# T he C ircle of L ife

## **D** iscovering the food web of the

## maritime forest

## G rades 5-7

B y: J ennifer J olly

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## **Unit Introduction**

This field trip will focus on the maritime forest at Edisto Beach State Park located on Edisto Island, a sea island. The maritime forest we will discover is bordered by salt marsh. Plant species typically found in a maritime forest ecosystem are present.

The field trip is structured so that it can be teacher-led and focuses on the food web and nutrient recycling in the maritime forest. To help illustrate this point, students will view the maritime forest through the eyes of early settlers. The first settlers learned how to utilize the natural resources from the Native Americans. A set of field guides will be available at Edisto Beach State Park's Nature Center for the teacher to use. Background information and the nature guides will aid the teachers and students in discovering the food web of the maritime forest. This packet includes pre-site activities, on-site activities and post-site activities to reinforce learning. Edisto Beach State Park will send out pre-site activities and information after the teacher makes a reservation. It is vitally important that students complete the pre-site activities so that they come to the field trip with a basic understanding of the concepts. This will reduce boredom and confusion once the students are on the trail! To make a reservation, contact the Park Interpreter at 843-869-9073. It is recommended that you take your students on this field trip between October and March. Between April-September, the mosquitoes dominate the forest and will make for a miserable experience! Please also remind students to stay on the trail. This protects the resource and the students - young naturalists may not be skilled at identifying poison ivy!

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This field trip will work best if you have at least 2 other chaperones so that you can split your class into three smaller groups. There are three on-site activities and the groups can rotate. The teacher may want to bring a backpack in order to carry materials provided by Edisto Beach State Park (like the "Medicine Man" activity bag).

The check-in kit will include the following items: "Plants for Pioneers" cards, a <u>Magnolia grandiflora</u> leaf (for plant identification activity), live oak leaves (for plant identification activity), map of the trail with the locations of the markers for "Plants for Pioneers" and the location of the rotting log, laminated leaf guides, hand lenses, clipboards (the supply is limited, you may suggest to your students to bring their own), and rulers.

Students should be familiar with the following vocabulary words: food web, food chain, fungus, decomposers, consumers, primary producers, evergreen, predator, prey, omnivore, scavenger, carnivore, herbivore, and sap.

## **Unit Science Standards**

Source: Jennifer Jolly, COASTeam Program, University of Charleston

## The Circle of Life

#### Discipline Life Science

*Objectives* Students will become more familiar with the maritime forest ecosystem.

#### Key Concept

The food web of the maritime forest includes plants, animals and decomposers. Decomposers are essential for nutrient cycling in the ecosystem.

#### Skills

Observing, Communicating, analysis, comparison, discussion, organization, data recording

#### Vocabulary

Predator, prey, consumer, producer, omnivore, herbivore, evergreen, fungus, food web, food chain, carnivore, scavenger, decomposer, sap

#### Duration Pre-site: 1.5-2 hours, On-site: 1.5-2 hours, post-site: 1.5-2 hours

*Relevant Pages in <u>Of Sand and Sea</u>* 63, 37-41

South	Carolina	Science	Curriculum	Standards
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		-			
Grade	Area	Unit of Study	National Science Education Standards *		S.C. Components**
5	Life Science	Cells and Systems, Ecosystems, (Aquatic/ Terrestrial)	Populations and Ecosystems	2. Populations of organisms can be categorized by the function they serve in an ecosystem	a
5	Life Science	Cells and Systems, Ecosystems, (Aquatic/ Terrestrial)	Populations and Ecosystems	3. For ecosystems, the major source of energy is sunlight	a, b
5	Life Science	Cells and Systems, Ecosystems, (Aquatic/ Terrestrial)	Populations and Ecosystems	1. A population consists of all individuals of a species that occur together at a given place and time	b

\*Indicated portions of the South Carolina Science Curriculum Standards that are derived directly from the National Science Education Standards \*\*Components of the South Carolina Curriculum Standards adopted January 12, 2000

Inquiry Standards		
Grade	National Science Education Standards*	S.C. Components
	Process Skills	
4,5	Observe	а
4,5	Classify	а
4,5	Measure	а
4,5	Communicate	а
4,5	Infer	a
4,5	Predict	
5	Hypothesize	
5	Define Variables	
	Inquiry	
4	Plan and conduct a simple investigation	a, c, d, e, f
5	Plan and conduct a simple investigation.	
	Abilities of Technological Design	
5	Identify appropriate problems for technological design.	
5	Design a solution or product.	
*Indicated	portions of the South Carolina Science Curriculum Standards that are derived directly from the Nationa	al Science Education Standards

## **Pre-Site Activities**

#### Pre-Site Activity 1: Making a Field Journal

Before your students begin to explore the maritime forest ecosystem, have your students make a field journal. There are data tables included in the packet that should be copied for each student. Be sure to remind them to add in plenty of blank pages for sketches of their observations. This will be used as assessment of the student's learning experience on the field trip!

Run copies of the following pages for the students' journals:

- "Animals Clues Key" from Pre-site activity 4.
- Dichotomous Key from On-Site Activity 1
- "Leaf Characteristics" guide from On-Site Activity 1
- "Data Sheet" from On-Site Activity 1.
- "The Medicine Man Data Sheet" from On-Site Activity 2.
- "Who's For Lunch?" from On-Site Activity 3.
- "Animal Clues Data Collection Sheet" from On-Site Activity 3.
- "Rotting Log Data Table" from On-Site Activity 4.
- "Thought questions for the rotting log" from On-Site activity 4.
- "Post-Site Activity 3 Student Sheet" from Post-Site Activity 3.
- The students will need blank pages to draw and record observations for the activities.

