SOUTH CAROLINA MAPS

AND AERIAL

PHOTOGRAPHIC SYSTEMS

SC MAPS

Teaching Manual

Fourth Edition
January 2000

Developed by

Peggy W. Cain, Ph.D.
South Carolina Department of Education (Retired)

John R. Wagner, Ph.D.
Department of Geological Sciences, Clemson University

James B. (Chip) Berry, III
South Carolina Department of Natural Resources

Editor

Richard D White
Department of Geological Sciences, Clemson University

Inez MooreTenenbaum.
State Superintendent of Education
South Carolina Department of Education

Dr. Paul A. Sandifer
Director, South Carolina
Department of Natural Resources

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South Carolina Department of Natural Resources
P.O. Box 167, 1000 Assembly Street
Columbia, South Carolina 29202
803-734-3885

To purchase any of the cartographic products, contact:

SC MAPS Distribution Center
Land Resources Division
South Carolina Department of Natural Resources
2221 Devine Street, Suite 222
Columbia, S.C. 29205
803-734-9100

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SECTION TITLES

LIST OF CONTRIBUTORS - FOURTH EDITION - JANUARY 2000

Contributing Authors

Sholto Bevis - Department of Geological Sciences, Clemson University
Martha Boswell - Manning High School
Jennifer Cain - Hillcrest High School
Erik Caldwell - Department of Geological Sciences, Clemson University
Libby Carnohan - Writing Improvement Network, University of South Carolina
Marjorie Claytor, Ph.D. - South Carolina Department of Education
Robin Copp - Richland County Library
Christy Counts - Pine Ridge Middle School
Kay Creamer, Ph.D. - Chester Middle School
Eugene Davis - Leavelle McCampbell Middle School
Dan Fairey - South Carolina Department of Natural Resources
Haydn Fox - Department of Geological Sciences, Clemson University
Lawrence Greer, Ph.D. - Beck Academy
Willie Harriford - South Carolina Department of Education
Patrick Henricks - Department of Geological Sciences, Clemson University
Mary Holmes - R.E. Davis Elementary School
Arla Jessen - Department of Biological Sciences, Clemson University
Dodie Marshall - Stono Park Elementary
Betty McDaniel - Florence School District #1
Sandy Morgan - Dent Middle School
Lyn Mueller, Ph.D. - Writing Improvement Network, University of South Carolina
Paula Pruett - Irmo Middle School
Mark Roberts - Schofield Middle School
Rich Scharf - South Carolina Department of Natural Resources
Marge Scieszka - League Middle School
Linda Sinclair - South Carolina Department of Education
Bill Steirer, Ph.D. - Department of History, Clemson University
Karen R. Stratton - Dutch Fork High School
Jody Tinsley - Department of Geological Sciences, Clemson University

