changed to its first quarter phase, which brought a period of lower or neap tides. After fields were given two more hoeings, they were again flooded during the period called harvest flow and kept under water for six to eight weeks. During this time, the water was allowed to rise higher on the plants, keeping the water level just below the heads of the growing rice stalks.
Following the harvest flow, which usually came in late August or early September, the fields were drained and the stalks cut with sickles called rice hooks. The rice sheaves were bound, dried, and laid in parallel rows on a large sheet. Laborers began the task of separating the grain from the husk. Wooden flailing sticks were used to thresh the rice. Mortars were hollowed out of cypress logs, and pestles were used for removing the husks and polishing the grain. Harvesting was finished in November, just in time to begin the cycle of rice culture over again in December. During the peak period of rice cultivation, mills for pounding, the separation of the hulls from the kernels, were built along many of the local rivers. Some are still standing today as a reminder of the importance of rice cultivation to the economy of the Low Country of South Carolina.

**Slavery on Waccamaw River Rice Plantations**

From 1810 to 1860, slaves made up 85-89 percent of the total population of the Georgetown District. Figures from the records of Brookgreen Gardens indicate that, in 1860, “. . . the estate of Joshua John Ward owned 1,121 slaves. In that same year the estate listed 10,100 unimproved acres; 3,500 improved acres; an annual rice crop of 4,410,000 pounds; 1,260 pounds of rice produced per acre; and 3,933 pounds of rice produced per slave. The average price of a prime field hand was $700 to $1,200. Rice brought from 2.9 cents to 4.3 cents per pound.” In 1840, nearly half of the national production of rice came from the Georgetown District of South Carolina.

Slaves on rice plantations worked in what was called the “Task System.” Each slave had a specified task which was based on the worker’s age, ability, and physical condition. Categories of tasks were “full,” “three-quarter,” “half,” and “quarter.” The owner of Laurel Hill Plantation, Plowden Weston, defined a task as “as much work as the meanest hand can do in nine hours working industriously.” Slaves were given their task assignments in early morning. Once the work was complete, the slave could pursue personal interests. Slaves often worked together to help each other complete tasks, a tradition carried over from their original African culture. The singing of songs while working was another African custom which made the work seem to go faster and easier.

Both women and men worked in the rice fields, but the harder work of ditching, building embankments, and preparing the fields for planting was usually done by the men. Pregnant women were given maternity leaves of up to six weeks. The basic slave diet consisted of corn, peas, potatoes, and of course rice, along with a ration of molasses, salted fish, pork, and bacon. Each worker received two quarts of soup each day. The soup was usually made from fresh beef stock thickened with rice and garden vegetables.
An Antebellum Rice Recipe from a Plantation Cook
Compiled by Robin R. Salmon, Brookgreen Gardens Resource Sheet

1. Wash the rice well in two waters, if you don't wash 'em, 'e will clag and put 'em in a pot of well salted biling water.

2. You mustn't hab a heaby han' like 'e was 'tata or sich, but mus stir 'em light and generous so 'e can feel de water all t'rou. . .

3. When 'e done be sure you dish 'em in a hot dish les 'e take a sma't chill and go flat."

Figure 10A-1: Rice Trunk Gate

CROSS SECTION OF TYPICAL RICE TRUNK GATE

Trickster Tales

The African slaves who brought the rice culture to South Carolina also brought with them a heritage of trickster tales. The major animal trickster spoken about on the rice plantations of South Carolina was Brer Rabbit, who would appear in a variety of different roles. Common to all the trickster tales was the theme of a smaller, weaker animal or person defeating a larger more powerful animal or person by using his wits. The title "Brer" can be translated as "Brother," and along with the title "Sister," was commonly used in addressing others of similar social status. Many of the Brer Rabbit tales also qualify as Pourquoi Tales (taken from the French word for "why"), a literary style which uses encounters between animals and natural events to explain how the world came to be the way it is.
One time, Brer Alligator’s back used to be smooth and white as a catfish skin. When he came out of the water and lay down to sleep in the hot sun, he shined like a piece of silver. He was mighty proud of that hide, and all ‘round stuck up and pleased with himself in every way.

He and his wife and his family lived down in the river at the edge of a rice field down near Georgetown. They had plenty of fish to eat and never had to bother any of the animals on land. And they were so satisfied with themselves that they thought that there wasn’t anybody quite like them in the entire county. And they had no notion how true that was!

Well, one hot day in the fall, Brer Gator was resting himself upon a rice field bank, letting the sun soak into that bright back of his, when along came Brer Rabbit. Now Brer Rabbit had no love for Brer Gator, but he stopped all the same to pass the time, to have a little conversation. Brer Rabbit loved to talk with anyone. So rather than keep his mouth shut he goes out of his way to talk.

“Howdy, Brer Alligator. How is Sister Alligator, and all the young alligators making out?” Brer Gator didn’t even bother to reply at first. “Please God, they’re getting on just fine. But it’s no wonder that those children are smart and pretty and raised right, because they live right here in the river. I swear to God, I can’t see how you others get by living up on top of that dry, drafty land.”

Brer Rabbit got really angry with Brer Gator for being so set in his notion and so superior in his manners. But you know how, even when he’s angry, he can hide it, so Brer Rabbit just stayed calm and pretended that Brer Gator is a wise man and sighs and says, “Maybe so. We sure have been seeing a lot of trouble up here lately.”