### **Pre-Site Activity 2** What Is Maritime Forest?

#### Materials:

• Copies of "What is maritime forest"

#### Procedure:

- 1. Run copies of "What is maritime forest?" page and distribute to the students.
- 2. Have students read the information.
- 3. Lead a discussion by prompting students with questions. Examples:
- List characteristics of a forest. (woodland; land covered with trees and shrubs)
- Compare and contrast different kinds of forests? (For example, is a rainforest the same as a forest in the mountains? The same as the forest in your backyard? Bring up location, types of trees, types of animals, etc.)
- What makes maritime forests different from other forests? (located close to the coast, different plants, some different animals)
- 4. As an extension, you may have your students research maritime forests using various resources.

#### What is maritime forest?

Maritime forests occupy higher ridges of barrier islands and sea islands where there is more protection from salt spray and winds. Typically, salt spray from the ocean limits the species that can survive this harsh environment, however, dunes and shrub communities shield most of the spray and allow salt-tolerant species to form maritime forest communities. The plants facing the ocean still exhibit a "salt sheer," which essentially causes the plants to look like they are leaning away from the ocean. Tiny droplets of salt water are blown onto oceanfront plants. The water evaporates, leaving just the salt. The salt then osmotically draws water out of the leaf, killing the exposed leaves. The community is typically found close to the immediate coast, however, maritime forests may sometimes be found on mainland areas that are bordered by salt marsh.

Edisto Beach State Park is physically divided. Approximately one-third of the park's 1255 acres is on Edisto Beach, a barrier island. The remainder of the park is located on Edisto Island, a sea island separated from Edisto Beach by marsh. The maritime forest of Edisto Beach, the barrier island, is rapidly eroding into the ocean. The Nature Center is built where maritime forest once stood. The forest has also been cleared to create the campground; however, remnants of the maritime forest still remain. Maritime forest is also found in the portion of the State Park located on Edisto Island, a sea island. This forest is bordered by marsh and is slightly more diverse than the maritime forest located on the barrier island.

The maritime forest on the sea island is a secondary community. The land on Edisto Island was cleared of its underbrush approximately 70 years ago and has since grown into a magnificent forest! Loblolly pines dominate the portion of the trail this field trip covers. Loblolly is a telltale sign an area has been disturbed because it is one of the first species to establish itself in a disturbed ecosystem.

The plant species in maritime forests are primarily evergreen. The year-round shedding of leaves provides a continuous source of nutrients to the relatively nutrient-poor soil. Maritime forests are important for several reasons: (1) protection of the mainland against storm surges, (2) habitat for a number of species, and (3) many migrating songbirds utilize the insect populations of the maritime forest as a food source. Fruits of maritime forest plants also provide food for resident birds.

Maritime forest communities are in danger of disappearing due to coastal development. For example, the maritime forest community is absent from Folly Beach. With coastal development, much of the overstory may be preserved, however, understory species of plants are destroyed and these are critical food and shelter sources for birds, small mammals, reptiles and amphibians.

### Pre-Site Activity 3 Find That Leaf!

#### **Objectives:**

Students will: (1) become familiar with the leaf characteristics that are used to identify plants.

#### Materials:

- Various leaves
- Paper for student descriptions

#### Procedure:

- 1. Gather leaves or have each student bring in a leaf from home.
- 2. Split class into smaller groups of approximately 5-6 students per group.
- 3. Distribute a different leaf to each member of the groups.
- 4. Have the students write a detailed description of the leaf. Students should put their names on their leaf descriptions.
- 5. Take up the leaves and put them in a pile in the center of the group. Take up the descriptions and re-distribute them to other members of the group.
- Have each member of the group find the leaf that matches the description he/she has been given and confirm his/her answer with the student who wrote the description.
- 7. Have students discuss in their journal how they might identify a plant they came across in the forest.

#### **Teacher Tip:**

While the students are writing their leaf descriptions, introduce terms they will be using in the field. A "Leaf Characteristics" guide is included in this packet with the On-Site activity "Plants for Pioneers".

#### Extension:

Give each group approximately four leaves. Have the students develop a simple dichotomous key based on observable characteristics of the leaves and record the key in their journals.

Example:



### Pre-Site Activity 4 Animals Clues Recall

#### **Objective:**

Students will become familiar with maritime forest animals and the clues they leave behind.

#### Materials:

- Copies of "Animal Clues Recall" cards
- Copies of "Animal Clues Key" if you choose to allow students to use this as a reference

#### Procedure:

- Distribute the "Animal Clues Key" and lead a discussion about the clues animals leave behind. You may want to have the groups play the game using the key the first time and without the key subsequent games.
- 2. Split class into groups of 3-4.
- Run as many copies of the Animal Clues cards as needed. Each table, i.e. ANIMALS, CLUES, REASONS CLUES LEFT BEHIND, should be run off in a different color.
- Place the CLUES face-up. The group should collaboratively match the ANIMAL with the correct CLUE. Finally, the group should add the REASON THE CLUE WAS LEFT BEHIND to the stack.
- 5. Students should record each correct match made in their journals.