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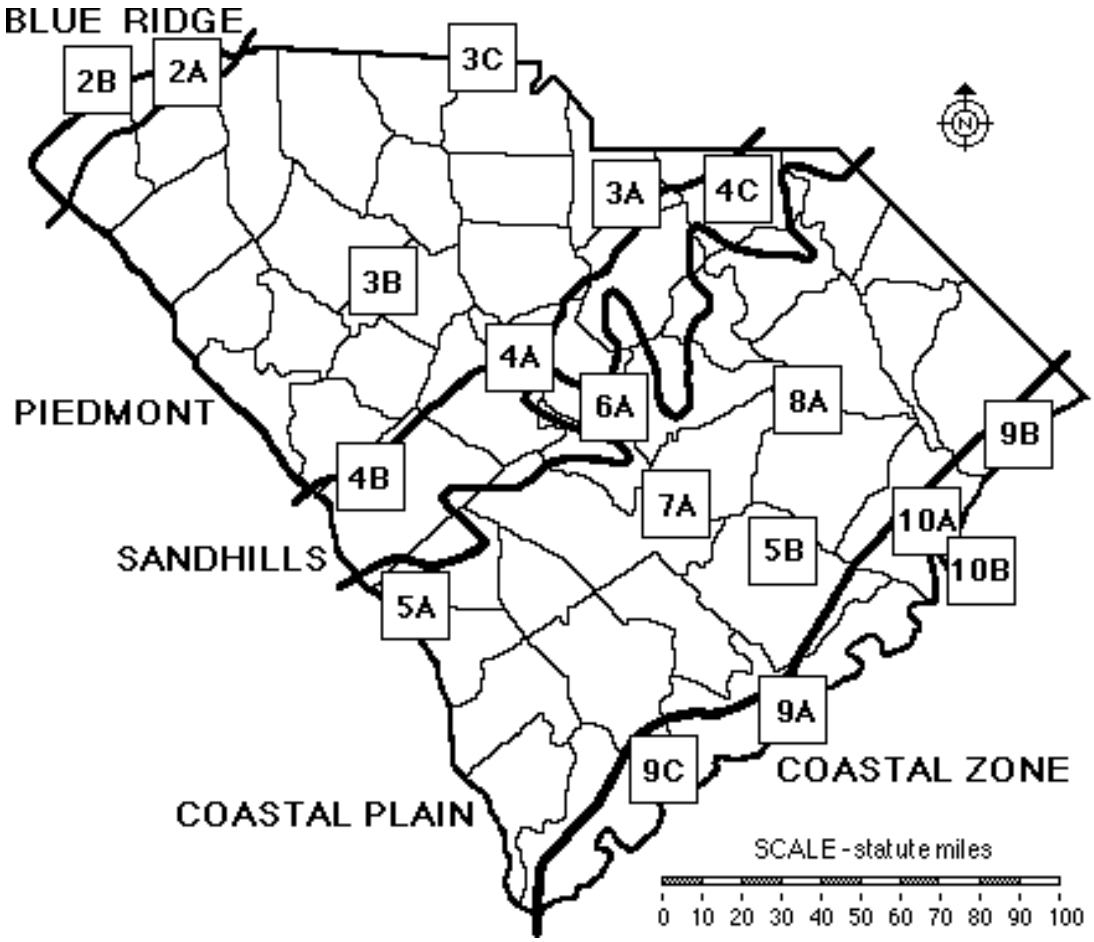
Bobbie Adams - South Carolina Department of Natural Resources
Norma Adams - Department of Geological Sciences, Clemson University
Philip Astwood - Center for Science Education, University of South Carolina
Neil Bartley - South Carolina Department of Natural Resources
Cary Chamblee - South Carolina Department of Natural Resources
April E. Childress - English Department, Greenville Technical College
Richard Clark - Congaree Swamp National Monument
John Davis - South Carolina Wildlife Magazine
Nancy Healy-Williams - South Carolina Commission on Higher Education
Carl Helms - Department of Geological Sciences, Clemson University
Richard Lacy - South Carolina Department of Natural Resources
Cleveland Lee - Fairfield Middle School
Jim Mayer - Oconee County School District
Katherine McKay - Congaree Swamp National Monument
Melba McKenzie - Estill Middle School
Allison Nix - Department of Geological Sciences, Clemson University
Steve Nix - Department of Geological Sciences, Clemson University
Jeff Priest - Central Savannah River Area Mathematics and Science Hub
Fran Rametta - Congaree Swamp National Monument
Linda Renshaw - South Carolina Wildlife Magazine
Giles Roberts - Episcopal Country Day School
Jennifer Rudisill - Duke Power Company
Leon Temples - South Carolina Department of Education
Maureen Webb - School of Education, Clemson University
Patricia White - J. F. Byrnes High School
Don Winslow - South Carolina Department of Natural Resources

SOUTH CAROLINA MAPS AND AERIAL PHOTOGRAPHIC SYSTEMS

MASTER INDEX TO LANDFORM REGIONS AND STUDY SITES



Index Map to Study Sites

2A	Table Rock (Mountains)	5B	Santee-Cooper Project (Engineering & Canals)
2B	Lake Jocassee Region (Energy Production)	6A	Congaree Swamp (Pristine Forest)
3A	Forty Acre Rock (Granite Outcropping)	7A	Lake Marion (Limestone Outcropping)
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4A	Columbia (Metropolitan Area)	9B	Myrtle Beach (Tourist Area)
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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

PREFACE TO THE FIRST EDITION

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.