“How’s that you’re talking about, Brer Rabbit--Trouble?” Brer Rabbit thought that Brer Gator must be joking with him. “How’s that, Brer Alligator! You never heard of--Trouble, Brer Rabbit shaking his head asks.” “No. I never heard about him, nor have I seen him. What does he look like?” “Oh, for crying out loud, Brer Alligator! Old as you is, and you haven’t seen Trouble yet?” “I tell you, Brer Rabbit, I ain’t never known nothing about this here Trouble. What does Trouble look like?”

Brer Rabbit is mischievous and scheming and he takes his chance to teach Brer Alligator a lesson. “I don’t know that I can tell you exactly what Trouble looks like. But maybe you’d like to see him?” “Of course I can show him to you, Brer Alligator, but maybe you won’t really like him so well when you actually meet him.”

Still full of himself, Brer Alligator says, “What are you talking about? I’m not worried about that. I just want to see him. If I don’t like him, that won’t matter to me at all.” “Well I’m pretty busy right now,” Brer Rabbit pretended. “Come now, Brer Rabbit! After all, it is me, Brer Alligator, that is requesting this from you, don’t forget that!”

“Of course, how can I forget that!” Brer Rabbit mocked him, only Brer Gator didn’t never recognize that Brer Rabbit meant to trick him. Brer Rabbit protested that he had to fix up his house and said that Sister Rabbit wasn’t feeling well, the children had to be watched and what all. Brer Alligator just kept on coaxing and begging ‘til at last Brer Rabbit agreed to show him Trouble. “Meet me here as
soon as the dew is dry on the grass next Saturday. Trouble may have some time off on Saturday.” And Brer Rabbit bid him good morning and went along down the road.

On came Saturday, and Brer Gator got up before dawn and started to make himself presentable. Sister Alligator woke up and asked, “Where are you going?” Brer Gator didn’t bother to answer, but Sister Alligator kept on asking until finally he said, “I am going out with Brer Rabbit.” Sister Alligator kept right on askin’ so Brer Alligator made a long mouth and tried to pay her no more attention, but Sister Alligator knew how to handle him. So after a while he told her that he was going to meet Trouble. Sister Alligator says, “What is Trouble?” Brer Alligator answers, “How do I know? That’s what I’m going to see.” “Can I go along,” asked Sister Alligator. “No,” says he. But after he saw that the woman would not shut up he said, “All right, you can come along.” His patience was worn thin.

After a while all the little alligators noticed their pappy and their mammy fixing themselves up and then nothing would have it but they had to go too. Then they fixed themselves all up too with mud on their heads, marsh on their backs, and moonshine on their tails and didn’t they think they looked fine! About this time Brer Alligator looked out the door and saw that the dew was almost gone, so he called them all to come on. They all came out crowding each other, going down the rice-field bank to wait for Brer Rabbit. They hadn’t been there long before Brer Rabbit came along and when he got to where they were, he was surprised to see the whole family there. He laughed to himself, but he didn’t say anything but “Howdy” to Brer Gator and his wife. He told them, “How nice your children look today!” But all the time he was saying to himself, “Oh Lord! This is an ugly gang of people, aren’t they? And just look at those clothes!”

All the little alligators were so excited because they feared Brer Rabbit was going to send them home that they danced about for joy. Brer Rabbit wanted to laugh but instead he just looked at his watch and knitted his brows and said, “Time to get going, I guess.”

So they all started down the rice field bank, Brer Rabbit and Brer Gator leading off, with Sister Alligator walking behind to make the little alligators behave themselves. But they wouldn’t hardly mind her, they played along, dawdled, or fought ‘til they almost drove her crazy.

Brer Rabbit led them up through a patch of woods until he got to a field grown over with broomgrass and briar! The grass stood like pure gold. The path they took went straight through this big field. When they got to the middle of the field he stopped and cupped his ear and pretended to be listening for something. “Sh! Sh!” he told the children. Sister Alligator said, “Sh! Sh! Or I’ll lick the tar out of you! Shh! Shh!”

Brer Rabbit listened some more and then he shouted out, “Who is that calling Brer Rabbit?” Then he pretended that he heard something more, and he yelled back, “Yes, it’s me. What do you want with me?” He cupped his hand to his ear again, and then he said, “I am coming right now.” And he turned to Brer Gator and told him, “I beg your pardon, but somebody is calling me away for a minute on business. Please excuse me. Wait right here, and I’ll be right back.” “We aren’t going anywhere,” Brer Gator promised.

Brer Rabbit made a low bow and ran along the path out of sight. That deceitful devil ran until he got to the edge of the wood, and he sat down and chuckled to himself like he was tasting the fun before it started. Then he got down to business.
He smelled the wind and looked which way it was blowing. Then he pulled a handful of that long, dry broomgrass down, pulled a match from his pocket, struck it and lit the broomstraw blowing on it till the grass caught fire good. Then he ran along the edge of the field and set the field ablaze all around. When he was finished, he got up on a safe high stump where he could see good and he sat down.

All the while Brer Alligator was back in the center of the field trying to rest with Sister Alligator and all the little alligator brats just pestering him to death saying, “Which way are we going to find Trouble? How long do we have to wait?” They sat and they sat until finally the wind caught the fire and the fire flared high and the sparks and flames flew way up in the sky. One of the little alligators saw that and he hollered, “Oh look! That must be Trouble! Trouble is pretty! Trouble is pretty!” Then all the little alligator brats sang out, “Trouble is pretty!”