### **Animal Clues Key:**

- Holes in tree = woodpecker (red-bellied, red-headed, pileated, yellow-bellied sapsucker, common flicker) = foraging for insects
- Furry pellet = owl (barred, great horned, or screech) = parts of prey that couldn't be digested
- 3. Tube-like hill in ground = mole = locomotion and food gathering
- 4. Large nest of plant material in trees = squirrel (grey or fox) = shelter
- 5. Small nest made of plant material = bird = shelter
- 6. Web = spider = catching food
- 7. Bark scraped off tree = white -tailed deer = scraping velvet from antlers



8.

= white-tailed deer = crossing marsh to search for plant material



9. **Solution** = bobcat = searching for rodents and mice (most successful mammalian

carnivore in maritime forest)



- = opossum = searching for insects and plant material (omnivorous)
- 11. "stripped" pinecone = squirrel = food source
- 12. empty acorn shells = squirrel = food source

### ANIMALS

Squirrel	Woodpecker	white tailed deer
A M	<b>R</b> A	bobcat
Songbird 🕮	Owl	
2	squirrel	opossum
Spider		
white-tailed		squirrel
deer		*

### **CLUES**

Large nest of plant material in trees	Holes In Tree	
Small Nest Made of Plant material	Furry Pellet	
Web	Empty acorn shell	JY.
Bark Scraped From Tree	Tube-Like Hill in the Ground	"stripped" pinecone

## **REASONS CLUES LEFT BEHIND**

Feeding on insects	Shelter	Crossing marsh to feed on plant material
		Crossing marsh to
Parts of prey that could	Shelter and use to raise	search for rodents and
not be digested	young	mice
		Crossing marsh to
Food source	Catching food	search for insects and
		plants
Underground		
locomotion and food	Scraping velvet from	Food source
gathering	antlers	

## **On-Site Activities**

### On-Site Activity 1 Plants for Pioneers

#### **Objectives:**

Students will (1) analyze the role of **producers** in an ecosystem, (2) explain the importance of green plants to the survival of other organisms in the environment, (4) use a dichotomous key to identify maritime forest plants.

#### Materials:

- "Plants for Pioneers" cards (provided by EBSP)
- Leaf guides (provided by EBSP)
- Dichotomous key (each student should have a copy in his/her journal)
- Magnifying lens (provided by EBSP)
- Ruler (provided by EBSP)
- "Leaf characteristics" guide (each student should have a copy in his/her journal)

#### Teacher Background:

The maritime forest is a unique ecosystem. Live oak, cabbage palmetto, loblolly pine, yaupon holly, laurel oak, and Virginia creeper (though this is most visible in the spring) dominate the plant-life in the maritime forest at Edisto Beach State Park. A large portion of the canopy is evergreen. If your class goes after October, when the leaves have dropped from all deciduous species, have your students make this observation. Evergreen trees are able to take advantage of favorable moisture and temperature conditions during the autumn months. Live oak, a major component of the maritime forest canopy, is an evergreen tree whose leaves have many stomata. This allows the

leaves to absorb moisture at night, when there is less danger of the leaf drying out. The branching nature of the live oak creates a canopy with a large total leaf area. This allows live oaks to capture more rainfall and atmospheric nutrients. Evergreen does not mean that the plant does not shed its leaves. The plant continuously sheds its leaves and produces new ones. This provides a continuous, yet low, supply of nutrients to the forest because the leaves decay once they fall to the ground. For these reasons, being evergreen is an important adaptation in the maritime forest.

#### Procedure:

- 1. Divide your class into groups of 4-5 students.
- Pass out copies of the "Plants for Pioneers" cards to the students who will represent Native Americans. These cards are included in the check-in kit.
- 3. Begin in the parking lot. Tell the students that in order to get accustomed to using the key, they will begin with an identified plant. Show the live oak leaves that are included in the check-in kit and identify the plant for the students. Ask the students to point out a live oak tree (there is one in the center of the parking lot or in any direction you look!). Then, lead students down the trail, stopping at each numbered plant. A guide to the plants is provided in the check-in kit. In order to protect the resource, a leaf from #1(Magnolia grandiflora) will be included in the check-in kit. Please use this leaf for identification and point out the tree to the students.
- 4. Have the students use the dichotomous key to identify each plant. After the students have identified the plant, have the "Native American" holding the description of that

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plant read his/her card aloud to the rest of the class. Remind the students that it is important to know how to use these plants in their daily lives and that they should record this information in their journals. Settlers obtained this information from Native Americans.

5. Please collect all hanging plant markers and return to the EBSP Nature Center.

#### Teacher Key:

Thought question: Plants capture energy from the sun and make it available to other organisms. Plants are the base of the food chain.

#### Teacher Tips:

- When the students get to red cedar, instruct them to use a magnifying lens to view the leaves. The "scales" show up well under magnification!
- When identifying Cabbage Palmetto, be sure the students understand to look at the *entire* fan when deciding if the leaf is "Broad-Leaf" or "Needle Leaf"!
- Break only ONE leaf by bending the leaf in half. Instruct your students to smell this leaf to determine if the leaves are "fragrant" or "not fragrant".

### **Plants for Pioneers Data Sheet**

As early settlers, you must identify the plants around you and learn as much about their uses as possible. Use the dichotomous key to identify each plant. Then listen as a "Native American" explains to you the everyday uses of the plant. Draw the plant, label it, and record its uses.