Interdisciplinary Expansion of SC MAPS

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 5; 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.

1996 Revised Edition SC MAPS Teaching Manual

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.

South Carolina Wildlife Magazine Supplement

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.

2000 Revised Edition SC MAPS Teaching Manual

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 intoductory 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.

Research Mammal Habitat in Mountainous Areas	2-18, #2	Enrichment
Compare Native American & Modern Hunting Practices	2-18, #3	Enrichment
Examine Vegetation and Lake Patterns	2A-4, #5	Perf. Task
Locate South Facing Cove	2A-4, #7	Perf. Task
Compare Drainage Basins . . .	2A-4, #8	Perf. Task
Correlate Land Use to Topography	2A-8, #2	Perf. Task
Analyze Land Use Changes Through Time	2A-8, #3	Perf. Task
Select Best Route for Trail	2A-9, #4	Perf. Task
Explain Location of Greenville's Water Supply	2A-9, #5	Perf. Task
Identify Ways People Have Altered Natural Landscape	2A-9, #8	Perf. Task
Interview a Forester	2A-11, #2	Enrichment

Piedmont Region

"The Dilemma of the Desperate Deer"	3-1	Power Thinking
Piedmont Reservoirs	3-16	Background
Soils and Red Clay	3-16	Background
Reforestation and Soil Conservation	3-17	Background
Unique Natural Habitats in the Piedmont	3-18	Background
Relate Development of Cities to River Location	3-25, #2	Perf. Task
Examine General Soil Map	3-26, #5	Perf. Task
Trace Watersheds Of Stream Systems	3-27, #6	Perf. Task
Make a Land-Man Relationship Chart	3-27, #8	Perf. Task
Analyze the Newspaper Article	3A-5, #4	Perf. Task
Estimate Value of Timber	3A-5, #7	Perf. Task
Trace Path of Flat Creek on Map	3A-7, #1	Perf. Task
Trace 400 ft. Elevation Contour to Create Reservoir	3A-7, #2	Perf. Task
Compare Soils of Bottomland vs. Highland	3A-8, #4	Perf. Task
Investigate Heritage Trust Site Selection	3A-8, #1	Enrichment
Construct Topographic Profiles of Piedmont Landforms	3B-4, #2	Perf. Task
Identify Soil Conservation Practices	3B-7, #6	Perf. Task

Sandhills Region

Sandhills Soils	4-4	Background
Carolina Sandhills National Wildlife Refuge	4-14	Background
Unique Natural Habitats in the Sandhills	4-15	Background
Characterize Sandhills Soils and Land Use	4-20, #2	Perf. Task
Compare Piedmont and Coastal Plain	4A-10, #3	Perf. Task
Research Long Term Impact of Human . . .	4A-14, #1	Enrichment
Analyze Land Use Changes Through Time	4A-15, #2	Perf. Task

Coastal Plain Region

"Reservoir Referendum"	5-1	Power Thinking
Soils of the Coastal Plain	5-4	Background
Soils and Land Use	5-15	Background
Unique Natural Habitats in the Coastal Plain	5-16	Background
Freshwater Fisheries	5-17	Background
Examine Land Use in Coastal Plain	5-21, #2	Perf. Task
Compare Drainage Patterns of Upper and Lower . . .	5-22, #3	Perf. Task
Estimate Amount of Swampland in Barnwell vs. Marion . .	5-22, #4	Perf. Task
Research List of Unique Natural Areas in Coastal Plain	5-26, #2	Perf. Task
Analyze Land Use Changes Through Time	5B-7, #3	Perf. Task

Coastal Zone Region

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.

Fairey, Daniel A. (1988) South Carolina's Land Resources: A Regional Overview. Columbia, SC: South Carolina Land Resources Commission.

Kovacik, Charles F. and Winberry, John J. (1989). South Carolina: The Making of a Landscape. Columbia, SC: University of South Carolina Press.

Murphy, Carolyn Hanna. (1995). Carolina Rocks. Orangeburg, SC: Sandlapper Publishing Co., Inc.

South Carolina Wildlife (1988). Silhouettes of Carolina: A Portfolio of Natural Areas. Columbia, SC: South Carolina Wildlife and Marine Resources Department's Division of Conservation Education and Communications.