But at last one of the hot sparks landed right on one of the little alligators’ back. He screamed and cried, “Trouble hurts!” His mother smacked him in the jaw and told him to mind his manners and to shut up, and to look at how pretty Trouble is. But just as she did that, a big spark lit on her and burned her bad. She started jumping around and hollering, “It’s true; Trouble hurts!” And they remembered then who they had forgotten. They called, “Brer Rabbit! We don’t want to see no more Trouble, Brer Rabbit!” By this time the sparks began to burn the whole bunch and they were so mixed up they didn’t know what to do. They ran around and ran around this way and that, to get away, but everywhere they turned was fire. They hollered and hollered, “Brer Rabbit, where are you? Call to Trouble, Brer Rabbit! Come for us!”

But Brer Rabbit didn’t come and he didn’t say anything. And very soon the fire got so close to those gators that they couldn’t hold their ground any longer. They stopped calling Brer Rabbit, and got ready to get through the fire the best they could. They didn’t have any notion left in their head but, Get Home! They went right through the scorching flames right past Brer Rabbit on the stump but they were going too fast to see him. “Wait, Brer Alligator!” he shouted, “I guess you have seen Trouble now! Get back in the water where you belong. And don’t ever hunt Trouble again.” And they didn’t stop either ‘til they got to the rice field bank and jumped in the river with a “Swish-ss-sh.” When they finally got a chance to look at each other they found that their white skin was just as black and crinkly as a burned log of wood, and as rough as live oak bark. From that day to this, alligators have had a horny hide.
Activity 10A-1: Plantations and the Rice Culture

<table>
<thead>
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<tr>
<td>6 STATE BASE MAP #1, SHADED RELIEF 1: 500,000</td>
</tr>
<tr>
<td>6 STATE BASE MAP #2, WITH HIGHWAYS 1: 500,000</td>
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<tr>
<td>6 LAND USE/LAND COVER MAP 1: 500,000</td>
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<td>6 GENERAL SOIL MAP 1: 594,000</td>
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<td>6 GEOLOGIC AND MINERAL RESOURCE MAP 1: 1,000,000</td>
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<tr>
<td>6 WINYAH BAY LITHOGRAPH 1: 18,000</td>
</tr>
<tr>
<td>1 State Map of Major Drainage Basins Figure 1-2</td>
</tr>
<tr>
<td>6 Wipe-off Pens</td>
</tr>
</tbody>
</table>

PERFORMANCE TASKS (Icon Key) Overview = ; Science = ; Math = ; History = ; Language Arts =

1. **Locate the study site.**
   Locate the Winyah Bay Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the GEOLOGIC AND MINERAL RESOURCE MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Locate natural and man-made features.**
   Compare the NORTH INLET TOPOGRAPHIC MAP with the WINYAH BAY LITHOGRAPH. Locate North Inlet, Waccamaw Neck, Debidue Beach, Debidue Creek, Bellefield Plantation, Arcadia Plantation, Bellefield Nature Center, US Hwy. 17, and old rice field impoundments along the Waccamaw River and Waccamaw Neck. How is the Waccamaw Neck area drained? Use a wipe-off pen to indicate drainage patterns. Locate the major drainage ditch extending from US Hwy. 17 to Debidue Beach. Determine the direction the ditch water is flowing by using the contour lines on the topographic map. Just barely visible on the lithograph are the original drainage ditches running in almost parallel bands in an east-west direction. These ditches marked the boundary lines between original land grant plantations and provided the owners access to both the Waccamaw River and the Atlantic Ocean. Locate a spoils pile of dredged material on the bank of the Waccamaw River.

3. **Compare marsh and wooded areas.**
   Refer to the NORTH INLET TOPOGRAPHIC MAP and the WINYAH BAY LITHOGRAPH. Notice, especially on the lithograph, several arc-shaped patterns of land covered by trees and other vegetation that have formed on ancient dune ridges over a long period of time. Analyze the topographic map symbols representing marsh and wooded areas to distinguish between areas of maritime (coastal) forest and tidal zone marshes on the topographic map. Compare these same areas on the lithograph and determine the type of vegetation present by using your understanding
of false-color infrared photographs, by referring to Figure 3, "Interpreting Infrared Images," in the Introductory Section, and by using the specific color codes below. Focus on the different hues of reds and grays to identify the different types of foliage found in maritime (coastal) forests, old rice fields, and oceanfront beach areas.

- gums, cypress, oaks (leaf-off condition - winter) = gray-green to very dark red
- pines and other evergreens (with leaves) = red to grayish-red
- estuaries or saltwater marshes = various shades of purplish-gray.
- brackish-water marshes or rice field impoundments = blue-gray or steel-gray
- rice field impoundments planted with a winter cover crop = bright pinkish-red.

4. **Analyze changes through time.**
   On the NORTH INLET TOPOGRAPHIC MAP, notice the features shown in purple. These represent developments or changes which have occurred between 1942 when the topographic map was first printed and 1973 when the photorevised version was printed. Identify major new features not present on the original map. What section of the map area has experienced the most change? How many of these changes are man-made? How many have occurred naturally? Why do you think these changes have occurred? How many of these changes can you recognize on the WINYAH BAY LITHOGRAPH? In what year was the aerial photograph taken? Circle and explain any additional changes which occurred between the time the map was revised and the time the photograph was taken. Does the difference in scale make it easier to recognize changes on the lithograph or the map? Explain your answer.

5. **Locate several plantation sites.**
   The NORTH INLET TOPOGRAPHIC MAP names two plantation sites still in existence. Locate these plantations. Discuss the strategic location of each in relation to rice fields, water transportation, and inland roads. Based on map data, explain why you think planters chose these particular locations for their plantations.