**Thought Question:** If we are studying the food web of the maritime forest, why are we doing an activity on plants?


# Leaf Characteristics:



Bundled =

<u>Needle</u> = leaves <3 <u>mm</u>

Broad Leaf = leaves > 3 mm

<u>Toothed</u> = notches along the edges of the leaf

**Bundled** = more than one leaf held together at a common point

Red Cedar	Sweetgum		
<ul> <li>A tea made from the cones was used for colds and coughs</li> </ul>	<ul> <li>Chewed sap for sore throat, coughs and colds</li> </ul>		
<ul> <li>Chewed cones for cold sores</li> </ul>	<ul> <li>Chewed sap for diarrhea</li> </ul>		
<ul> <li>Note: Red cedar cones are very small, round, blue, and berry-like</li> </ul>	<ul> <li>Externally, used sap for wounds</li> </ul>		

Yaupon Holly	Loblolly Pine
<ul> <li>For certain ceremonies, Native Americans drank a strong leaf tea to induce vomiting. It was believed this cleansed the person.</li> <li>Only native plant that contains caffeine.</li> <li>Do not eat berries, they may make you very sick!</li> </ul>	<ul> <li>Needles were used to make a tea rich in vitamins A &amp; C</li> <li>Can also cook male pinecones as a vegetable</li> </ul>

<ul> <li>Leaves were used as a cooking spice</li> <li>Harvested for ship building by settlers (junction between limbs and trunk were used)</li> <li>Acorns are the sweetest of all oaks and can be eaten from the tree</li> <li>Acorns can be crushed to make flour for breads</li> </ul>

<u>Magnolia grandiflora</u>	Cabbage Palmetto
<ul> <li>Liquid from boiled bark has been used to treat malaria (a disease carried by some mosquitoes)</li> </ul>	<ul> <li>Center of the plant can be cooked; taste is similar to cabbage (this unfortunately kills the tree)</li> </ul>
• Flowers can be used as a spice	<ul> <li>Colonists used the trunks to build forts. The soft stems would absorb the impact of cannonballs and not shatter. (The trunks are not "true" wood.)</li> <li>This is the South Carolina state tree!</li> <li>Dried fruits can be pounded into a flour for making bread</li> </ul>

## On-Site Activity 2 The Medicine Man

#### **Objective:**

Students will understand the importance of native flora to Native Americans and early settlers.

#### Materials:

• The "medicine man" bag (provided by EBSP)

#### Background:

Now the students will use the information they just recorded in their journals. This can be done on the trail, or in the parking area adjacent to the trail.

When the settlers first arrived, there was no Eckerd or Wal-Mart, but there was a group of people who understood the many important uses of native plants. Many of the plants in the maritime forest held medicinal uses or served as a food source for Native Americans. Native Americans boiled the leaves of yaupon holly down to a very strong tea. This tea induced vomiting and was used for ceremonial purposes. Acorns present on both live oak and laurel oak can be crushed into meal to make breads. Acorns are rich in fat and protein. The sap from the sweetgum tree can be used for gum to treat coughs, sore throats, colds, diarrhea, dysentery, and ringworm. Externally, the gum could be used to treat wounds. The inner bark of pine trees can be used to make flour and the needles can be used to make tea, rich in vitamins A and C. *Smilax sp.* stems were used to relieve localized pains, cramps, twitching. The leaves and stems were used to make a tea that cured rheumatism and stomach troubles. Native Americans chewed the berries of American holly for colic and indigestion. They used leaf tea for

measles, colds, flu and pneumonia. Externally, they used American holly for sores and itching. Chewing 10-12 berries acted as a strong laxative. Root preparations from Yellow Jessamine were used as a central nervous system depressant, to deaden pain and reduce spasms. Native Americans would rub poison ivy leaves on skin that was infected with poison ivy-a kind of fight fire with fire mentality. Natives used an ointment made from the heating of Resurrection fern stems and leaves to cure sores and ulcers. A tea made from Resurrection fern leaves was used for headaches, dizziness, sore mouth and bleeding gums. Dried cones, or "berries", from red cedar were used as a cooking spice. Medicinally, Native Americans would prepare a red cedar "fruit" tea and use it for colds, worms, rheumatism, and coughs. They also chewed the red cedar fruit for canker sores, and leaf smoke or steam was inhaled for colds, bronchitis, purification rituals and rheumatism. The twigs of the flowering dogwood were used as a toothbrush. Native Americans pounded the dried fruits and the pith of the upper trunk of the Cabbage Palmetto into flour for making bread. The center tip of the plant can also be eaten as a vegetable, similar to asparagus; however, this kills the plant. Muscadine vines were a good source of fresh fruit in the fall. Virginia creeper plant tea was used for jaundice; and root tea was used for diarrhea.

#### Procedure:

- 1. Split the class into smaller groups.
- 2. Have each group choose an item from the "medicine man" bag.
- 3. Instruct the students to record the item they pulled, and to use their journals to determine what an early settler might have used in its place.

# Medicine Man Bag Key

- Can of mixed vegetables male pinecones from loblolly pine; center of cabbage palmetto; some students may mention that live oak acorns can be eaten, though this is actually a fruit
- 2. Toy boat live oak was used by early colonists to build ships
- 3. Cooking spice flowers of <u>Magnolia grandiflora</u>; leaves of red bay
- 4. Bread bag dried fruits of cabbage palmetto; acorns from live oak
- 5. Cold, cough and sore throat liquid medicine sweetgum sap; red cedar cones
- 6. Imodium AD sweetgum
- 7. antiseptic medication sweetgum
- 8. Cold sore herbal medication red cedar cones
- 9. Pepsi can yaupon holly (contains caffeine)
- 10. Vitamin C bottle loblolly pine
- 11. Fake vomit yaupon holly
- 12. box of tea loblolly pine or yaupon holly

# The Medicine Man Data Sheet

So, how much did you learn from the Native Americans? Could you treat an ailing member of your settlement or find various food sources and building materials? Choose an item from the bag. Record the item you choose and use your jour nal to describe what an early settler might have used in its place.