Resources for Aerial Photography, Satellite Imagery, and Cartography

Fairey, Daniel A. (1989). South Carolina Cartographic Information Center. Columbia, SC: South Carolina Land Resources Conservation Commission.

Purvis, John C., Tyler, Wesley, & Sidlow, Scott. (1986). Hurricanes Affecting South Carolina. Columbia, SC: South Carolina State Climatology Office.

Steger, Theodore D. (1982). Topographic Maps. (0-383-966). Washington, DC: US Government Printing Office. (Can be obtained from South Carolina Cartographic Information Center.)

National High Altitude Photography Program (NHAP). (1981). The Sky's the Limit. Sioux Falls, SD: United States Geological Survey.

National High Altitude Photography Program (NHAP). (1982-83). US Department of Agriculture. Salt Lake City, UT: Agriculture Stabilization and Conservation Service.

National Aerial Photographic Program (NAPP). (1989). US Department of Agriculture. Salt Lake City, UT: Agriculture Stabilization and Conservation Service.

United States Geological Survey. (1981). Understanding Color-Infrared Photographs and False-Color Composites. Reston, VA: US Department of Interior.

United States Geological Survey Topographic Maps. (USGS). US Department of Interior, Denver, CO: US Geological Survey Map Distribution Center.

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

Alston, Elizabeth and Hunter Draper. (1975). Ethnic History of South Carolina. Charleston, SC: Charleston County Public Schools.

Bass, Robert D. (1978). Ninety-Six: The Struggle for the South Carolina Back Country. Lexington, SC: The Sandlapper Store, Inc.

Bodie, Idella. (1978). South Carolina Women: They Dared to Lead. Lexington, SC: The Sandlapper Store, Inc.

Botsch, Carol Sears, et al. (1994). African-Americans and the Palmetto State. Columbia, SC: South Carolina State Department of Education.

Bridenbaugh, Carl. (1980). Myths and Realities: Societies of the Colonial South. New York: Atheneum Press.

Brown, Douglas Summers. (1953). A City Without Cobwebs: A History of Rock Hill. Columbia, SC: University of South Carolina Press.

Burton, E. Milby. (1990). The Siege of Charleston 1861 - 1865. Columbia, SC: South Carolina Press.

Cornish, Dudley Taylor. (1987). The Sable Arm, Black Troops in the Union Army, 1861-1865. Lawrence, KS: University of Kansas Press.

Dabbs, Edith M. (1983). Sea Island Diary: A History of St. Helena Island. Spartanburg, SC: The Reprint Company Publishers.

Davis, Marianna W. ed. (1976). South Carolina Blacks and Native Americans 1776-1976. Columbia, SC: The State Human Affairs Commission.

Edgar, Walter B. (1984). History of Santee Cooper, 1934-1984. Columbia, SC: R. L. Bryan Company.

Edgar, Walter B. (1991). South Carolina in the Modern Age. Columbia, SC: University of South Carolina Press.

Expectations of Excellence: Curriculum Standards for Social Studies. Bulletin 89. Washington, DC: National Council for the Social Studies.

Froner, Eric. (1983). Nothing But Freedom: Emancipation and Its Legacy. Baton Rouge, LA: Louisiana State University Press.

Gragg, Rod. (1984). Pirates Planters, and Patriots: Historical Tales from the South Carolina Grand Strand. Winston Salem, NC: Peace Hill Publishers.

Higginson, Thomas Wentworth. (1984). Army Life in a Black Regiment. New York: W.W. Norton and Company.

Huff, Jr., Archie Vernon. (1991). The History of South Carolina in the Building of the Nation. Alester G. Furman III.

Jones, Lewis P. (1971). South Carolina: A Synoptic History for Laymen. Orangeburg, SC: Sandlapper Publishing Co., Inc.

Jones-Jackson, Patricia. (1987). When Roots Die: Endangered Traditions on the Sea Islands. Athens, GA: The University of Georgia Press.

Joyner, Charles. (1984). Down by the Riverside: A South Carolina Slave Community. Chicago: University of Illinois Press.