6. **Examine parallel remnants of former beach ridges.**
   With the NORTH INLET LITHOGRAPH, locate several parallel beach ridges left by a previous shoreline. Describe the terrain and vegetation of the beach ridges and compare to the terrain and vegetation of marsh or tidal areas. Are the older beach ridges exactly parallel to the modern shoreline? How many different beach ridges can you identify? Assume differences in vegetation (color) are caused by differences in elevation. Is the elevation of each ridge is constant? Explain your answer.

7. **Analyze the newspaper article.**
   Read the newspaper article on page 10A-1, "Scuba Divers Find Evidence of Ancient Forests Off S.C. Coast." Explain how the story relates to the Coastal Zone Landform Region. Identify on the STATE BASE MAP #2, WITH HIGHWAYS, (refer to the COASTAL SATELLITE IMAGE if needed), where the places and events named in the story might be located. Explain why the publisher thought this story might be of interest to newspaper readers. Using the same references and setting, write another newspaper article related to the same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose a title (headline) and draw an appropriate picture to illustrate your main point.
8. **Estimate size of average rice field impoundment.**

Using the [NORTH INLET TOPOGRAPHIC MAP](#), estimate the size (in acres) of the average rice field impoundment along the Waccamaw and Pee Dee rivers. Use a ruler to measure the dimensions of 5-10 fields before calculating the average field area in square inches. Assume fields are separated by drainage ditches. Use the scale bar on the map to convert your answer to square feet, and then convert your answer to acres (1 acre = 43,560 square feet). Also determine the median and the mode of your statistical data. Notice the map patterns made by the rice field impoundment ditches which regulated the water entering and leaving the fields. Why do you think the ditches were dug perpendicular to the rivers? Would you have placed the ditches differently? Explain your answer.

9. **Outline steps necessary for planting rice.**

Cultivating rice was a year-long, labor-intensive process. Using the paragraphs entitled "Rice Cultivation" on pages 10A-3 and 10A-4, make a year-long histogram (timeline) outlining the steps for cultivating rice. Next, answer the following questions. In what months was rice planted? Why was it necessary to flood the rice fields? List any other advantages you can think of to flooding the rice fields periodically. How long did it take rice seeds to mature? When was rice harvested? After removing the rice from the fields, what was the next step in preparing it for the market? Why was rice cultivation such a labor-intensive crop? Refer to the [WINYAH BAY LITHOGRAPH](#) and the [NORTH INLET TOPOGRAPHIC MAP](#) to identify possible locations where each of the above steps would have been carried out. Also locate Bellefield Plantation, where the owners lived, and the slave community of Friendfield. Lastly, identify possible routes by which the final product was taken to market.

10. **Graph and analyze rice production.**

Use Figure 10-1, "Comparison of State Agricultural Production, 1860," to calculate each state's percentage of rice grown in relation to the total United States rice production. Rank these states in descending order according to rice production. What place did South Carolina hold in this ranking? Make a pie graph showing the percentages for the top four states. Have one slice show all other states combined. How did our neighboring states, Georgia and North Carolina rank? Using only your percent rankings and your knowledge of the topography necessary for rice production, compare South Carolina's coastal region with that of Georgia and North Carolina.

11. **Analyze why escape was difficult for slaves.**

Study the [NORTH INLET TOPOGRAPHIC MAP](#) and the [STATE BASE MAP #1, SHADeD RELIEF](#). Why do you think escape was extremely difficult for the African slaves during the period from the early 1700's to the mid 1800's? What were the problems they encountered in escaping from plantations? Before the advent of highways, where could they go?

The fanner basket, still available for purchase in sweet grass basket stands along the coast, was used during harvest to separate the grains of rice from their husks. People in Sierra Leone, Africa, still make a basket very similar to those made in South Carolina. Enslaved Africans brought this rice-related craft to South Carolina along with their methods of cultivating rice. Pretend to be a two hundred year-old fanner basket handed down through eight generations in a South Carolina family. Give yourself a voice. Write an eight stanza poem with four lines per stanza. Include references to rice cultivation, local landscape and local history in each stanza. Refer to several landform characteristics in the Winyah Bay area as you tell your story.

13. Solve Alexander the Ant's problem.

Alexander the Ant lives in a rice field on the Waccamaw River. He moved in when the rice was beginning to grow and did not need additional irrigation. He worked hard to store up 3,000 rice grains for his future food supply. Now Alexander has overheard some field workers say that the land is going to be flooded soon for harvest, so he has to move back to his old home 1,000 feet away. Alexander decides he wants to take the rice he has collected with him. As he begins his journey, he finds he can only carry 1,000 rice grains at a time. He has to eat one rice grain for every foot that he travels in order to keep up his strength.

Alexander's problem: What is the greatest number of grains that he can amass at his new home?

14. Explain relationship of physical setting to Pourquoi Tale.

The Brer Rabbit story (found on page 10A-6) is set in a rice field. Using the NORTH INLET TOPOGRAPHIC MAP, find the ditches along the rivers that marked the boundaries of the old rice plantations. Considering elements visible on the topographic map, decide what kinds of settings will be favored by the future tellers of Pourquoi Tales in this area. What do you think is the most popular medium for storytelling today? How does this medium tie together stories with their physical setting?

15. Write your own Pourquoi Tale for this region.

The Brer Rabbit story (found on page 10A-6) explains why alligators have a horny hide. Use the following list of suggestions, or your own mental list of observations of Low Country land and sea scapes, flora and fauna, etc., to develop a Pourquoi Tale of your own (remember pourquoi means "why" in French). You may choose to use a known folk hero like Brer Rabbit or you may choose to develop a wily trickster character of your own, or you may make yours a romantic tale. To borrow the phrase of famed African-American folklorist Zora Neale Hurston, what should follow will be "lies above suspicion." The only requirement is that in the Pourquoi Tale tradition you explain some fact of nature in a memorable way that totally ignores science. Above all, relax and have fun with your story! Remember to give your tale an intriguing title.