## On-Site Activity 3 Animal Clues

#### **Objectives:**

Students will (1) analyze the role of **consumers** in an ecosystem and (2) Identify kinds of relationships organisms have with each other (predator/prey).

#### Materials:

• Copies of "Who's For Lunch?" (each student should have a copy in his journal)

#### Teacher background:

A group of 20-30 talking students does not create an environment conducive to animal viewing. Since it will be very difficult for the students to actually view animals, the students will look for clues left behind by organisms of the maritime forest. There are animals that we may not see any sign of, and, therefore, I have created a sheet "Who's for Lunch?" so that students may get a better feel for what types of organisms form the food web in the maritime forest.

The great horned owl, bobcat and deer are going to be at the top of the food chain. The red-shouldered, red-tailed, and sharp-shinned hawks can be thought of as sharing the top with the great-horned owl, however, the great horned consumes any of these birds. The great-horned also consumes the other two owls present in the maritime, the barred owl and the screech owl. I have listed a few species on the students' sheet. There are, however, more species that may be seen in the maritime forest.

Energy flows and nutrients cycle. (Students will study nutrient cycling in The Rotting Log activity.) Energy is not recycled; however, there is a constant input of

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energy from the sun into the ecosystem. Photosynthesizing organisms (plants, lichens, and algae) "capture" energy from the sun and convert it into a usable form. Energy transfer from one trophic level (the levels of feeding that when put together form a food chain) to the next is not completely efficient. Approximately 90% of the energy is lost at each trophic level. The energy is lost as urine and feces, which go to feed bacteria and fungi. Some of the energy is transformed to heat - a form of non-usable energy for organisms.

#### Procedure:

- 1. Lead students down the trail. Any area of the trail can be used for this activity.
- 2. Look for clues left behind by animals. Stop and focus the students' attention on a particular area so that everyone sees the "clues". For example, if you see holes in a tree, you might say, "I spy evidence that an animal has been feeding does anyone see the clue?"
- Stop in an area and instruct students to look very closely at the branches hanging onto the trail. Chances are they will observe insects, spiders, or eggs laid by an insect. Have them record this on their data sheet.
- 4. Don't forget to remind students to look up and down for animal signs. Organisms utilize both the ground and the treetops for shelter and protection from predators.
- 5. Gather students together to discuss their findings.
- 5. Using their Data Sheet and "Who's For Lunch", instruct the students add a plant and draw 3 simple food chains. Then have them take those 3 food chains and construct a food web.

# Who's For Lunch?

### This list includes animals common in the maritime forest. All animals listed,

### predator and prey, are present in the forest.

- 1. Great-horned owls eat rats and mice, squirrels, opossums, rabbits, red-tailed hawks, red-shouldered hawks; and can eat barred owls and screech owls.
- 2. Red-bellied woodpecker eats ants, caterpillars, woodborers, grubs, grasshoppers, nuts, acorns, berries
- 3. Carolina wren eats caterpillars, moths, beetles, grasshoppers, ants, flies, spiders
- 4. Yellow-rumped warbler eats seeds of wax myrtle, red cedar, and poison ivy; also flies, beetles, plant lice and insect larvae.
- 5. White-tailed deer eats plant material (primary consumers)
- 6. Gray squirrels eat fruits of oak trees and magnolia trees, cones from pine trees, and some insects
- 7. Cotton mice, cotton rats, eastern wood rat eat plant material (primary consumers)
  - 8. Opossums are omnivorous, they eat: insects and a variety of plant material.
  - 9. Bobcats eat rodents and rabbits.
  - 10. Shrews and moles (rodents) eat insects.

11.

Bats present in the maritime forest include seminole bats,

evening bats, big brown bats, and red bats. Bat predators include snakes, owls,

hawks and opossums. Bats eat insects.

- 12. Insects eat plant material.
- 13. Turkey and black vultures are scavengers (they eat dead animals).



- Red-tailed hawks eat mice, rats, moles, shrews, squirrels, opossums, woodpeckers, songbirds and crows.
- 15.Red-shouldered hawks eat snakes, frogs, songbirds, insects, and small mammals (mice, rats, shrews, moles).
- 16.Barred owls eat mice, squirrels, opossums, shrews and bats, snakes, insects and songbirds.
  - 17. Screech owls eat insects, like moths, small bats, mice, shrews, moles, spiders, frogs, snakes, and songbirds.
  - 18. Sharp-shinned hawks eat songbirds.
  - 19. Green anoles eat insects and spiders.

# **Animal Clues Data Collection Sheet**

Native Americans used clues left behind by animals to aid in the search for their next meal. Likewise, early settlers had to learn to observe animal clues in order to eat. Look and listen for these animal clues and record the information in the data table. After each item, **draw your observation and explain why the clue was left behind and what type of animal the clue belongs to.** 

1. holes made by an animal \_\_\_\_\_

2. evidence of insects (eggs, holes, etc.)

3. evidence an animal has eaten

\_\_\_\_

4. evidence of an animal home

5. evidence of a burrowing animal

6. Did you observe any living organisms? If so, draw.

7. Listen for evidence of animal communication. Describe what you hear. Do you *hear* evidence of an organism feeding? If so, which organism?

