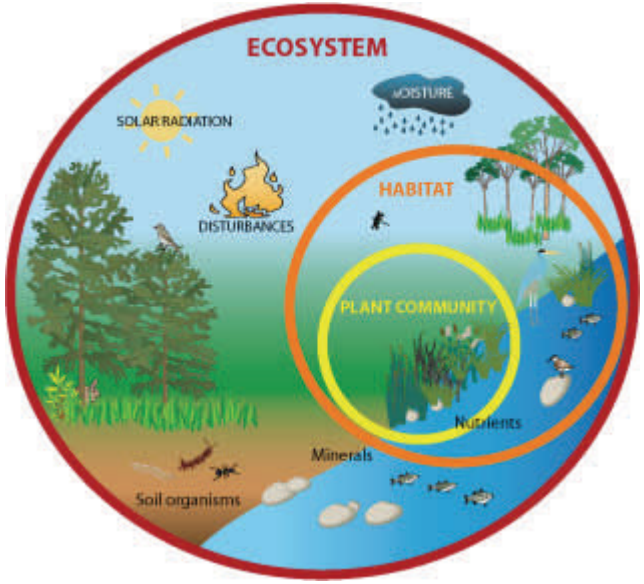
Life in an Ecosystem

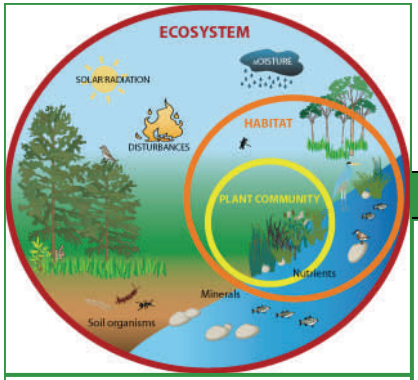


This activity is designed to be an Off-Site at the Five Forks Contact Station.

Petersburg National Battlefield

Lesson 1

Life in an Ecosystem



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1. Understand the concept of an eco-system
2. Understand the interdependence of members of an ecosystem.

Standards of Learning:

Life Processes K.6, 1.4, 2.4, 3.4

Living Systems 2.5, 3.5, 3.6, 4.5, 6.7,

Resources 3.10, 3.11, 4.8,

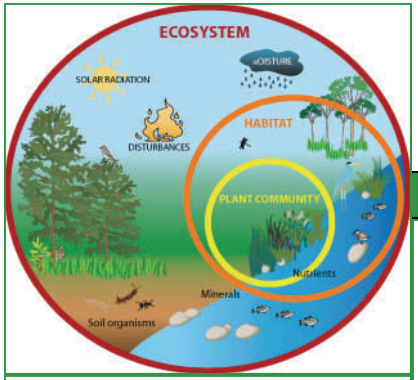
Life Sciences LS.4-LS.14

Cross Curriculum:

1. Ecology
2. Art
3. Language

Vocabulary

1. **Web of Life**: the network of relationships that interconnects all members of an ecological community.
2. **Ecology**: the study of how plants and animals interact with each other and their environment.
3. **Food Chain**: pathway along which food is transferred from one feeding level of organisms to another.
4. **Food Web**: the interconnected food chains of an ecosystem.
5. **Producer:** organisms that use energy from sunlight to make their own food through photosynthesis (i.e. trees).
6. **Consumer**: organisms that cannot make their own food, and must consume other organisms to get energy.
7. **Herbivore**: animal that eats plants (i.e. deer, rabbit).
8. **Carnivore**: animal that eats other animals (i.e. hawk, bobcat, shark).
9. **Omnivore**: animal that eats both plants and other animals (i.e. bear).
10. **Decomposer:** organism that absorbs nutrients from non-living material such as dead plants and animals and wastes of living organisms then recycles these nutrients so they can be used again by plants (i.e. bacteria, fungi).



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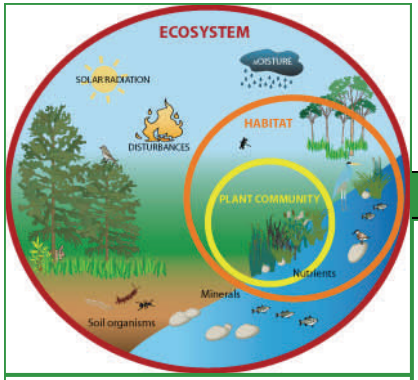
What is an ecosystem?

