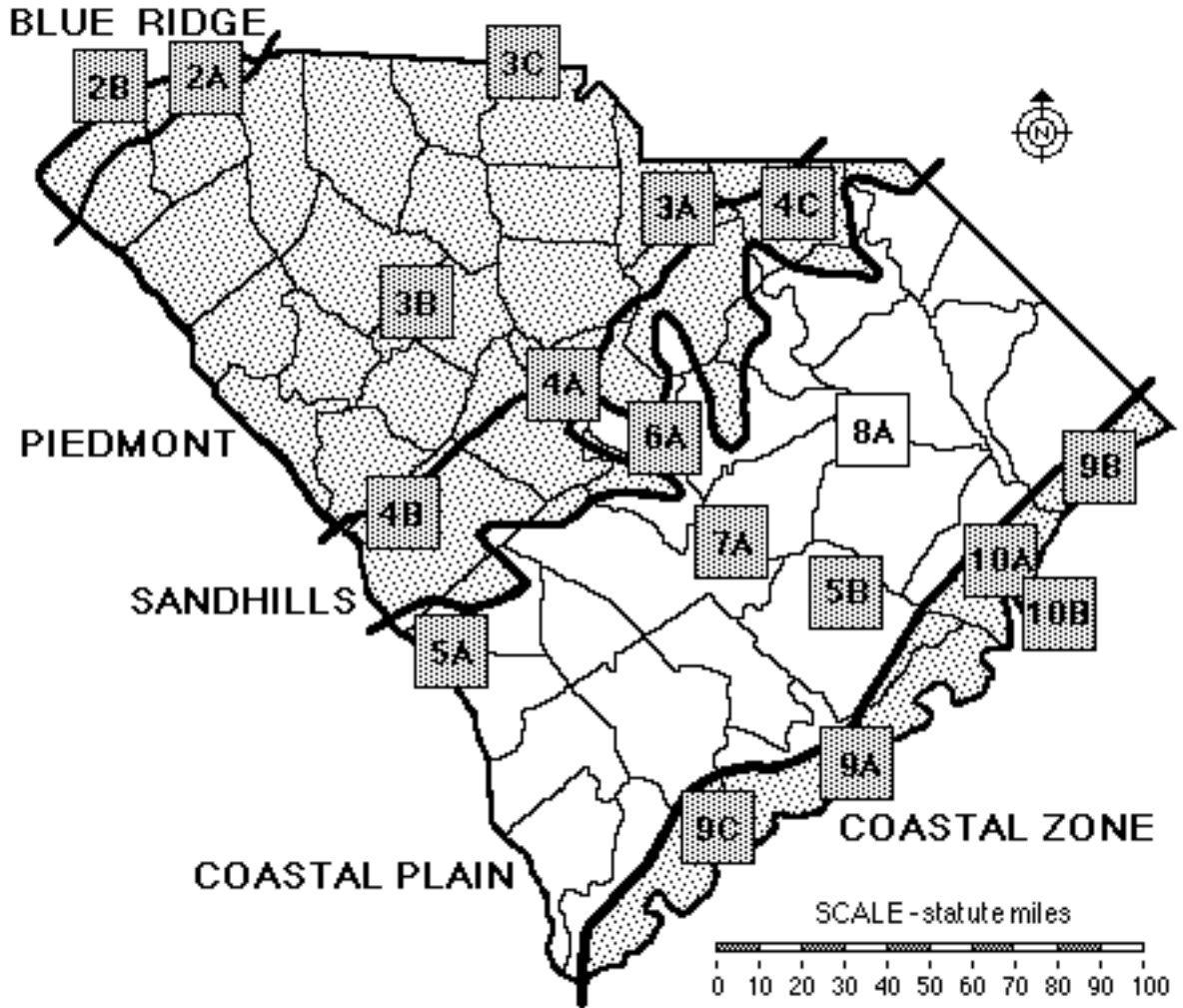


SECTION 8

COASTAL PLAIN REGION / CAROLINA BAYS



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)
3B	Silverstreet (Agriculture)	8A	Woods Bay (Preserved Carolina Bay)
3C	Kings Mountain (Historical Battleground)	9A	Charleston (Historic Port)
4A	Columbia (Metropolitan Area)	9B	Myrtle Beach (Tourist Area)
4B	Graniteville (Mining Area)	9C	The ACE Basin (Wildlife & Sea Island Culture)
4C	Sugarloaf Mountain (Wildlife Refuge)	10A	Winyah Bay (Rice Culture)
5A	Savannah River Site (Habitat Restoration)	10B	North Inlet (Hurricanes)

TABLE OF CONTENTS FOR SECTION 8
COASTAL PLAIN REGION / CAROLINA BAYS

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- **Table of Contents for Section 8**
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 - p. 8-2 - Geographic Features of Special Interest
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 - p. 8-5 - Gradualistic Terrestrial Theory
 - p. 8-5 - Carolina Bays Soils
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 - p. 8-10 - Draining the Bays for Agriculture and Forestry
 - p. 8-10 - Carolina Bays as a Unique Natural Habitat
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 - Summary
- **Places to Visit**
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- STUDY AREA 8 : CAROLINA BAYS

(ICONS) Overv = → Sci = ⚙ Math = 🖨 Hist = 📖 Lang Arts = ✍

- Activity 8-1 : Overview

- Materials

- Performance Tasks

- p. 8-13 1. make an index chart of Carolina Bays → 🖨
- p. 8-14 2. compare characteristics of Marching Bays 🖨 ⚙
- p. 8-14 3. evaluate pros and cons of Carolina Bay origin theories ✍ ⚙
- p. 8-15 4. contrast Native American uses of bays with modern uses ✍ ⚙
- p. 8-15 5. compare objective and subjective descriptions of Carolina Bays ✍
- p. 8-15 6. evaluate desirability of Carolina Bays for home sites ✍
- p. 8-15 7. identify potential non-point source pollution by examining land use ⚙

- Enrichment

- p. 8-16 1. request a copy of the Carolina Bay Project survey ⚙ ✍
- p. 8-16 2. compare your Carolina Bays index to official index ⚙ ✍
- p. 8-16 3. research what crops in your area were grown by sharecroppers 📖 ✍

- STUDY SITE 8A : WOODS BAY (PRESERVED BAY)

(ICONS) Overv = → Sci = ⚙ Math = 🖨 Hist = 📖 Lang Arts = ✍

- Newspaper Article - "Lawmen say "Lizard Man" exists"

- Rationale

- Brief Site Description

- p. 8A-2 - Characteristics of Woods Bay
- p. 8A-2 - Park Facilities, Boardwalk, and Canoe Trips
- p. 8A-2 - Land Use in Woods Bay

- Activity 8A-1 : Anatomy of a Carolina Bay

- Materials

- Performance Tasks

- p. 8A-3 1. locate the study site → ⚙
- p. 8A-3 2. analyze the newspaper article ⚙ ✍
- p. 8A-3 3. analyze land use changes through time →
- p. 8A-3 4. relate different temperatures to habitat characteristics 🖨 ⚙
- p. 8A-4 5. identify features in and around Woods Bay State Park → ⚙ 🖨
- p. 8A-4 6. estimate surface area of Woods Bay 🖨
- p. 8A-5 7. trace boundaries for Carolina Bays soil types ⚙
- p. 8A-5 8. make line plot graph of Woods Bay biota, identify veg. groupings ⚙ 🖨
- p. 8A-5 9. explain unusual contour line patterns ⚙