Kovacik, Charles F. and John J. Winberry. (1987). South Carolina: The Making of a Landscape. Columbia, SC: University of South Carolina Press.

Lander, Ernest M., Jr. (1988). South Carolina: An Illustrated History of the Palmetto State. Northridge, CA: Windsor Publications, Inc.

Lipscomb, Terry W. (1993). South Carolina in 1791: George Washington's Southern Tour. Columbia, SC: South Carolina Department of Archives and History.

Milanich, Jerald T. and Susan Millrath, eds. (1989). First Encounters: Spanish Exploration in the Caribbean and the United States, 1492-1570. Gainesville, FL: University of Florida Press.

Milling, Chapman J. (1966). Red Carolinians. Columbia, SC: University of South Carolina Press.

Mitchell, Broadus. (1928). William Gregg: Factory Master of the Old South. Chapel Hill, NC: University of North Carolina Press.

Neuffer, Claude Henry, ed. (1945-1965). Names in South Carolina. Columbia, SC: South Carolina Press, Vols. 1-12.

Pettus, Louise and Ron Chapesiuk. (1991). The Palmetto State: Stories From the Making of South Carolina. Orangeburg, SC: Sandlapper Publishing Co., Inc.

Possen, Robert N. (1982). A Short History of Charleston. Charleston, SC: Peninsula Press.

Pringle, Elizabeth Allston. (1994). A Woman Rice Planter. Columbia, SC: University of South Carolina Press.

Rogers, George C. and Taylor, James. (1994). A South Carolina Chronology: 1497-1992. Second edition. Columbia, SC: University of South Carolina Press.

Rose, Willie. (1964). Rehearsal For Reconstruction: The Port Royal Experiment. New York: Bobbs-Merrill Co.

Rosengarten, Theodore. (1986). Tombee: Portrait of a Cotton Planter. New York: William Morrow and Company, Inc.

Rouse, Parker. (1973). The Great Wagon Road From Philadelphia to the South. New York: McGraw-Hill Book Co.

Savage, Henry. (1980). The Mysterious Carolina Bays. Columbia, SC: University of South Carolina Press.

Sherry, Frank. (1986). Raiders and Rebels: The Golden Age of Piracy. New York: Hearst Marine Books.

Sloan, Eugene B. (1966). Scenic South Carolina. Columbia, SC: The State Printing Company.

South Carolina. (1991). The WPA Guide to the Palmetto State. Columbia, SC: University of South Carolina Press.

South Carolina Department of Archives and History. Public Programs Document Packets: Jehu Jones: Free Black Entrepreneur, Packet No. 1; The Spanish in South Carolina: Unsettled Frontier, Packet No. 3; The Civilian Conservation Corps in South Carolina, Packet No. 4; African-Americans in the Civil War: Two Sides to a Story, Packet No. 6.

Wallace, David Duncan. (1961). South Carolina: A Short History, 1520-1948. Columbia, SC: South Carolina Press.

Wright, Louis B. (1976). South Carolina: A Bicentennial History. New York: W.W. Norton and Company, Inc.

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

Assessment Standards for School Mathematics. (1995). Reston, VA: National Council of Teachers of Mathematics.

Curriculum and Evaluation Standards for School Mathematics. (1989). Reston, VA: National Council of Teachers of Mathematics.

South Carolina Mathematics Academic Achievement Standards. (1995). Columbia, SC: SC Department of Education.

South Carolina Mathematics Framework. (1993). Columbia, SC: SC Department of Education.

South Carolina Statistical Abstracts. (1993). SC State Budget and Control Board, Columbia SC: Office of Research and Statistical Services.

South Carolina Statistical Abstracts. (1994). SC State Budget and Control Board, Columbia SC: Office of Research and Statistical Services.

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.*
>
> --Harry Crews, Catawba Texts, by Frank G. Speck. New York: Columbia University Press, 1934.