We hear the word ecosystems in the news and at school but just what are ecosystems? To start off, let's take a quick look at the word because it holds some clues to its meaning. "Eco" comes from ancient Greek and Latin and means "house". So "eco" means that all of the parts exist together, as if they were together in a house. You have probably heard the word "system" in lots of places, and it means "interacting parts". So "system" tells us that not only do the parts exist together as if they were in one house, but the parts also affect one another.

Think of the last time you were outdoors. You were probably outside your house or your school. What did you see? You maybe saw living things like grass and people. You may also remember non-living things like concrete, soil, or maybe puddles or snowbanks. An ecosystem contains all of those parts that you can see, like soil, water, insects, rocks, birds, trees, and people. There are also parts you cannot see with your eye, including microscopic organisms like bacteria and fungi, or molecules of food and nutrients that are in water, soil, and air.

Often, ecosystems are confused with another word-habitat. This describes the conditions a particular organism needs to live. For example, a whale needs salty water and fish to eat, gophers need plants to eat and soil to burrow in, and giant sequoias (a tree) need lots of water and soil nutrients. Ecosystems include much more than just the requirements needed for a particular type of organism to live. Ecosystems include interactions among many types of organisms and abiotic parts of the environment too.



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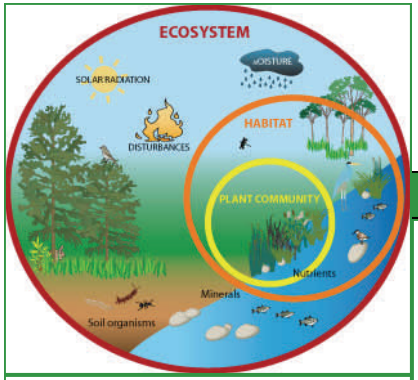
How Do Ecosystems Work And What Do They Do?

Now that we know that ecosystems are all around us, let's try to figure out what exactly ecosystems do. Since we know that ecosystems are made up of many interacting abiotic and biotic parts, those interactions must hold the key to what ecosystems can do. First, an ecosystem needs energy to work. Just like the computer you are using to read this, an ecosystem cannot function without energy. In many ecosystems, energy first enters the ecosystem from the sun. You may have heard of solar-powered electricity. Well, many ecosystems are also solar-powered. Plants and some bacteria can capture energy from sunlight and store it in their tissues. They use the energy to grow and reproduce.

The energy captured by plants doesn't stay there forever. Plants are food for consumers, so the energy in plant tissues is passed on to organisms that eat plants. Predators get their energy by eating consumers. Dead plants and animals are food for tiny micro-organisms like bacteria and fungi. You probably know these feeding relationships as a food web. The food web allows energy to flow through the ecosystem and power the activities of many organisms (including people).

You may have heard that ecosystems are delicate and that they can change with only the slightest outside influence. Ecosystems are always changing, so it is true that ecosystems rarely stay the same for long periods of time. But ecosystems are far from delicate. Sometimes changes in ecosystems are slow and gradual, like a forest growing from a group of seedlings to mature old trees. Other times changes happen suddenly. Fires, floods, or volcano eruptions can quickly remove most of the biotic parts from an ecosystem and can even change the abiotic parts.

Often ecosystems can bounce back from these big changes and return to the way they were before the sudden event. We use the word resilience to describe



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the ability to bounce back from a change in conditions. However, there are changes to ecosystems that are so large that ecosystems cannot bounce back. Climate warming and inputs of fertilizers from agriculture are examples of forces that ecosystems often do not bounce back from

Introduction to the Forest

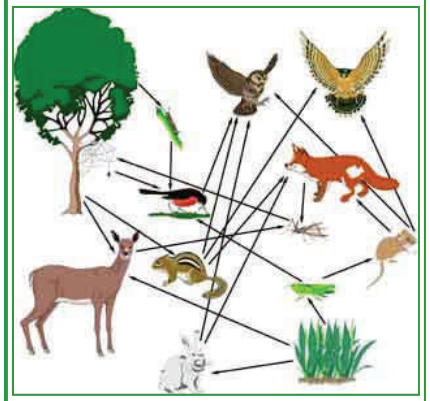
A forest ecosystem involves the complete interaction of all of the living and non-living parts of the ecosystem.