- Enrichment

- p. 8A-6 1. research the sand ridge habitat around Woods Bay ⚙
- p. 8A-6 2. use an equation to describe the shape of Woods Bay 🖨

SECTION 8

COASTAL PLAIN / CAROLINA BAYS

POWER THINKING ACTIVITY - "Swamp Search"

A Hollywood motion picture studio has decided to do a re-make of the old monster movie Creature from the Black Lagoon using Woods Bay State Park as their filming location. You are put in charge of the local arrangements, since the movie makers have never been to Woods Bay before and know nothing about real swamps. Use the WOODS BAY LITHOGRAPH and the WOODS BAY TOPOGRAPHIC MAP to locate places the film crew needs to visit to get the right scenes.

Scene 1 - a dark, swampy, forested area where you can't even see the sky through the thick foliage

Scene 2 - an open water area where lots of sunlight gets through and you could film a small boat capsizing

Scene 3 - a wide, sandy area where the crew can build a bonfire safely to keep the monster away

Remember that for every actor you see in a movie there are many more workers behind the scenes running cameras, fixing lights, holding cue cards, preparing meals for crew and cast, and doing a variety of other tasks. For each scene, explain how you will get the entire film crew to the proper location, what problems you will encounter once you get there, and how you will overcome them. Also explain where the actors and crew will stay at night (there are no hotels or other lodging on Woods Bay).

PERFORMANCE OBJECTIVES

1. Describe the geological framework and ecological characteristics of Carolina Bays.
2. Compare scientific authenticity of current and past theories of Carolina Bay origins.
3. Compare and contrast physical features of Carolina Bays, including size, topographic relief, ground cover, land use, and spatial orientation.
4. Use mathematical concepts to describe geometric shape and spatial dimensions of Carolina Bays.
5. Classify Carolina Bay soil types by analyzing moisture content and vegetative cover from lithograph data.
6. Compare current versus historical land uses of Carolina Bays.
7. Evaluate effectiveness of recent efforts to preserve Carolina Bays in their natural state.
8. Use folk tales of Carolina Bay area sharecroppers as source for storytelling and writing activities.

BACKGROUND INFORMATION

Description of Landforms, Drainage Patterns, and Geologic Processes

Characteristic Landforms of Carolina Bays

Carolina Bays are elliptical depressions, found primarily in the **Coastal Plain** Region of South Carolina, that have intrigued residents since the arrival of the first settlers. Additional investigations have shown that all of the Carolina Bays are smooth elliptical depressions only a few feet deep, with their long axis oriented in a remarkably consistent northwest to southeast direction. Most have a surrounding rim of sand that is especially obvious along the southeastern edge. Sand ridges usually have gentle slopes and rise only a few feet above the level of the Bay. In exceptional cases, sand rims may reach heights of 15 feet and widths of several hundred feet. However, ridges may be totally lacking. Bay size ranges from an area of only a few square feet to monster Bays having dimensions up to four miles long and two miles wide. Bays average 2,210 feet in length and 1,430 feet in width. The depth of these basins lies anywhere from a couple of feet to as much as forty feet below the surface level of the surrounding Coastal Plain. Depth can be misleading, however, since most Bays contain thick accumulations of soil and peat deposits.

Because they are such subtle features, and because they are usually very **swampy** and hard to cross, most Carolina Bays generally went unnoticed by the local population. The exact number and geographic extent of Carolina Bays were not recognized until aerial photographs, first made by the United States Geological Survey in the 1930's, revealed that hundreds of these unique Bays existed from Southern New Jersey all the way to Northern Florida. They are distributed over an area of 25,000 square miles along a strip of Coastal Plain nearly 80 miles wide. Estimates for the total number of Bays now range as high as 500,000. Estimates of ages for Bays range from 6,000 to 60,000 years, and even older. Data obtained from the bottom-most sediments in the Bays indicates that most existed as lakes many years ago and have since filled in with mud and vegetation. None appear to be developing today.