* Why so many cockroaches live in the South Carolina Low Country
* Why seagulls are such greedy birds
* How the sea islands came to protect the mainland
* How the oyster got such a homely shell but the sweetest juice
* How sea grass learned to dance so gracefully
ENRICHMENT

1. **Determine effect of end of slavery on rice cultivation.** Some sources say that the Civil War and the abolition of slavery greatly impacted the rice industry in South Carolina. Others credit the series of terrible hurricanes that struck the Carolina coast with ultimately making the growing of rice unprofitable. Do some research and try to settle this question for yourself. After researching the impact of hurricanes on rice cultivation in the state, use the voice of either a rice planter, an overseer or the descendant of an enslaved African-American field-hand living in the early part of the twentieth century to explain the effect of hurricanes on the cultivation of rice.

2. **Invite a storyteller to perform for the class.** Invite a storyteller who includes Brer Rabbit or Gullah tales in his or her repertoire to perform for the class.

3. **Collect samples of Pourquoi Tales.** Make a list of stories you are familiar with which explain some aspect of nature. Try to include one from as many different cultures as possible. You may be familiar with tales such as “Why Mosquitoes Buzz in People’s Ears” and “How the Elephant Got Its Trunk.” Discuss the ways these tales are alike and the ways they are different. Decide which ones are most familiar and why. What physical environments are described in each of these stories?
The Greenville News
January 31, 1995

Soft Sand Added Danger near Beaches

Wading is outlawed in the deadly currents of Breach Inlet between the Isle of Palms and Sullivans Island, but there's also a lesser-known danger: soft sand that tugs at the feet of unwary beachcombers.

The soft, wet sand near the water's edge recently pulled one Mount Pleasant man thigh-deep as he collected seashells with his wife and son.

The 5-foot-10-inch man sank without warning. His wife and son also began to sink as they tried to pull him to safety.

"That sand was like a vise. The more I struggled, the deeper I sank down. It was endless," the man, a retired law enforcement officer, said. The man, who asked not to be identified, said he bent forward on his stomach to break the suction and released himself from the sticky pull of the sand.

"That's the best thing, to bend over or lean backward," said Michael Katuna, who heads the College of Charleston's geology department. He said bending at the waist reduces the surface area of the body and the weight being pulled down.

Isle of Palms Police Chief Jim Arnold said he knows exactly what the man is talking about.

"That's happened numerous times," Arnold said. "Any time there's a tide change, it will literally suck the sand from under your feet and you'll fall down."

RATIONALE

Hurricanes have visited the South Carolina coastline repeatedly both during recorded and prerecorded history. Some of these unwelcome visitors have ruined entire harvests, flooded plantations and cities, destroyed houses and businesses in coastal communities, and killed thousands of people. During several of these hurricanes, storm wave action has cut through barrier islands to create new tidal inlets, washed beach sand over into marsh lands, and significantly altered the shape of the coastline. The North Inlet Study Site highlights the physical changes that Hurricane Hugo produced in the Winyah Bay area of South Carolina as seen from a comparison of two aerial photographs, one taken before the hurricane and one taken just after the storm. It also provides an opportunity to recount tales of prior hurricanes in this part of the state and to analyze human reactions to this type of natural disaster.
Brief Site Description

Shoreline Changes Due to Major Storms

Because South Carolina's beaches and barrier islands are composed of loose sand, they can be moved or changed significantly in a very short time by major storms and, to a more limited extent, by normal wave and tidal action. Erosion and subsequent deposition of sand can cause tidal inlets to migrate, islands to disappear, lagoons to be filled in, and river estuaries to shift course. Significant storms can produce washover deposits, where beach sand is washed or blown over tidal flat or salt marsh deposits, and extensive shoreline erosion, including the creation of new tidal inlets whenever waves cut new channels through existing barrier islands. Each time shoreline changes occur, the pattern of sediment distribution also changes. Most tidal inlets produce ebb tidal deltas from sediment that is flushed out of tidal channels with the outgoing tide. The sediment accumulates just offshore as a succession of shallow sand bars which are easily visible on infrared aerial photographs.

Comparing a succession of maps or photographs from several decades is the most practical way to document the specific shoreline changes that have occurred along the coast. Within the Study Site, the area around North Island provides an excellent example of the dynamic changes that can occur on barrier islands. A study of the shoreline movement of North Island, based on data from several 7.5 minute United States Geological Survey Topographic Maps, compared the location of the shoreline of North Inlet over a period of more than 100 years. Results indicated that during this time, North Inlet had experienced extensive positional changes.

Figure 10B-1: North Inlet Migration
Famous South Carolina Hurricanes

The most dramatic changes to coastal landscapes are the direct result of irregular and unwelcome hurricanes and other tropical storms which affect the state on the average of every four to five years. During the Colonial Period, these storms were called September gales. Often the crops in an entire county were destroyed just before harvest time.

Hurricanes are usually born in the tropical and subtropical North Atlantic Ocean, near the Cape Verde Islands off the coast of Africa, in the Caribbean Sea, or in the Gulf of Mexico. The eye of a hurricane is strangely calm due to its higher pressure as air within the eye gradually descends and compressively warms, but it is surrounded by the eye wall, the part of the storm with the most destructive winds and intense downpours. If the eye of the hurricane moves over land during high tide, the damage increases because the storm surge is piled on top of an already higher sea level. Storm surges are usually highest under the northeast side of the counter-clockwise turning storm (in the northern hemisphere), and can sometimes submerge an entire low lying island.