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

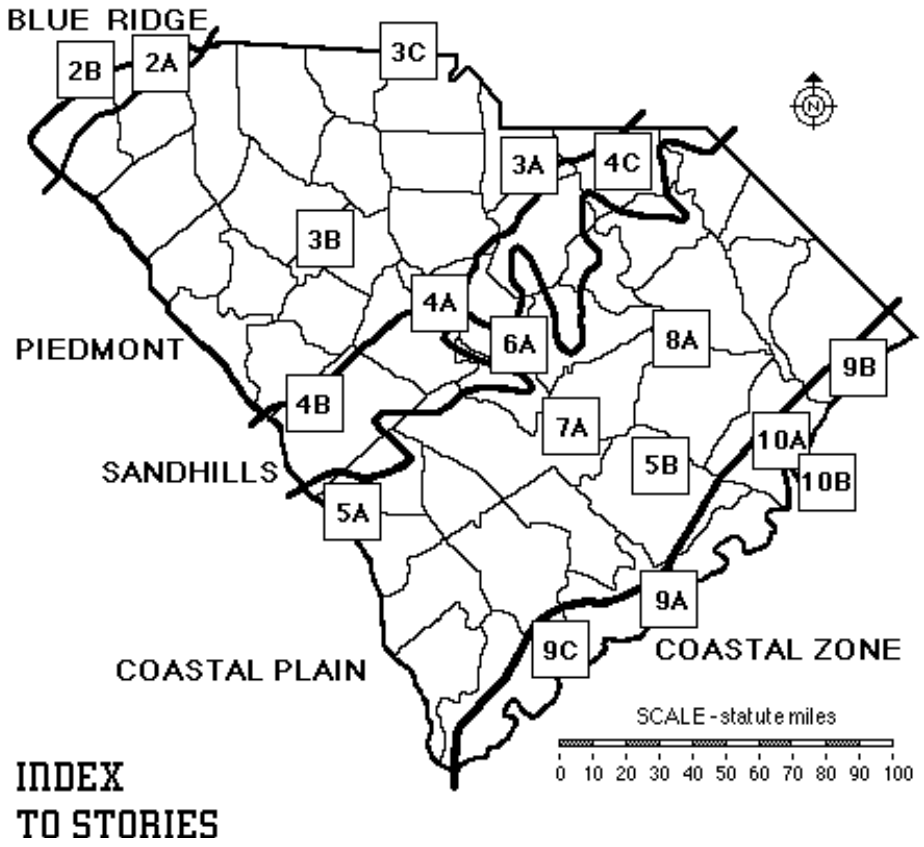
Storytelling helps students develop and refine skills critical to language arts mastery and is a natural way to address these goals. The strands of the new South Carolina English Language Framework document stress "using language to learn," "using the conventions and forms of language," "using language 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.

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

Afro-American Folktales, by Roger D. Abrahams. Pantheon Books, 1985.

Been in the Storm So Long, Compact Disc, Smithsonian Folkways Records, 1990. Video available from the SC Department of Education.

Before Freedom, When I Just Can Remember, Edited by Belinda Hurmenal. John F. Blair, Publisher, 1989.

Cabins in the Laurel, by Muriel Earley Sheppard. University of North Carolina Press, (1935) 1991.

Carolina Decameron: Tales of Hugo and Other Stories, Compiled and edited by D. DuBols & K. Kress. Sandlapper Press, Inc., 1993.

Carolina Hurricane, by Marian Rumsey. William Morrow, 1977.

Catawba Texts, by Frank G. Speck. Columbia University Press, 1934.

Charleston Ghosts, by Margaret Rhett Martin. University of South Carolina Press, 1963.

Charles Towne Birth of a City**,** by Warren Ripley. Evening Post Publishing Co., 1970.

Civil War Ghost Stories & Legends, by Nancy Roberts. South Carolina Press, 1993.

Coastal Ghosts, by Nancy Rhyne. Sandlapper Press, 1989.

Diary of a Confederate Soldier, by John S. Jackman of the Orphan Brigade, Edited by William C. Davis. University of South Carolina Press, 1990.

Folklore From the Working Folk of America, by Tristam Potter Coffin & Hennig Cohen. Anchor Press/Doubleday, 1973.

Ghosts of the Carolinas, by Nancy Roberts. Loftin Publishers, 1967.

Ghosts of the Southern Mountains and Appalachia, by Nancy Roberts. South Carolina Press, 1988.

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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 ✈, 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

can be used either in whole or in part. Most performance tasks are designed to be completed in a traditional fifty minute class period.