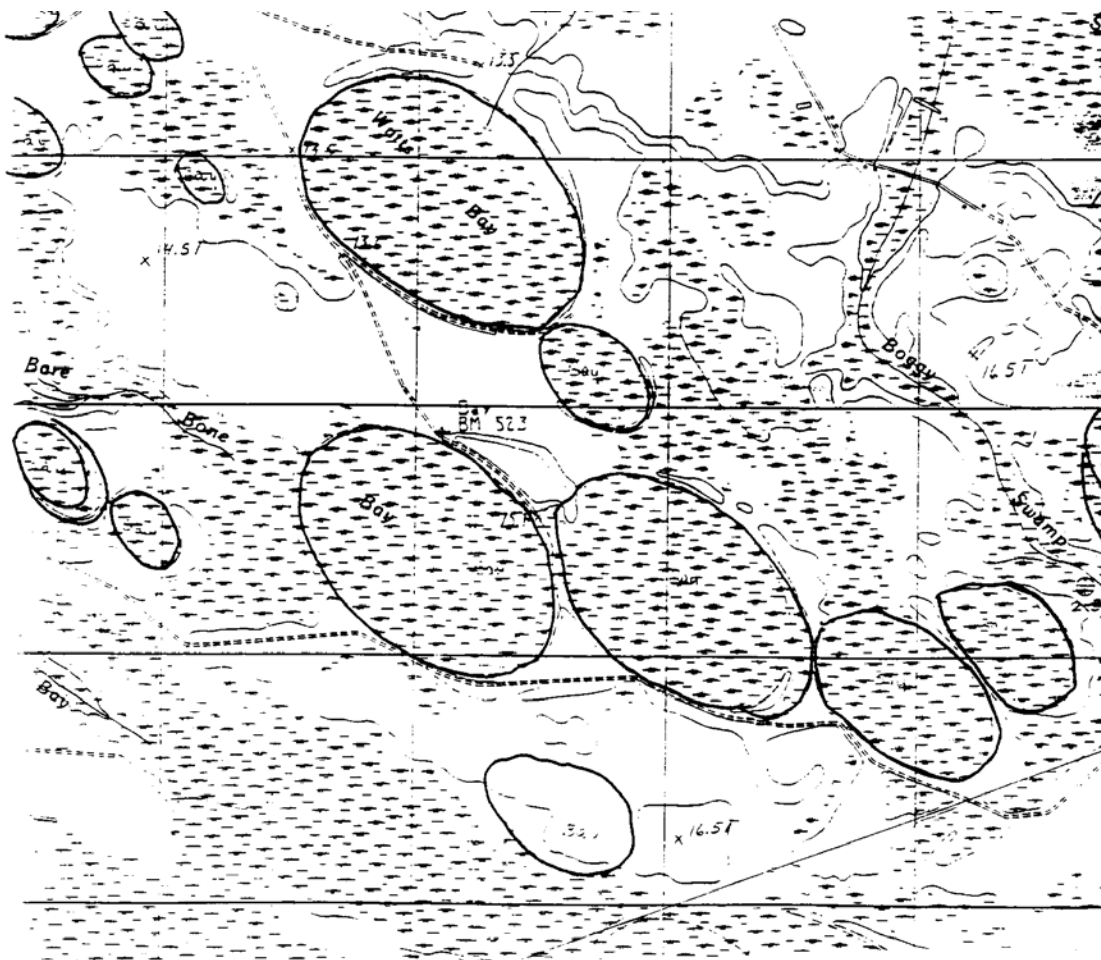
Geographic Features of Special Interest

Almost any large section of the South Carolina Coastal Plain Region will contain at least a few Carolina Bays. However, Bays are not uniformly distributed throughout this region. Horry County has over 400 known Bays while Beaufort County has none. Other counties with large numbers of Bays include Marlboro, Lee, Orangeburg, Barnwell, Allendale, and Darlington. Only a few of the Bays are still in their natural state; most have been ditched and drained. The original outlines of drained and cultivated Bays are hard to locate and often can only be seen from the air. A few Bays have been preserved in close to pristine condition and several of these may be visited by the public.

Several Carolina Bays are well enough known to have been given individual names. Woods Bay and Dials Bay, located along the boundary line separating Sumter and Clarendon counties, are good examples. Woods Bay is home to a state park which offers on-site educational programs. Dials Bay has been drained for agricultural purposes. Cathedral Bay, near the town of Olar, Bamberg County, is now a Heritage Preserve site and also offers tours. Big Sister and Little Sister Bays in Marion County are a another pair of Bays sitting side by side. One has been drained for agricultural purposes while the other is still in its natural state. A group of Bays called the Lewis Bay Complex, located in Horry County near Myrtle Beach, is an example of so-called Marching Bays. These Bays depict a closely-aligned group of Bays in stair-step sizes.

Figure 8-1: Map of Marching Bays

LEWIS BAY COMPLEX, HORRY COUNTY



Scale 1:31,000

Theories of Origin

The origin of Carolina Bays has intrigued local residents for years, with many theories being proposed, investigated, and discarded. With the advent of aerial photography in the 1930's, a number of geologists and local citizens again became interested in these features. Many scientific theories (hypotheses) of their origin began to emerge. Listed below are several theories of origin which have been proposed over the years. Some are whimsical, having few if any observations to support them. Others are within the realm of possibility, having observations that do support them. Many of the early hypotheses have been eliminated because conclusive data did not match the theories. For example, the wave theory that giant schools of fish waved their fins in unison over **submarine artesian springs** has been eliminated because the depressions are flat and shallow. Waves would have left an uneven bottom profile and the artesian springs were never found. Likewise, the **limestone sinkholes** theory was never substantiated because of the lack of any limestone deposits associated with the Bays. Here are some of the many theories of origin for Carolina Bays:

- A basin scooped out by giant turtles,
- Fish nests made by giant schools of fish waving their fins in unison over submarine artesian springs,
- An extraterrestrial origin where meteorite showers struck the earth causing depressions on the land,
- Large sinkholes formed in limestone solution areas,
- Solution basins related to activity of artesian springs, and
- Natural circular depressions elongated by prevailing winds resulting in elongation and deposition of sand on the perimeter of the Bay.

The development of scientific knowledge begins with observations and a systematic investigation of a proposed hypothesis. Data are gathered and analyzed to determine if they fit the hypothesis model. Repeated investigations must be made to verify the hypothesis. If the data are conclusive, then the hypothesis becomes scientific knowledge. If there is not enough data to substantiate the hypothesis, then the hypothesis is modified or rejected. In the case of the Carolina Bays, there are no conclusive data that substantiate any of the theories. Geologists have proposed and investigated many hypotheses, but the origin of the Carolina Bays is still a mystery. The following two theories deserve further elaboration.

Catastrophic Extraterrestrial Theory

Of all the theories (hypotheses) that surround the origin of the Bays, the one that has captured the most attention and imagination is the suggestion of extraterrestrial origin. This theory, first proposed by Melton and Schriever in 1933, hypothesized that the Carolina Bays were caused by the impact of a cluster of meteorites striking the earth. The theory was based on the smooth elliptical shape, the peculiar rim of sand found predominantly on the southeastern edge, and a consistent northwest to southeast orientation of all the Bays.

Many geologists have conducted surveys trying to substantiate this theory. In 1952, Prouty carried out magnetometer surveys in an attempt to locate magnetic properties associated with meteorite material. His data were not conclusive. He also conducted projectile experiments using a .38 caliber bullet to determine if elliptical

depressions could be made at a small angle of impact. The conclusion of his data was that a meteorite could produce an elliptical depression, but it would be 2-3 kilometers deep with an uneven bottom. The Bays, on the other hand, are flat-bottomed depressions only a few feet below the surface of the surrounding ground. After comparing the Carolina Bays with craters known to have been caused by meteorite impacts, most geologists now believe that the Carolina Bays were not caused this manner. An alternate possibility is that impacts related to comets or cometary fragments striking the earth may have been responsible. Because comets are almost entirely gaseous, there would be no fragments left behind.

Gradualistic Terrestrial Theory

The currently preferred theory hypothesizes a terrestrial origin for these Bays. Natural depressions in the Coastal Plain caused circular lakes to form. The prevailing winds over a lengthy period elongated the lakes into their present elliptical basin shapes. The winds also caused sand to be deposited on the perimeter of the Bays with the greatest amount deposited on the southeastern rim where the wind velocity decreased. This occurred before heavy vegetation covered the Bays. One piece of evidence that substantiates this theory is that radioactive Carbon-14 dating indicates the Bays are not all the same age. These ages vary from 6,000 to 60,000 years, although other estimates suggest the Bays are much older. Using the terrestrial origin of circular depressions, coupled with prevailing winds, the Bays could very well have been formed over a long period of time.

The very nature of science indicates that any theory must undergo constant scrutiny; therefore, the origin of the Carolina Bays remains a continuing and intriguing mystery perhaps awaiting yet another very different explanation. As more evidence is gathered and recorded other theories will be proposed that explain the data better.