Many hurricanes are remembered long after they occur because of the tremendous destruction to life and property. Hurricane Hazel hit shore around the North Myrtle Beach area in 1954, while Gracie hit St. Helena Island outside of Beaufort in 1959. Both of these hurricanes caused tremendous damage and made major changes to coastal beach boundaries. In modern times, hurricanes are constantly monitored by both the National Weather Service and the South Carolina State Climatology Office. Warnings are reported on the news in advance of landfall in order to keep the public informed. On numerous occasions, as the hurricane approaches, beaches are evacuated to protect people from harm. Hurricane warnings must be taken seriously, as past experience tells us of the likely dangers associated with these unwelcome visitors from the sea.

Figure 10B-2: List of Famous South Carolina Hurricanes

<table>
<thead>
<tr>
<th>NAME</th>
<th>DATE</th>
<th>WHERE EYE ENTERED</th>
<th>DAMAGE</th>
<th>LIVES LOST</th>
<th>STORM CLASS</th>
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<tr>
<td>none</td>
<td>1893</td>
<td>Savannah</td>
<td>$10 million</td>
<td>2000</td>
<td>H</td>
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<tr>
<td>none</td>
<td>1911</td>
<td>Beaufort</td>
<td>$1 million</td>
<td>17</td>
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<tr>
<td>Hazel</td>
<td>1954</td>
<td>SC-NC Line</td>
<td>$27 million</td>
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<tr>
<td>Gracie</td>
<td>1959</td>
<td>St. Helena Is.</td>
<td>many millions</td>
<td>several</td>
<td>H-3</td>
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<tr>
<td>David</td>
<td>1979</td>
<td>Savannah</td>
<td>$10 million</td>
<td>N/A</td>
<td>H-2</td>
</tr>
<tr>
<td>Hugo</td>
<td>1989</td>
<td>Charleston</td>
<td>$6 billion</td>
<td>35</td>
<td>H-4</td>
</tr>
</tbody>
</table>
Figure 10B-3: Map of Major South Carolina Hurricanes: 1893-1989

MAJOR HURRicanes AFFECTING SOUTH Carolina

1893 - * * *
1911 - * *
1954 - HAZEL - * *
1959 - GRACIE - * *
1979 - DAVID - * *
1989 - HUGO - * *

Adapted from Kovacik & Winberry
The Hurricane of 1893

The following excerpt is taken from a personal account told by Dr. J. Ward Flagg, about his family’s vacation at Magnolia Beach.

It all happened on the 13th—a bad luck day the 13th—a Friday too, the 13th of October 1893, when the great storm came and made the new Inlet and filled up the old Inlet. . . .

It was ten o’clock in the morning when the terrible storm blew out of the east . . . all at once it got blacker and blacker so that it was like the middle of the night. The big waves began to come way up the beach, rushing toward the house and we stood, my father and my brother and I, to watch the storm. My father said, “I am afraid we may lose the house.” I got two axes and began tearing away the floors in the piazza . . . so that the rooms downstairs could fill with water and keep the house down. But the roof of the porch caved and I said—Run—everybody—run and swim all to the tree . . . the tree was an old gnarled husky cedar, very strong and spreading. There were fifteen servants . . . my father was 65 but my mother was 60 and she was in her prime. We got to the tree and we all crowded under the spreading branches and held on tight as we could but the water kept sweeping over us and then we would be beaten under again. My little niece was with me and I took a piece of the flooring I had split off and braced her with the nurse’s son in a crotch of the cedar tree. We held on like leeches—lashing (locking our) legs and arms over and around the cedar.

He (my father) put his arms around her (my mother’s) waist and held her up close to him and she put her arms around him right under his arm pits . . . she would try to push him up when the water came and he would get down on the tree and try to push her up. The last time I saw them come up, they were just like always . . . my father had her close in his arms. Maybe they could have gotten out of it if it had not been for a wire fence my father had put around the house. The water came just like a wall around us and the fence wrapped around anybody who tried to swim through it.

All at once, just like it had come on us, the wall of water began to go down again . . . in a little while the tree was not under water and my niece, and my man here and five servants were clinging like leeches. . . . The house was gone and they (my father, brother, and mother) were all gone . . . It all happened on the 13th of October. . . . It was Friday and Friday the thirteenth is a bad luck day.”
Without question, the worst storm to ever hit the city of Charleston was hurricane Hugo in 1989. It was classified as a Category Four Storm, which means the top wind speed is between 130 and 150 mph. At midnight, on September 21, 1989, the eye of the hurricane passed over Sullivan's Island with winds of 135 mph. In the city, 80 percent of all the buildings sustained some roof damage. The city lost electricity, water and telephone service. Four people were killed by the storm, and final damages in the Charleston area alone were estimated at around three billion dollars.

In all, South Carolina lost more than $6 billion and nearly 7,000 jobs in tourism and trade. When Hugo hit the South Carolina coast, 300,000 people were left without electricity, 70,000 people were left homeless, nearly 10,000 buildings were destroyed, 94,000 people had to evacuate to 439 Red Cross shelters, and 35 people died.