8. Remember humans are animals also. What clues do we leave behind?

9. After you have gathered animal clues data, use the "Who's for Lunch" sheet to draw 3 different food chains. **Be sure to add a plant into your food chain.** Label the organisms in the food chains as producers or consumers. Does anyone eat the great horned owl? The bobcat? The deer? What happens when these animals die? When you have completed the three food chains, try putting the three food chains together to form a food web. When constructing a food web, draw an arrow in the direction in which the energy is being transferred (i.e. who gains the energy, the prey or the predator?). When a hawk eats a mouse, energy is transferred from the mouse to the hawk. As energy is transferred through the food web, is some of the energy "lost", or is the transfer completely efficient?

10. Observe your food web. Discuss what would happen if the green plants were removed from the food web. What would happen to other consumers? Where does the sun fit into the food web?

# **Teacher Key:**

- 9. There are no predators of bobcat, deer, or great horned owls in the maritime forest. Humans are the biggest threat to these organisms. When these organisms die, decomposers break them down and the nutrients are returned to the soil where the nutrients can then be absorbed by plants. Approximately 90% of the energy is transformed to heat at each transfer and is therefore unusable ("lost").
- 10. Green plants are at the base of all food chains. They capture energy from the sun and make it available to other organisms. Other consumers would have no food if green plants were removed from the food web. The sun provides energy to be converted by green plants. If energy from the sun were not present, plants would not be able to produce food.

# On-Site Activity 4 Are You Finished With Those Nutrients?

#### Objectives:

Students will (1) Describe the most effective conditions for the growth of fungi, (2) explain the importance of fungi as decomposers, (3) analyze the role **decomposers** in an ecosystem, and (4) examine how materials are reused in a continuous cycle in the ecosystem.

#### Materials:

• Hand lenses (provided by EBSP)

#### Teacher Background:

Decomposers play a vital role in nutrient cycling and transfer of energy between trophic levels in the maritime forest ecosystem. While plants are still alive, they collect nutrients from the soil and the atmosphere and store the nutrients in their bark, wood, branches, and other vegetative parts. When the plant dies, it is decomposed and gradually turned back into soil. The nutrients that were stored in the plant are returned to the soil and taken up by the roots of another plant.

How are dead plants broken down? Larger animals such as sow bugs (cannot roll into a ball), bark beetles, and pill bugs (can roll into a ball) move in and begin tunneling their way through the dead plant, aiding in breaking down the plant by fragmenting the large matter. Bark beetle tunnels form an intricate pattern underneath the bark. Fungi are present and actively breaking down the log. The fruiting bodies of some fungi, mushrooms, alert observers to their presence. Fungi are adapted to live in moist conditions because they are long and threadlike and, therefore, the damp rotting

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log is a perfect habitat for fungi. Fungi feed by absorbing nutrients. Numerous hyphae extend throughout the log and the fungus secretes digestive enzymes to break down the wood. Their presence is apparent on dying trees throughout the trail. Students may also observe spiders or centipedes, which feed on sowbugs and other creatures tunneling in the log. These organisms in turn provide a food sources for birds, like woodpeckers, and small mammals. It is possible to find a salamander taking advantage of the damp log during the day. Salamanders are amphibians and need to keep their skin moist. Young plants, as well as lichens and mosses take advantage of the nutrient source provided by the decaying log.

#### Procedure:

- 1. The map provided in the "check-in kit" will help you to locate fallen logs.
- 2. Instruct students to begin exploring the fallen log. Instruct students to carefully explore different levels of the log, underneath, on top, and under bark. Have students do as little damage as possible to the fallen log-it is a miniature habitat in and of itself!
- Have students fill out the data table and answer the questions as they explore the log.

#### Teacher Tip:

This is an exploration activity, so do not be intimidated if you do not know the names of all organisms! The important concept here is that the log is being broken down and the nutrients are recycled.

# **Rotting Log Data Table**

Is the organism	Effect on the	Draw the organism	Location on the
or animal? (If	log?		log (on top, under
you're unsure,			horl(2)
mark and be			Dark?)
sure to draw the			
organism!)			

# Thought questions for the rotting log!

1. Are plants growing on the log? Why might a young plant grow on a rotting log?

 Is there a difference between the types of organisms in the various locations of the rotting log?

3. Is there evidence of animal activity on the log? If so, what?

4. What benefits does the rotting log provide to the forest? What organisms utilize the log?

5. Can you draw a simple food chain from the organisms you observe on the rotting log?

# **Teacher Key:**

- 1. It is possible to see young saplings growing on the tree. The plants are taking advantage of a great source of nutrients from the decomposing log.
- 2. The students should see a difference in the types of organisms in the various levels of the log. For example, young plants will not be growing underneath the log. Pill bugs will likely be seen crawling just underneath the bark. Spiders may be observed on top of the log, lying in wait for prey.
- 3. Answers will vary.
- 4. As the log is decomposed, the nutrients are returned to the forest. The log also provides valuable habitat for various organisms. Students will observe varying organisms utilizing the log. Encourage them to understand that birds and small mammals may feed on insects that use the rotting log for shelter. Salamanders may hide out underneath the damp log.
- 5. Answers will vary.

# **Post-Site Activities**

# Post Site Activity 1 Building a Food Web

### **Objectives:**

Students will use data gathered in the field to build a model of the maritime forest food web.