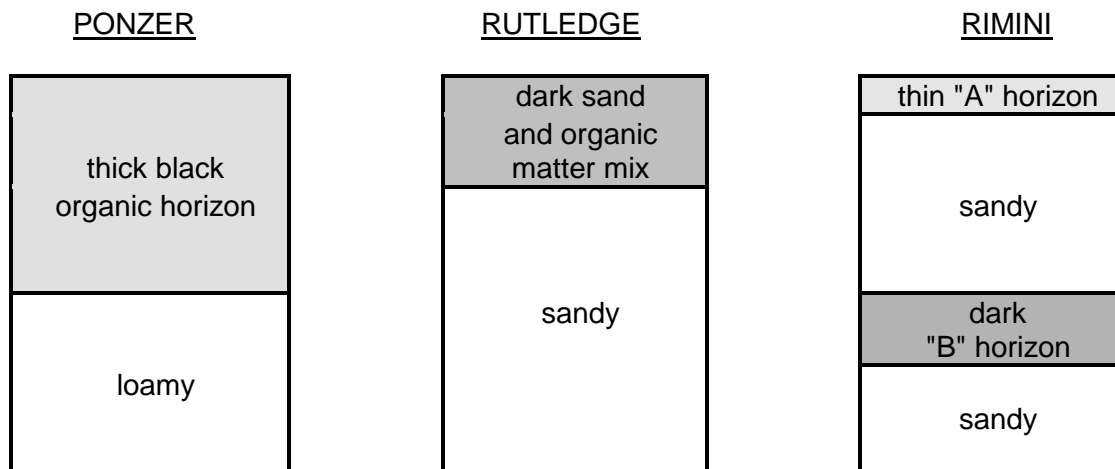
Carolina Bays Soils

Carolina Bays have characteristic soil assemblages which are the result of the very moist conditions commonly found in these environments and which can be distinguished easily from one another and from surrounding soil types on aerial photographs. Wet soil generally appears darker due to the greater accumulations of black organic matter. However, when winter cover crops have been planted, wetter soils usually support more vigorous plant growth and appear a deeper red or pink on infrared photographs than drier soils. Soil mapping surveys, such as those run by the United States Department of Agriculture, commonly draw boundary lines, delineating different soil types, directly on aerial photographs while working in the field. These surveys look at factors such as landscape position, shades of bare soil, types of vegetation growing on the soil, and water drainage patterns commonly found on that soil. Although not all soils can be so easily determined, the unique soils of the Carolina Bays can usually be separated and identified on a variety of remotely sensed images.

Three distinct soil types are found in most of the larger Carolina Bays.

- PONZER - This is often the dominant soil in large Bays, and it is also found in the center of smaller ones. Due to the lack of oxygen caused by water saturation, which slows decomposition, this soil is almost all organic matter. The soil microbes which would normally cause complete decomposition need oxygen to break down the leaves and other plant litter that fall to the soil surface. Over the years, an organic rich "A" horizon layer accumulated that is several feet thick. This soil appears dark in an aerial photo. While some pine trees can grow in it, they cannot compete well with better adapted deciduous vegetation. When drained, this is a highly productive agricultural soil.
- RUTLEDGE - This soil is found along the inside of the boundary of large Bays and occupies most or all of the area of smaller Bays. It is slightly higher in elevation than Ponzer soils and is therefore slightly drier. It also has a high organic matter content but is much more sandy. It also more easily supports loblolly pine trees. Rutledge soils also make productive agricultural land when drained. The land appears dark in an aerial photo, but not as dark as Ponzer. In Infrared aerial photos (taken in winter), Rutledge soils will appear much redder than Ponzer due to the abundance of evergreen trees such as pines.
- RIMINI - This soil is sometimes found on the sandy rims of Carolina Bays. It is a rather unusual soil in that its subsurface "B" horizon layer is full of organic acids combined with aluminum atoms that leached from overlying horizons. While the surface color can be bright enough to appear almost white, the color of the "B" horizon layer is often brown or black, like topsoil, but it is found about four feet below the soil surface. [Soils of this type are usually found in northern regions, like New England, Northern Michigan, Minnesota, and Canada.] For several reasons, including acidity and possible aluminum toxicity, this is not a good soil for plant growth and is only sparsely covered by scrubby pines, blackjack oak, and turkey oak. This is not an extensive soil, and is almost never used for agriculture. It appears very light in an aerial photo due to the high sand content and dryness of the soil surface.

Figure 8-2: TYPICAL CAROLINA BAYS SOIL TYPES



A Brief Historical View of the Bays

Soon after the Europeans settled in the state, they started to call these small swamps, dominated by small, aromatic bay trees, "bay swamps" or "pocosins" (a Native American term). Later, to avoid confusion with coastal bays, they were called "Carolina Bays." John Lawson recorded the first written mention of Carolina Bays in the late 1700's. In 1765, the Pennsylvania botanist John Bartram wrote of seeing "bay swamps" in South Carolina. He reported that local Native American fishermen utilized the buckeye tree's branches and leaves to make a highly effective fish narcotic used to stun fish before catching them. They also used the seeds of the buckeye trees for making eyes for the deer masks they wore while stalking deer. The Native Americans made extensive use of these **wetlands** and their diversified biological productivity without changing them in any significant way.

In 1848, Michael Toumey, then South Carolina State Geologist, officially described these unique geological formations in the following terms: "A peculiar feature in the **topography** of this sand-hill region is the number of circular depressions that are scattered over the surface. They are not deep and conical, like 'lime sinks,' but flat and shallow, at first sight reminding one of a circular race-course." (Kaczorowski, 1977) The actual term "Bay" was first introduced to describe these features in 1895, by L.C. Glenn, who described them in an article published in Science. Glenn's scientific description follows, along with a more modern descriptive essay, which was published in South Carolina Wildlife, written by Glenn Oeland.

Objective Description of Carolina Bays

by L.C. Glenn

Having noted on a surveyor's map of my school district of Darlington, SC, several lake-like expanses usually represented as being at the head of some very small stream, I began inquiries concerning them and followed this up by visiting several of the largest.

To the lake-like expanses the term bay is usually applied and by it is meant a perfectly flat, clayey area with a surface some two to four feet below the general level of the country and varying from a few acres in size to stretches a mile or two long and a half mile or more in width; the smaller ones being much more numerous and having usually an area of 20 to 30 acres. They are in some cases approximately round in shape, though they are usually ovoid or elliptical, and are covered with vegetation-stained water from a few inches to a foot or two deep according to the season. Growing in this water, where the bay is uncleared, are cypress, juniper or black-gum trees with a moderately thick swamp undergrowth.

Subjective Description of Carolina Bays

Abridged from an article by Glenn Oeland

From the air they look like impressions made in the earth's surface by a giant egg, ovals of dark greenery surrounded by patchworks of tilled farmland. The Bays are a wetland oasis supporting a rich variety of plants and animals. About one-third of the bay is covered by a watery prairie of **marsh** grasses and water lilies, a sunny environment preferred by alligators and wading birds. The larger portion of the bay is a dense swamp forest of cypress and tupelo gum trees, a shaded realm inhabited by water snakes, wood ducks, and barred owls. The dense thicket of evergreen bay trees swells right to the edge of the swamp, but there it comes to an abrupt halt. Sporadic openings in the green vegetative curtain provide an intimate glimpse of the swamp at its wildest, a chance to experience one of nature's genuine mysteries.

Sharecropping

Sharecropping is a system of farming in which the landowner provides supplies and equipment and tenant farmers provide labor in exchange for a portion of the crop. The Coastal Plain Region experienced the greatest extent of sharecropping, although this system was common throughout the state during the period between the Civil War and World War II, even extending into the 1950's. Many Carolina Bays were ditched and drained to provide suitable land for sharecropping.