Almost everyone in South Carolina was affected in some way by Hurricane Hugo. And almost everyone has a story to tell that recounts those events and reports their feelings, just like South Carolinians who encountered hurricanes in previous years also had their stories to tell. For example, a historical footnote to the story of Dr. J. Ward Flagg's father, Dr. Arthur Flagg, is that his pocket watch was discovered still ticking in the vest covering his half-buried body after the hurricane of 1893. There are also stories of strange recurring figures who warn people of impending storms. You may have heard of the ghost of the Gray Man who supposedly walks the beach just prior to an incoming hurricane. Have you wondered if anyone saw him just before Hugo?

Following are the poems of three students who told about their experiences with Hurricane Hugo. Notice as you read these poems that they each tell the same story from a different point of view.
Hugo Stories
Edited by Lyn Zalusky Mueller

Hurricane Hugo
Elizabeth Kurlan, 7th grade, Hanahan Middle, Hanahan

Hurricane destroys,
Under the blackness of night
Reeling houses violently.
Rain beating against windows like drumsticks.
Intense winds are howling
Changing their speed and direction.
All trees tremble and collapse
None spared from Hugo's wrath.
Everyone sits in their houses

Hoping the storm will pass.
Under bushes, animals take cover
Grasping for branches of safety; but
On goes Hugo, tearing through the land.

The Winds Blew
Chad Hayes, J.V. Martin Junior High, Dillon

I sat in silence.../ And the winds blew.
I watched the trees bend back and forth / And the winds blew.
I listened to the leaves holding on for their life / And the winds blew.
I heard a big crash / And still the winds blew.
The morning sun rose over the horizon / And the winds blew no more.

Hugo Speaking
Ben War, 8th grade, Westview Middle, Goose Creek

Well, my name's Hugo and I'm here to say,
I was the baddest hurricane in the U.S.A.
I chewed up counties and I spat them out,
made everyone scream and shout
blew away Charleston and flooded it too
made all the purple turn a greenish hue.
The insurance companies were having fits
because the people were claiming wherever I hit.
The Isle of Palms was practically rubble.
As you can see I am nothing but trouble.
I sent tornadoes down in my wrath,
Destruction was the aftermath.
I smashed everything as I came inshore,
But I fizzled out and I was no more.
Activity 10B-1: Hurricane Hugo

Materials

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PERFORMANCE TASKS

(Icon Key) Overview = ; Science = ⚫; Math = ▶; History = ▶; Language Arts = ✡

1. **Locate the study site.**  ⚫

   Locate the North Inlet Study Site on the STATE BASE MAP #2, WITH HIGHWAYS, on the LAND USE/LAND COVER MAP, on the STATE GEOLOGIC MAP, and on the GENERAL SOIL MAP by drawing a small box around the correct site on each map using a wipe-off pen. Briefly summarize the one or two most important land uses at this site, the age (Geologic Period), the type of rock at the site, and the predominant soil type at the site. Use the scale bar on the base map to estimate the straight-line distance between this study site and your school. In which local river drainage basin (watershed) is this site located? Through which of the major river systems, Savannah, Santee, Pee Dee, or Coastal Plain, does this site drain? Refer to Figure 1-2, "State Map of Major Drainage Basins."

2. **Analyze the newspaper article.** ✡

   Read the newspaper article on page 10B-1, "Soft Sand Added Danger Near Beaches." Explain how the story relates to the Coastal Zone Landform Region. Identify a possible location on the NORTH INLET TOPOGRAPHIC MAP (refer to the NORTH INLET LITHOGRAPH if needed) where a similar story could have taken place. Explain why the publisher thought this story would be of interest to newspaper readers. Using the same people as characters and your setting, write another newspaper article related to this incident, but date it either before or after the given story occurred. Choose an appropriate title and draw an appropriate picture to illustrate your main point.

3. **Compare pre and post Hurricane Hugo features.**  ⚫

   Compare the WINYAH BAY LITHOGRAPH to the NORTH INLET LITHOGRAPH. These two images cover nearly the same area and can be examined side by side. Is there a difference in scale? What is the time interval represented by these two images? What major changes are seen in the post-Hugo image? Compare the sand overwash areas. Identify the changes in vegetation cover. In processing infrared aerial lithographs, color balance is usually maintained so that accurate comparisons can be made. Although the color balance between these two images is not perfect,
the difference in red coloration (representing vegetation) is distinctive. Locate the reddish-brown area on the landward side of the beach. These are trees damaged by Hurricane Hugo. Notice the tidal creek patterns along the salt marsh. What does this feature tell you about the elevation of the landscape? What changes do you predict will happen to this coast during the next major hurricane? Examine evidence for water flow direction in the tidal inlet to determine if the tide is going in or coming out. Compare the two lithographs. What are the major differences?

4. **Assess extent of Hurricane Hugo damage.**
   
   The **COASTAL SATELLITE IMAGE** was taken from 438 miles above the Earth in 1990, several months after Hurricane Hugo ripped through the state. By analyzing the color differences, especially the red that indicates vegetation, you will see that Hurricane Hugo's path is clearly visible. Follow the path of the swath starting at the coast between Charleston and Georgetown and move northward parallel to the Wateree River. Compare the color of the floodplain areas just northeast of Lake Moultrie and Lake Marion to the color of the floodplains southwest of these lakes. Use the **STATE BASE MAP # 1, SHADED RELIEF** to make a list of the counties and river systems that suffered significant damage from Hugo.