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!**

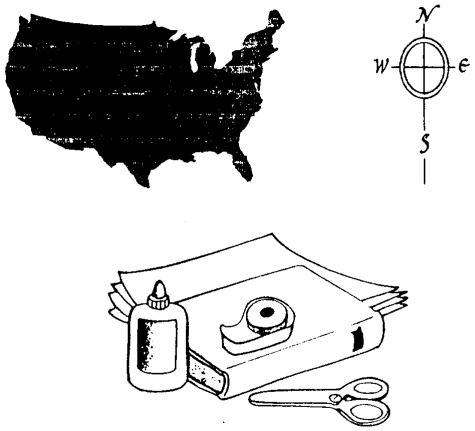
Which learning style is each of the following expressions conveying?

- **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

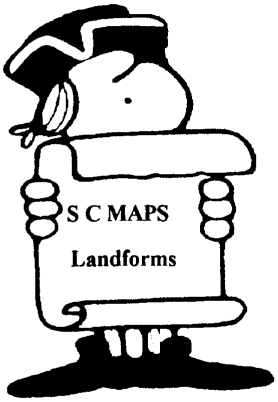
S C MAPS - Cooperative Group Job Cards

Maps & Materials Manager



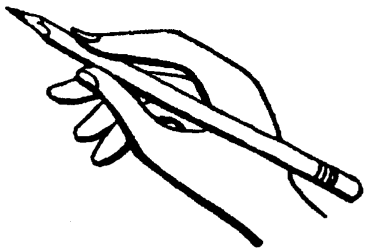
Gathers all maps needed and other supplies.

Reader



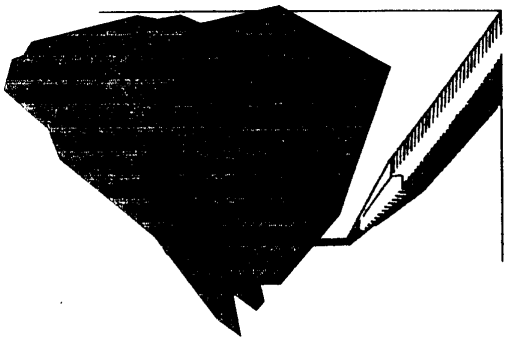
Read information from resources aloud to the group. Check to be sure everyone is listening.

Recorder & Checker



Fill out any forms. Write information as group members dictate. Check to be sure all members agree on your group's answer or information.

Map Marker



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.

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.
   (Johnson, David W., Johnson, Roger T., & Holubec, Edythe Johnson. (1991). Cooperation in the Classroom. Edina MN: Interaction Book Company.)

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.

Series & Scale	One Inch Represents Approx.	Land Area	# of Maps Needed for Statewide Coverage
State Base 1:500,000	8 miles	State Area	1
State Base 1:250,000	4 miles	2^{o} x 1^{o}	10
State Base 1:100,000	1.6 miles	1^{o} x 30 min.	28
State Base 1: 24,000	2000 feet	7.5 x 7.5 min.	566

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.

Black	Cultural features such as roads, buildings, and place names
Blue	Hydrographic feature such as lakes, rivers, and swamps
Brown	Contour lines
Green	Forested areas and orchards
Red	Major roads and public lands boundaries
White	Open areas such as agricultural fields and pasture lands
Purple	New features added from aerial photographs during map revision

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. Normal

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

COLOR KEY

COLOR	MEANING
shades of red	healthy vegetation
bright red	winter rye, oats, wheat
darker red	evergreen -- pine, conifers
dark red	cypress, tupelo
bluish-gray	dormant vegetation deciduous forests -- leaf-off season hickory, oak, gum
light blue	cities, quarries, paved areas
pinkish	damaged pine forests (especially areas damaged by Hurricane Hugo)
white	sandy beaches and overwash along shoreline
gray	roads
ribbon of mixed colors	utility corridors
shades of blue to black	bodies of water -- lakes, rivers, streams
light blue	water with heavy sediment load
blue	water with some sediment load
dark blue to black	clear water with little sediment
dark green-blackish	wetlands

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 oneside ,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

GLOSSARY

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

cuspate 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