Unlike cash renting, where the landowner provided only land, house, and fuel, sharecropping required landowners to provide for all the needs of their tenant farmers. Usually supplies, food, and medical expenses were furnished through a credit arrangement in which the tenants were to pay back what they owed after the crop was harvested and sold. Unfortunately, merchants often overcharged for goods purchased on credit and many also charged interest. As a result, few sharecroppers ever amassed enough wealth to purchase their own land. Tenants had no choice in what they were to grow, as seed was also furnished by the landowner. As a result, almost all sharecropping during this period was dedicated to growing cotton. But low prices for cotton during that time limited earnings for both the landowner and the tenant.

Both Black and White families worked as tenant farmers, but Black farmers accounted for the majority of sharecroppers. Although the Reconstruction Government promised land to freed slaves following the Civil War, that promise came true in only a few areas of the state. Most Blacks ended up returning to the plantation, but as tenant farmers rather than slaves. Although the new system was not an enormous improvement, tenant farmers at least had mobility. After they fulfilled their annual contract, they were free to move to the property of another landowner who promised a better deal for the next year. A study published in 1924 reported that only about one-fourth of South Carolina's tenant farmers had been on the same land for more than five years. Even as late as 1945, tenants still operated 54 percent of the farms in the state.

Sharecropper Accounts

Collected by Mary Holmes

From the early explorers who came to America long ago, we know that many, many foods are produced from corn. For example, there's the popcorn plant handed down to us from the Native Americans who raised many types of corn including sweet corn and dent corn. According to members of the Timmons family who are local to these parts, corn is about all they ate in the old days and is still a big part of their meals. In this family of 16 children, it was the custom for this family to boil large black pots of corn with 5 to 10 dozen ears or more. Reverend James Curry said that the Timmons family loved corn better than a hog loves slop! Corn cobs were used to make fires to warm their homes and the shucks were boiled to make a tea to treat measles.

The cotton crop, according to Mr. Willie Moses III, was just as important in this area as tobacco. Cotton was picked by the sharecroppers--who were the people that lived in the tenant houses, which were usually of very poor quality. The families and their children would pick the cotton in sacks, tie it up in burlap sheets, and take it to the gin for payment and processing. Each sharecropper was paid an amount of money for the cotton minus the expenses charged him for the crop. For most share croppers, this was all they had to live on during the harsh winter months.

Draining the Bays for Agriculture and Forestry

The rich organic soils which underlie most Carolina Bays have attracted large numbers of farmers and led them to ditch and drain the Bays in order to convert them to agriculture. Once a ditch is dug through a Bay, water will seep out of the surrounding soil, under the influence of gravity, to seek a lower elevation. Of course the ditch must cut through the rim of the Bay to empty into a lower elevation stream which will carry the water out of the area. Eventually the Bay dries out enough so that the soil can be plowed and crops can be planted. Once the standing water is removed and the water table is lowered, the organic rich soils respond by producing abundant crops. The shallow water table helps to prevent crops from drying out during summer drought conditions.

A similar procedure was followed to provide access to valuable hardwood timber. Particularly cypress trees were normally inaccessible to large scale lumbering operations in the 1800's and early 1900's due to the swampy surroundings. Lumber companies would typically ditch and drain a Bay when possible, then build plank roads over the spongy landscape. After cutting the timber, the logs were dragged out of the Bay by horses or mules, or later by tractors. Some Bays still show the scars of the ditching and the paths of tramways even after decades of restoration efforts.

Carolina Bays as a Unique Natural Habitat

Carolina Bays are the dominant freshwater wetland feature of the Coastal Plain of South Carolina. But not all Bays provide the exact same **habitat** conditions. Some Bays are wet all of the time, supplied by springs, producing a bog-like ecosystem with its associated unique mix of plant and animal species. These Bays maintain an acidic environment with very low oxygen levels. Various species of blueberries, wild azaleas, hollies, loblolly bays, pond pines, and abundant vines and briers thrive in those unique habitat characteristics. Some wet Bays also contain rare insectivorous plants such as the Venus fly trap, pitcher plant, and sundew. In turn, this lush vegetation has attracted various species of wildlife, ranging from the small tiger salamanders and tree frogs, to much larger bobcats and alligators. The thick underbrush also offers a safe haven to deer. Other Bays are dry much of the time providing a more grassy savanna-like habitat. Rare plant species are also found in drier Bays. Examples include mock bishop's weed, quill-leaf, rose coreopsis, and spoonflower.

Recent Efforts to Preserve the Carolina Bays

Many of the Carolina Bays have succumbed to our growing population's desire to develop additional land. They are being logged, cleared, plowed, sliced up by roads, and built up at an alarming rate. In a recent survey, the South Carolina Department of Natural Resources identified 2,651 Bays, over two acres in area, in the state. It has been estimated that only 36 Bays are still relatively untouched. Woods Bay, in Sumter and Clarendon counties, now preserved in its natural state but once the site of a water powered grist mill, is part of the South Carolina State Park System and has been kept in an almost pristine condition. Several other Bays have been protected as nature preserves through the Heritage Trust Program. Cathedral Bay in Bamberg County was

purchased and is now under the care of this public foundation. Several other Bays purchased by the Heritage Trust Program include Junkyard Bay in Clarendon County, Cartwheel Bay in Horry County, and Savage Bay in Kershaw County. Bays are being preserved so that future generations will be able to continue to enjoy these unique elliptical shaped "botanical treasure houses" and continue the search for their origin.

Summary

Carolina Bays are interesting geological formations that have intrigued South Carolinians for generations. Many theories have been suggested to explain the formation of the Bays, ranging from the difficult to accept ones - such as the Bays' being scooped out by giant turtles - to the difficult not to accept ones - such as the Bays' being formed by a meteorite shower. However, the current front-running theory suggests that the Bays were formed gradually from pre-existing ponds by the slow action of prevailing winds. If this is true, however, some interesting questions arise. What formed the original ponds? Why are no Bays forming today? These and other related questions need the efforts of new scientists with fresh ideas.

However the Bays formed, they are organically rich and normally very wet. They support several rare and endangered plant and animal species and provide major wetland habitat for one of the most diverse biological communities of the Coastal Plain Region. If drained, the rich soils of the Bays can be used for farming. Except along the rim of the Bays, where the soil is sometimes almost totally sand, typical Bay soils are able to support the growth of both row crops and forest products.

Historically, sharecropping was common in and around the Carolina Bays, as it was throughout most of the Coastal Plain Region. Even though the system served as a way of life for many tenant farmers it is no longer practiced in South Carolina. Several of the Carolina Bays remain in their natural state, but the majority have been ditched and drained for agriculture or logging. Only 35-40, out of an estimated 2651 original Bays over two acres, have been protected. The preservation of remaining natural Bay areas is an important contemporary issue.

PLACES TO VISIT 🏠

Woods Bay State Park. Located near Turbeville and Sumter-Clarendon counties. Olanta, SC. For information call (803)-659-4445.

Cathedral Bay Heritage Preserve. Located in Olar and Bamberg counties. For information call (803)-734-3893.