5. **Outline changes in North Inlet since 1872.**

   Using Fig. 10B-1, “North Inlet Migration,” trace each change in shoreline position, with a different color wipe-off pen, on the **NORTH INLET TOPOGRAPHIC MAP**. The shoreline movement shows the dynamics of the erosion and deposition patterns typical of barrier islands. What has happened to the north end of the island at North Inlet? What are the dynamics of this movement? What is the time interval between each of these maps? Has Town Creek undergone much change? Explain the pattern of changes over the last 100-year period. Predict where the shoreline of the North Inlet will be in the year 2000, 2025, and 2050. Make appropriate drawings on the topographic map with a wipe-off pen.

6. **Estimate buildup of sand at inlet.**

   Locate Debidue Beach and Pawleys Island on the **NORTH INLET TOPOGRAPHIC MAP**. One significant difference between Debidue Beach and Pawleys Island is the fact that Pawleys Island has been extensively developed. Note the purple area on the south end of Pawleys Island indicating the deposition of sand during the period between 1942 and 1973, when the map was revised. Do you think this purple area is a good location on which to build a beach house or condominium? Why or why not? Measure the length of the sand bar (sand spit) in the purple area. Use the scale bar to determine this distance in feet. Based on the publication and revision dates listed on the map, calculate the average linear rate of deposition of sand in feet per year. Do you think this rate will continue indefinitely? Explain. Measure the width of the sand spit in several places and calculate the average width in feet. Assume that the sand depth is five feet, and estimate the total volume of sand, in cubic feet, added to the area between 1942 and 1973.
7. **Trace shoreline position during storm surge.**

Looking at the NORTH INLET TOPOGRAPHIC MAP, identify several elevation points marked in black by an "X" with the number nearby. Some of these numbers are accompanied by the letters BM (abbreviation for Benchmark) and a black triangle. What is the highest elevation marked on this topographic map? Locate several benchmarks along US Hwy. 17. Determine the average elevation of this highway. Also determine the elevation of at least two plantations listed on the map. What would happen to this area if sea level rose 20 feet? What would happen to the plantations? Using a wipe-off pen, draw a line on top of the 20 foot contour line on the topographic map. This was the approximate height of the Hugo storm surge, which was actually 18 feet. Another factor involved in the total height of the storm surge is the tidal phase. Hurricanes hitting at times of high tide can receive an additional 5-10 feet of storm surge. How much of the land on the map would be covered by salt water if the storm surge rose to the 30 foot contour mark?

8. **Evaluate effects of hurricanes on rice impoundments.**

What happens to the dikes, ditches and canals associated with rice fields after a major hurricane hits these coastal areas? Describe what you think rice impoundments looked like shortly after Hurricane Hugo. Now describe what you think might have happened to rice impoundments after the two hurricanes hit the coast in 1904 and 1906. Why do you think planters abandoned rice cultivation after these major hurricane disasters?

9. **Tell your favorite hurricane story to your group.**

Read the "Hugo Stories" on page 10B-7. Try to remember where you were the last time a hurricane hit South Carolina. If a hurricane has not come to your area recently, ask your family members or neighbors for stories they may recall about a hurricane. Tell your group your favorite Hurricane Hugo tale (or other hurricane tale). It does not have to be original. Make sure that your tale has all the basic components necessary for effective storytelling.

10. **Plot paths of major hurricanes.**

Plot the pathways of major South Carolina hurricanes from 1893 to 1989 on the STATE BASE MAP # 2, WITH HIGHWAYS. Use Figure 10B-3, "Map of Major SC Hurricanes: 1893-1989" as a guide. Use different colors of wipe-off pens to illustrate the track taken by each hurricane. Mark the location of your school on the map and use the scale bar to measure how close each of these storms came to your school.

11. **Make up a name for the Hurricane of 1893.**

Hurricanes were not given names until the '50's. And until recently they were always given female names. Pick an appropriate name for the Hurricane of 1893 that damaged the rice fields on the Carolina coast. Tell a story, complete with the details of the destruction, to justify your choice of name for this storm. Read “The Hurricane of 1893" on page 10B-5.
ENRICHMENT

1. **Research recent local natural disasters.**
   Find out when the last natural disaster occurred in your community. Interview community members about their recollection of events and their feelings about what happened, or about event stories that they’ve heard.

2. **Research impact Hurricane Hugo had on wildlife habitats.**
   On September 21-22, 1989, Hurricane Hugo had a tremendous impact on a significant part of South Carolina. Research the impact that Hugo had on trees, birds, insects, reptiles, and fur bearing animals. What are the long-lasting effects on the timber industry in South Carolina? What happened to timber prices after Hugo? What attempts have been made to reforest the land?

3. **Determine how hurricanes are classified and named.**
   When does the official Atlantic hurricane season begin? When does it end? How are hurricanes classified by categories? How are records kept on hurricanes? Where are the official records kept? What is a storm surge? How high was the Hugo storm surge? How are hurricanes assigned names? Why do you think female names were usually used prior to 1985? Why did Hurricane Centers start using male as well as female names? What are Cape Verde storms? Where is Cape Verde? What is the difference between a hurricane and a tornado? In a tornado, which does the most damage, the high winds, excessive rain or the high tides? Which does the most damage in a hurricane?

4. **Analyze hurricane-induced changes in Santee Delta.**
   Locate old maps of the Santee Delta. How is the land different today? Discuss how the delta shape changed with time. How might hurricanes have affected the delta? What human activity has caused changes to the delta? Are the changes positive or negative? Explain.

5. **Relate tales of other natural disasters.**
   If students in your class have been through other types of natural disasters and wish to talk about them, ask them to relate what happened to them. Class members may ask specific questions to help storytellers recall the details of their experiences. For instance: What time of day was it? Do you remember any unusual sounds? How old were you? Did you have any warning? Were you scared? What did you do?