### Materials:

- various colors of construction paper (different color per group)
- scissors
- "Who's For Lunch" from On-Site Activity 2

### Procedure:

- 1. Split class into cooperative learning groups of 3-4 students
- 2. Write on the board the animal clues each group found and have the students hypothesize which animals may have left that clue behind (Who's For Lunch might be helpful.) If all students have observed the same animal clues, also assign each group 3-5 animals using "Who's For Lunch" (otherwise, the web won't look like much of a web!). Remember to assign plants and the sun. Also hand out a different color of construction paper to each group.
- 3. Have each group create a food chain by either drawing the organisms or writing the name of the organism on construction paper. Remind each group to cut out arrows.
- 4. Call each group one-by-one. Have the first group put their food chain, with arrows, on the wall (or bulletin board). Have the students begin drawing the food web in their journals. Instruct the next group to add their organisms to the original food chain by connecting their organisms to the original food chain with arrows. If their

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organisms do not connect to the organisms present, the students may just connect their organisms with arrows.

- Continue the process until each group has added their organisms to the food web.
   The different colored paper should demonstrate the web concept.
- 6. After all organisms are added to the food web, have the students analyze the model and see if any more connections can be made. Be sure that the sun and plants are present in the food web.

# Post-Site Activity 2 Model the Rotting Log

### **Objective:**

Students will use the information gathered in the field to model the flora and fauna of a rotting log.

### Materials:

- Large paper model of a rotting log
- Paper for students to draw organisms

### Procedure:

- List the organisms each group observed on the board. Have students copy the information into their journals and graph the information. "Organism" should be on the X-axis; "Number of Groups Who Observed Organism" should be on the Y-axis.
- 2. Cut out a large model of a rotting log. (A small model is also provided in this packet if you would like for each group to have a separate log.)
- 3. Have the students stay in the same groups as Post-Site Activity 1.
- 4. Have each group draw all the organisms they observed on the log.
- 5. Have each group add their organisms to the cutout of the rotting log. Remind the students to add the organism to the area of the rotting log where they observed it in the field.
- 6. Have each group explain their observations. For example, why might a salamander be observed underneath a log? (damp area, keeping skin moist) Why might pill bugs be observed under the bark? (more protection from predators & pill bugs breathe through gills, so need moisture). Are the pill bugs, spiders, centipedes, and

etc. a food source for other organisms in the maritime forest? (yes, songbirds,

woodpeckers) Why is the rotting log important to the forest? (returning nutrients to the soil)

7. Have the students draw the rotting log in their journals.



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# Post-Site Activity 3 Focusing on the Circle of Life

### **Objectives:**

Students will reflect on their understanding of the interconnectedness of organisms.

### Materials:

 If you choose, copies of Chief Seattle's speech from <u>www.webcom.com/duane/seattle.html</u>

or the book Brother Eagle, Sister Sky: a message from Chief Seattle

### Teacher Background:

Chief Seattle was the chief of the Susquamish Native Americans in the Washington area. The phrase "Man did not create the web of life, he is but a strand in it. Whatever man does to the web, he does to himself" is a Native American proverb credited to Chief Seattle. You may like to have your students read more by Chief Seattle. In 1854 he responded to an offer made by the President to buy the Native Americans' land and provide them with a reservation on which to live. The "original" words of Chief Seattle were recorded by Dr. Smith in the Seattle Sunday Star in 1887. It should be noted that some historians doubt the authenticity of Dr. Smith's account. (For more information, visit www.nara.gov/publications/prologue/clark.html.) Modern interpretations of the speech include a strong environmental message. The book <u>Brother Eagle, Sister Sky: a message from Chief Seattle</u> is one interpretation of the speech. A screenwriter in the 1970s wrote a speech inspired by Dr. Smith's original account that has become popular today. A copy of this version, as well as the original account by Dr. Smith, can

be found at <u>www.webcom.com/duane/seattle.html</u>. An Internet search for "Chief Seattle" yields many results if your students request more information.

#### Procedure:

- Lead a brief discussion about Chief Seattle. If you choose, have your students read an interpretation of the 1854 speech and clarify any concepts that may cause confusion.
- 2. Have students write a paragraph in their journals explaining their understanding of the phrase "Man did not create the web of life, he is merely a strand in it. Whatever man does to the web, he does to himself." How does this concept relate to the food web the students observed in the maritime forest? (each organism is in some way dependent on the others) What would happen if one of the species were removed because of habitat loss? (For example, if great horned owls were removed, what would keep the rodent population in check?) Do the students think the early settlers viewed themselves as a link in the web of life, or as the dominant species? (this is an opinion, however, the students may mention habitat destruction for construction of colonies, overhunting) What does the phrase "circle of life" mean to you? (students may choose to discuss the food web squirrel eats acorns from a tree, a hawk eats the squirrel, the hawk dies, decomposers break down the hawk's body, the nutrients are returned to the soil, the tree then takes up the nutrients, produces more acorns and starts the circle again.)

### **Post-Site Activity 3 Student Sheet**

Maritime forests are threatened due to coastal development. Pollution from overpopulation and bulldozing of the resource for houses has destroyed much of the maritime forest along South Carolina's coast.