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STUDY AREA 8: CAROLINA BAYS

Activity 8-1: Overview

Materials		
6	STATE BASE MAP #2, WITH HIGHWAYS	1: 500,000
6	COASTAL SATELLITE IMAGE	1: 332,640
6	CONGAREE SWAMP LITHOGRAPH	1: 12,000
6	CONGAREE SWAMP TOPOGRAPHIC MAP	1: 24,000
6	LAKE MARION LITHOGRAPH	1: 18,000
6	LAKE MARION TOPOGRAPHIC MAP	1: 24,000
6	MYRTLE BEACH LITHOGRAPH	1: 12,000
6	MYRTLE BEACH TOPOGRAPHIC MAP	1: 24,000
6	WOODS BAY LITHOGRAPH	1: 12,000
6	WOODS BAY TOPOGRAPHIC MAP	1: 24,000
6	SAVANNAH RIVER SITE LITHOGRAPH	1: 8,900
6	SAVANNAH RIVER SITE TOPOGRAPHIC MAP	1: 48,000
1	Map of Marching Bays	Figure 8-1
6	Transparent grid Overlays	
6	Wipe-off Pens	

PERFORMANCE TASKS

(Icon Key) Overview = →; Science = ⚙; Math = 📐; History = 📖; Language Arts = ✍

1. Make an index chart of Carolina Bays. → 📐

Divide into groups, each group using different maps. Locate as many Carolina Bays as possible on your assigned map(s) and fill in the Index chart below. Unaltered Carolina Bays will appear as oval depressions. Bays that have been altered for logging or agriculture may appear more irregular in shape. Organize your list of Bays according to names, assigning a number if there is no name. Measure the length of the long axis of the Bay and determine the size of each Bay in square feet or square miles. Use either the mathematical formula for the area of an ellipse, or estimate this value using the transparent grid overlay. Convert your answer to acres (there are 640 acres in one square mile). Next, record the direction (orientation) of the long axis of each Bay. Use contour line information to determine the elevation of the center of each Bay. Then determine the approximate elevation of the rim, and calculate the elevation difference. Also note land use by analyzing if the Bay has been disturbed. Green on the topographic maps indicates wooded areas, white indicates open fields. What percent of the Bays recorded on your index have been disturbed? What environmental concerns address the need for the protection of Carolina Bays?

Group I **Map of Marching Bays-Lewis Bay Complex (Figure 8-1)**

Group II **Congaree Swamp Topographic Map and Lithograph**

Group III **Myrtle Beach Topographic Map and Lithograph**

Group IV **Lake Marion Topographic Map and Lithograph**

Group V **Savannah River Site Topographic Map and Lithograph**

Group VI **Woods Bay Topographic Map and Lithograph**

When you have collected all of your data, use information provided on your map to pinpoint its location on the STATE BASE MAP #2, WITH HIGHWAYS. Select one person from your group to mark your Carolina Bay locations on the map, at the front of the room, with a wipe-off pen. Discuss with other groups the geographic distribution of Carolina Bays throughout South Carolina. Which landform regions contain Bays? Which do not? Examine the COASTAL SATELLITE IMAGE. Are any Carolina Bays large enough to show up on the image? Use the Scale Bar to predict how large a Carolina Bay would have to be (minimum size) to show up on the satellite image.

CAROLINA BAY INDEX

NAME OR NUMBER OF BAY	LENGTH OF LONG AXIS (FT.)	SURFACE AREA OF BAY (ACRES)	DIRECTION (ORIENTATION) OF LONG AXIS	ELEVATION AT CENTER OF BAY	ELEVATION AT EDGE OF BAY	ELEVATION DIFFERENCE	LAND USE

2. Compare characteristics of Marching Bays. 🗺 ⚙

"Marching Bays" is the nickname for the pattern formed when several Bays are found sitting side by side, appearing to be grouped together. Examine the WOODS BAY LITHOGRAPH, the LAKE MARION LITHOGRAPH, and Figure 8-1 "Map of Marching Bays-(Lewis Bay Complex)." Outline all Marching Bays on each lithograph with a wipe-off pen. Compare these patterns to the Lewis Bay Complex shown on Figure 8-1. Are most Bays in the groups of Marching Bays about the same size, or is there a big size difference? How many Bays have sand ridges on the perimeter rim? Do the sand ridges go all the way around the Bay, or do they occur only in certain places? How can you recognize sand ridges on the infrared lithographs? What percent of the Bays on each lithograph are associated with swamps? Are there other swamps nearby which are not associated with the Carolina Bays? Which Bays drain into swamps? Into what do the other Bays drain?

3. Evaluate pros and cons of Carolina Bay origin theories. 🗺 ⚙

List what you think are the pros and cons of the proposed theories for the origin of the Carolina Bays. Discuss the possibility of proving each theory. Make up your own theory of the origin of the Carolina Bays and present it to your group or to the whole class. How could you gather data that would support, modify, or disprove your theory?

4. **Contrast Native American uses of Bays with modern uses.** ✍ ⚙
Contrast Native American uses of the Carolina Bays to the later or current uses of the Bays. Construct a Venn diagram showing which uses have not changed. Report your comparisons to the class. Set up a class debate on whether more of these unique wetlands should be preserved.

5. **Compare objective and subjective descriptions of Carolina Bays.** ✍
Read carefully through both descriptive articles printed on pages 8-7 and 8-8. One was written for a scientific journal, while the other was written for a more general audience. Both are describing similar Carolina Bays. What are the similarities and differences between the two styles of writing? What landform features are mentioned by both writers? Are the landscape features described the same way? Explain any differences in the authors' approaches.

Select a local landform feature that you know well. Write two descriptions of this feature, one an objective scientific description, the other a more subjective description. Which one was easier for you to write? Why?

6. **Evaluate desirability of Carolina Bays for home sites.** ✍
Read through the selection of Sharecropper Accounts on page 8-9 and discuss various aspects of farming life within your group. Why do you think a farm family might locate their home site in a Carolina Bay? What about on the rim of a Bay? Make a list of pros and cons and decide where you would choose to live if you were a farmer. Select a Carolina Bay which fits your desired characteristics and which is visible on the COASTAL SATELLITE IMAGE. Mark its location on the lithograph and explain to the class why you would want to live there.

7. **Identify potential non-point source pollution by examining land use.** ⚙
On the WOODS BAY LITHOGRAPH, locate the outlet for the drainage ditches present in Dials Bay, the large drained Bay just west of Woods Bay. Use the WOODS BAY TOPOGRAPHIC MAP as a reference if needed. Into what waterway does this water drain? What kinds of non-point source pollutants would you expect to find in this water? Now locate the outlet from Woods Bay. Into what waterway does this Bay drain? What kinds of non-point source pollutants would you expect to find in this water? Is the danger from pollutants the same for each Bay? Explain your answer.

ENRICHMENT

- 1. Request a copy of the Carolina Bay Project survey.** ⚙️ ✍️
Request a copy of the Carolina Bay Project survey results published by the South Carolina Department of Natural Resources. What has been done to preserve the Bays? What is the value of these unique wetlands? What are some of the rare and endangered plants found on the federal endangered species list? As a citizen, what can you do to save these Bays?
- 2. Compare your Carolina Bays index to official index.** ⚙️ ✍️
The Department of Natural Resources has made an extensive index of Carolina Bays. Note that the index records only Bays with an area of more than two acres. Contact the Department of Natural Resources for their report of Carolina Bays and compare their data with your own data from Performance Task #1 (pages 8-13 and 8-14).
- 3. Research what crops in your area were grown by sharecroppers.** 📖 ✍️
Ask around your community to see if you can find someone who picked cotton or cropped tobacco by hand. In your interview, ask about stories from those times. If you live in an area where tobacco or cotton is not grown, find out how these crops are harvested today. Are migrant workers used today to harvest cotton, tobacco, or other crops? How do the workers get in and out of your community? What about their children? Look for books or stories that talk about sharecropping. One book available is Picking Cotton by Sherley Anne Williams, illustrated by Carole Byard. The publisher is Harcourt Brace Jovanovich, 1992. Prepare a report and present it to your class.

The Greenville Piedmont

July 28, 1988

Lawmen say "Lizard Man" exists

<p>staff report</p> <p>A Lee County sheriff's deputy and a South Carolina Highway Patrol trooper say their experience responding to a report of a Bigfoot sighting along U.S. 15 and Interstate 20 before daylight Sunday left them convinced that "something is out there." They believe that whatever is out there watched as they stepped out of their car to examine garbage strewn onto a dirt road near Scape Ore Swamp.</p> <p>They also examined a broken tree limb dangling about 9 feet overhead before they got back in the car, drove down the road and turned around.</p> <p>When they returned to</p>	<p>the site, the officers said, they found that something had walked across their tire tracks, leaving a fresh set of the three-toed, 14-by-7 inch prints before it entered the woods.</p> <p>Trooper Mike Hodge, a former marine who has been with the patrol for 1 1/2 years, said, "If a prankster were out there and the law pulled up, they would have gotten out of there."</p> <p>But Lee County Sheriff Liston Truesdale, skeptical to the core, said he believes the tracks were a prankster's work, designed to keep the Lizard Man mania alive. "Whoever did it sure did a convincing job," Truesdale said with a chuckle.</p> <p>"They were just some</p>	<p>weird tracks," said Hodge. "They were too consistent to be fake. They were deep down in that hard dirt. "I stomped in the road, and I couldn't make a track," Deputy Wayne Atkinson said. "I put my foot in the track and I'm 6-foot, 3 1/2 - inches tall and I lacked touching that limb by about 3 feet."</p> <p>Truesdale seems to be growing weary of the Lizard Man, described as a red-eyed, tall, green creature by a Lee County youth, but Deputy Atkinson says, "I'll be back, you can bet on that. I'm going to stay on it until I find out what's out here. If it is a prankster, I've got one thing to say: He'd better cut it short."</p>
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RATIONALE

Of all the landforms in South Carolina that have aroused the curiosity of both geologists and local residents, Carolina Bays are at the top of the list. Woods Bay was selected as the Carolina Bay study site because it is the largest Bay preserved in a near-pristine condition and also because it is one of the most easily accessible, being located just south of Interstate Highway 95 on the border of Clarendon, Florence, and Sumter counties. In the 1920's, most of the cypress trees were logged, and tramways were laid over swampy areas to allow timber to be hauled out. In 1971, logging companies were prevented from repeating the harvest when Woods Bay was made a state park. It contains both swampland areas and grassy savanna areas, as well as pine barrens along its sand rim. A cypress-tupelo community dominates the interior of the Bay, while longleaf pines cover the drier rims. Woods Bay stands in sharp contrast with nearby Dials Bay, which was drained for agricultural use. The park is a refuge for many varieties of birds, amphibians, reptiles, and mammals, as well as to a host of rare and specialized plants.

Brief Site Description

Characteristics of Woods Bay

Woods Bay State Park was established in 1972 following the efforts of naturalist J.C. Truluck, who led the movement to protect the Bay from impending logging operations. The park contains the 1,548 acre Bay itself and just enough surrounding land to provide a buffer zone between neighboring agricultural fields and wetlands of the interior. This Bay is one of the wettest in the state because of artesian springs which flow year round and keep the basin covered with about three feet of water, pure enough to drink. About one-third of the area is covered by a watery blanket of marsh grasses and water lilies, while most of the remainder is a dense, swampy, shaded forest dominated by cypress and tupelo gum trees. Neighboring Dials Bay provides a clear contrast in land use, as it has been extensively ditched and drained for agricultural purposes. Several smaller Bays nearby have also been converted to agricultural use.

Park Facilities, Boardwalk, and Canoe Trips

Unlike many state parks in South Carolina, Woods Bay does not offer camping, swimming, miniature golf, or any other of the typical recreational amenities which traditionally draw large numbers of visitors to the outdoors. For individuals or groups who wish to experience the wilder side of nature, unspoiled by development, Woods Bay is the perfect location. The park offers a boardwalk which winds through dense forests and open swamp areas, offering close-up views of a variety of plant and animal life from the safety of a dry platform. More adventurous visitors can take advantage of canoe rentals. Although there is not a lot of open water available, there is enough for a leisurely hour-long paddle through several sub-environments of the Bay habitat.

Land Use in Woods Bay

Woods Bay was extensively logged for its cypress trees in the 1920's and 1930's. Because it was swampy year-round, the Bay could not be logged in the traditional fashion; instead, tramroads or boardwalks had to be constructed on top of the swamp so that logs could be hauled out without bogging down in the wet soils. Because of the underground artesian springs which keep most of its acreage under water, Woods Bay was never drained for agriculture. In fact it has seen some very different types of land use than most of the other Carolina Bays in this part of South Carolina.

Although it proved unsuitable for agricultural use, Woods Bay does offer a naturally occurring **reservoir** of fresh water suitable for another important type of land use. At least three water-powered grist mills were operated here by three different people. One of the mills was owned by Andrew Woods, for whom the Bay was named. The last of these mills ceased operation in the 1930's. At some time during this period, a mill pond was constructed along the north side of the Bay. Remnants of this pond, near the park's Visitor Center, can still be seen from several viewpoints along a mile long trail which encircles it. The former pond area has been almost totally reclaimed by nature and is now a favorite feeding ground for birds and alligators.

Activity 8A-1: Anatomy of a Carolina Bay

Materials

6	STATE BASE MAP #2, WITH HIGHWAYS	1: 500,000
6	LAND USE/LAND COVER MAP	1: 500,000
6	GENERAL SOIL MAP	1: 594,000
6	GEOLOGIC AND MINERAL RESOURCE MAP	1: 1,000,000
6	COASTAL SATELLITE IMAGE	1: 332,640
6	WOODS BAY LITHOGRAPH	1: 12,000
6	WOODS BAY TOPOGRAPHIC MAP	1: 24,000
1	State Map of Major Drainage Basins	Figure 1-2
6	Transparent Grid Overlays	
6	Wipe-off Pens	

PERFORMANCE TASKS

(Icon Key) Overview = →; Science = ⚙; Math = 📊; History = 📖; Language Arts = ✍

1. **Locate the study site.** → ⚙

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

2. **Analyze the newspaper article.** ⚙ ✍

Read the newspaper article on page 8A-3 titled, "Lawmen say 'Lizard Man' exists." Explain how the story relates to the Coastal Plain Landform Region. Identify on the STATE BASE MAP #2, WITH HIGHWAYS, (refer to the COASTAL SATELLITE IMAGE if needed), where the places and events named in the story might be located. Explain why the publisher thought this story might be of interest to newspaper readers. Using the same references and the same location as your setting, write another newspaper article related to the same situation, but date it far enough in either the future or the past so that you will have some changes to report. Choose a title (headline) and draw an appropriate picture to illustrate your main point.