Write a paragraph reflecting on your understanding of the Native American proverb "Man did not create the web of life, he is merely a strand in it. Whatever man does to the web, he does to himself." Could humans live without other plants and animals? How does this phrase apply to the food web you observed in the maritime forest? What would happen if one of the species were removed because of habitat loss? Do you think early settlers viewed themselves as a link in the web of life, or as the dominant species? What does the phrase "circle of life" mean to you?
## Journal Assessment Grading Rubric

## Pre-Site Activities (5 pts)

• Does the student correctly state characteristics used to identify leaves? (color, shape, feel, length, width, edges, etc.)

#### 3 pts

• Has the student recorded the correct animal clues?

#### 2 pts

### **On-Site Activities**

- Plants for Pioneers (20 pts)
- Did the student try to draw the leaves?

#### 8 pts

• Are the leaves labeled with the correct name and uses?

#### 10 pts

• Does the student understand how plants fit into the food web?

#### 2 pts

- The Medicine Man (5 pts)
- Does the student have the correct modern day remedy/object with the corresponding native plant?

### 5 pts

- Animal Clues (20 pts)
- Did the student draw each clue from the scavenger hunt and answer the corresponding questions?

#### 10 pts

• Did the student draw 3 correct food chains? (i.e. no owls eating plants, etc.)

#### 5 pts

• Did the student correctly answer what would happen to the food web with no green plants?

#### 3 pts

• Does the student understand where the sun fits into the food web?

#### 2 pts

- Are You Finished With Those Nutrients? (20 pts)
- Did the students correctly fill out data table?

#### 10 pts

• Are the responses to the thought questions logical and well explained?

#### 10 pts (2 pts each)

## **Post-Site Activities**

- Building a Food Web (10 pts)
- Group observation-Does the student contribute to the group discussion of the food chain?

### 3 pt

• Does the student's group make correct food web connections on the class model?

### 2 pt

• Did the student correctly record the class food web?

### 5 pts

- Model the Rotting Log (10 pts)
- Group Observation-Does the student contribute to the group discussion?

### 3 pt

• Does the student's group place the organism in the correct area of the log?

### 2 pt

• Did the student correctly record the rotting log model?

### 3 pts

• Does the student's bar graph correctly represent class data?

### 2 pt

- Focusing on the Circle of Life (10 pts)
- Is the paragraph well structured?

### 2 pts

• Is the paragraph grammatically correct?

#### 3 pts

• Does the student adequately explain his/her point of view?

### 5 pts

## GLOSSARY

Carnivore	a flesh-eating animal
Consumer	an organism which does not produce its own food
Decomposer	an organism which breaks down dead plant or animal material
Evergreen	a plant with leaves that persist throughout the year; the plant only
	loses its leaves after new leaves have formed
Food chain	a series of organisms in an ecosystem, related by feeding habits,
	which represents energy transfer
Food web	Interrelated food chains in an ecosystem
Fungus	a single-celled or filamentous decomposer which lacks chlorophyll
Herbivore	an animal which feeds only on plants
Omnivore	an organism which feeds on both plants and animals
Osmosis	the tendency of a fluid to move through a membrane into a solution
	where the concentration of solvents is higher; thereby equalizing
	the concentration of materials on both sides of the membrane
Predator	an animal which hunts and feeds on other animals
Prey	an animal hunted for food by carnivores
Producer	an organism which produces food from sunlight
Sap	a liquid that contains salts and sugars and flows through the tissues
	of plants
Scavenger	an animal which feeds on dead plants or animals

#### RESOURCES

<u>Books</u>

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- Keener-Chavis, Paula and Sautter, Leslie R. <u>Of Sand and Sea: Teachings From the</u> <u>South Carolina Shoreline.</u> Charleston: S.C. Sea Grant Consortium, 2000.
- Lawlor, Elizabeth P. <u>Discover Nature at Sundown</u>. Mechanicsburg: Stackpole Books, 1995.
- Parnell, James F., Potter, Eloise F., and Teulings, Robert. <u>Birds of the</u> <u>Carolinas.</u> Chapel Hill: UNC Press, 1980.
- Peterson, Lee Allen. <u>Peterson Field Guide: Edible Wild Plants</u>

Eastern/Central North America. New York: Houghton Mifflin Company, 1977.

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York: Houghton Mifflin Company, 1980.

Porcher, Richard D. <u>Wildflowers of the Carolina Lowcountry and Lower Pee</u> <u>Dee.</u> Columbia: USC Press, 1995

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South Carolina Forestry Commission. <u>Tree Identification: What Tree Is This?</u> 1988.

Stall, Chris. <u>Animal Tracks of the Southeast States.</u> Seattle: The Mountaineers, 1989.

#### <u>Websites</u>

http://www.sherpaguides.com/georgia/coast/natural\_history/natural\_communities.html http://www.csc.noaa.gov/otter/htmls/ecosys/ecology/maritime.htm

#### CD-ROMs

South Carolina Department of Natural Resources and National Oceanic and Atmospheric Administration, Coastal Services Center. 2000. *Characterization of the Ashepoo-Combahee-Edisto (ACE) Basin, South Carolina.* CD-ROM. SC Marine Resources Center Special Scientific Report Number 17. NOAA/CSC/20010-CD. Charleston, SC: NOAA Coastal Services Center.

Appendix:

Leaf Guide

# **Cabbage Palmetto**





**Red Cedar** 



# **Loblolly Pine**





# Sweetgum



# Magnolia grandiflora





# Poison Ivy



# Yaupon Holly





## Yellow Jessamine



Virginia Creeper





# **Muscadine vine**





# **Spanish Moss**



Live Oak



# **Resurrection Fern**



# Smilax sp.





# **Red Bay**