3. **Analyze land use changes through time.** →

Look in the margins of the WOODS BAY TOPOGRAPHIC MAP and the WOODS BAY LITHOGRAPH to determine the year the map data was gathered and the year the aerial photograph was taken. Examine each cartographic product carefully to identify any changes which have occurred during the interval. How many of these changes are man-made? How many have occurred naturally?

4. **Relate different temperatures to habitat characteristics.** 📊 ⚙

Crickets are known to chirp at different rates depending on the temperature of the environment they are living in. (Crickets in warmer habitats chirp more frequently.) As part of a school project, your group took an afternoon field trip to the Woods Bay

area to gather data about surface temperature differences between agricultural Dials Bay (large drained Bay west of Woods Bay) and forested Woods Bay. Your data consisted of two tape recordings of crickets chirping. Unfortunately, when you returned to school to analyze your data, you realized that nobody in your group had marked down which recording came from which Bay.

First your group will have to calculate the average temperature represented by each of the recordings of cricket chirps. Your data indicate that crickets from one of the Bays were chirping at an average rate of 200 times per minute, while crickets from the other Bay were chirping at an average rate of 180 times per minute. The formula for converting cricket chirps per minute (P) into Fahrenheit temperature (F) is:

$$F = \frac{1}{4} P + 37$$

Secondly, you will have to examine carefully the WOODS BAY LITHOGRAPH to determine, as best you can, which Bay would be cooler. Consider land use differences, vegetative cover, and soil differences to determine your answer. Put your answers together to report the afternoon surface temperature of Dials Bay and of Woods Bay.

5. **Identify features in and around Woods Bay State Park.** → ✨ 🗺

Woods Bay and Dials Bay are situated on the Sumter-Clarendon County line near Turbeville, SC. Locate Woods Bay on the WOODS BAY TOPOGRAPHIC MAP. Woods Bay State Park is an excellent example of a Bay that, since the 1930's, has been preserved in its wooded state. On the WOODS BAY LITHOGRAPH, note the remnant pattern of the tram roads running through the Bay. Now examine adjacent Dials Bay. What do the patterns you see there indicate? Are those same patterns present on the topographic map? Continuing to examine the topographic map, determine the elevations of Woods Bay (in feet) and Dials Bay (in meters). Which Bay is higher? How far above sea level would you be if you climbed to the highest point on this map? How far would you be above Woods Bay? Locate the town east of the State Park. Name the main river and its tributaries flowing between the town and the Park. In which direction are these waters flowing? On the lithograph, locate the town of Olanta, Douglas Swamp, and sand ridges on the rim of the Bays.

6. **Estimate surface area of Woods Bay.** 🗺

Outline Woods Bay on the WOODS BAY LITHOGRAPH with the wipe-off pen. Estimate the image area in square inches using the transparent grid overlay. Then use the conversion factor for this map, 1 square inch = 22.9 acres, to find the approximate acreage of Woods Bay. Use a measured dimension of Dials Bay and the area of Woods Bay to set up a ratio to calculate the approximate surface area of Dials Bay.

7. **Trace boundaries for Carolina Bays soil types.** ✨

Use the soil type descriptions in the Background Information section to identify exposures of the Ponzer, Rutledge, and Rimini soil types in as many Carolina Bays as possible on the WOODS BAY LITHOGRAPH. Trace the boundary lines between each soil type with a wipe-off pen. You may use the WOODS BAY TOPOGRAPHIC MAP as an additional resource. Which areas will require a lot of on-the-ground investigation to determine true soil boundaries? What is your reasoning for placing these boundaries where you did? Look at the cleared agricultural fields on the lithograph. Can you make any assumptions regarding different soil types in these fields? Explain.

8. **Make line plot graph of Woods Bay biota, identify vegetative groupings.** ✨ 📊

The ability to organize, summarize, and communicate numerical information is a necessary skill in many situations, especially science projects and science laboratory reports. You will often find data presented in charts or tables, but one of the most efficient and revealing presentations of data is in the form of a graph. One of the simplest types of graph is the line plot.

 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

The table below summarizes the relative diversity of flora and fauna found at Woods Bay State Park. To visualize relative levels of diversity on a line plot, place markers or symbols on a horizontal line containing a scale of numbers. Since the smallest number in your data is 5, and the largest is 96, the scale might run from 0 to 100. Some estimation will be required in placing your markers or symbols on the line plot. Identify gaps, clusters, or outliers (a lone point far from others) in your plotted data.

BIOTA OF WOODS BAY STATE PARK		
GROUP	VARIETIES	SYMBOL
Trees	16	S
Scrubs	20	B
Herbs	25	A
Ferns	5	W
Mammals	6	O ₁
Reptiles	15	D
Amphibians	10	O ₂
Birds	96	Y

9. **Explain unusual contour line patterns.** ✨

Locate Interstate Hwy. 95 in the northwest corner of the WOODS BAY TOPOGRAPHIC MAP. Why are contour lines so straight on either side of the interstate? Locate Dials Bay just west of Woods Bay. Why are the contour lines so unusual in parts of Dials Bay?

ENRICHMENT

1. Research the sand ridge habitat around Woods Bay. ✨

Write to Woods Bay State Park Headquarters for information about the sand ridge habitat on the southeastern rim of Woods Bay. Describe the plants and animals that are found growing on this sand ridge. Why is this considered a very different ecosystem from the interior Bay?

2. Use an equation to describe the shape of Woods Bay. 📐

Use the equation for an ellipse to determine if Woods Bay is truly elliptical. The following equation is used to define an ellipse.

$$1 = \frac{y^2}{a^2} + \frac{x^2}{b^2}$$

Using the WOODS BAY TOPOGRAPHIC MAP, draw a line lengthwise across the Bay so that it divides the Bay into equal halves. This line is called the major axis. Draw a line across the Bay perpendicular to the major axis, so that it divides the Bay into equal quarters. This line is called the minor axis. From the intersection of the major and minor axes, measure the distance (convert to feet with Scale Bar) along the major axis to the edge of the Bay. This distance is "a" in the formula above, the semi-major axis. The measured distance (convert to feet with Scale Bar) from the intersection of the axes along the minor axis to the edge of the Bay is "b" in the formula above, the semi-minor axis. Substitute these distance figures into the formula.

Use the transparent grid overlay to identify several (x, y) coordinate pairs along the edge of the ellipse. Orient your grid so that the semi-major axis "a" corresponds to the "y" axis in your coordinate system, and use the intersection of the major and minor axes as the origin (0,0). Use the scale of the map to determine the x and y distances associated with these coordinate pairs. Substitute your x and y values into the formula above. How close is your calculated value to 1? The answer is 1 if the Bay is an exact ellipse. Does the formula accurately describe the shape of Woods Bay?