The community of organisms living in the forest depends upon each other and interacts with each other in a number of ways.

The forest ecosystem distributes energy to all members of the community. Energy entering the ecosystem as sunlight is transferred by producers into chemical energy made during photosynthesis.

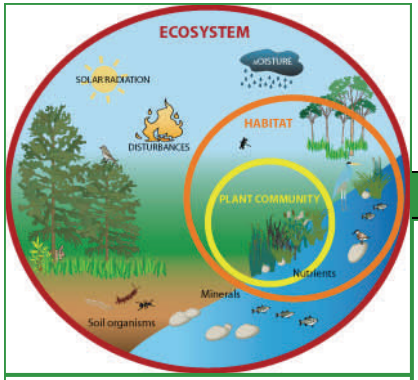
This energy is then transferred from one organism to the next through the food web. Plants, the **producers** of the ecosystem, use sunlight to make energy through photosynthesis.

Herbivores are animals that eat plants and **carnivores** are animals that eat the herbivores. **Omnivores** eat both plants and other animals. **Decomposers** break down waste materials and recycle it to a form that can be used again by the plants. This forms a food chain. If we take all of the food chains in an ecosystem and examine their relationships to each other, we have a **food web**.



Introduction to the Stream

A flowing fresh water stream is all business. It rushes forward. If it slows at all, it is just to create small whirlpools or eddies, and then it's back on down the mountain. It makes its bed on gravel or hard rock. Its wa-



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ter is cool, sometimes painfully cold, especially in the spring when the stream is brimming with newly-melted snow.

A stream is not like a river. A stream's banks follow the straight and narrow. No playful meandering curves, no muddy bottom, no sunny, quiet shores. A river is a stream without the push.

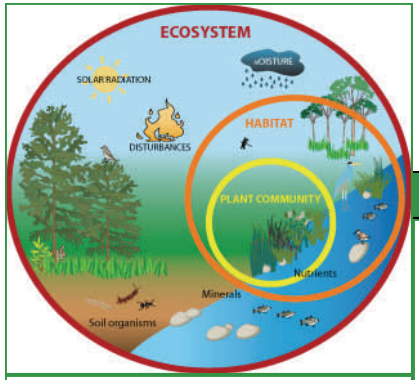
Animals that live in a stream are adapted to life in the fast lane. Brook trout have strong, streamlined bodies and powerful tail fins that can push against the current. These fish need the cold, oxygen-rich water of a flowing stream in order to thrive. Shade is very important in keeping the stream cold. When forest fires, lumbering, or road building make streams lose their shade, they also lose their trout.

Other animals adapt to the swift current. Black fly larvae attach their rear ends to the underside of rocks by tiny hooks. If they lose their foothold (so to speak), they can lasso another rock with silken threads. Caddis fly larvae fashion durable homes from sand grains, leaf pieces, or grasses.

Introduction to the Pond

It is easy to tell the time of year in a pond. Spring is the season of birth. Plants bloom. Eggs hatch. Turtles and frogs wriggle out from the shallow bottom after a long winter's nap. The water's surface ripples with aquatic insect larvae chasing each other. Male red-winged blackbirds arrive to stake their claims to the cattails. Tiny spring peepers twang for mates all night long. They only become silent when raccoons appear at the water's edge, their yellow eyes glowing in the dark.

By summer, some of the residents of the pond have started to move out. Salamanders and frogs which breathed with gills in the spring have grown into air-breathing adults. Mosquito larvae started life hanging out at the surface of the pond. Now their new wings carry them away from the water. The males will drink plant nectar. The females will drink blood and only re-



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turn to the pond to lay their eggs.

Water striders tiptoe across the calm water. Turtles climb on top of each other to gain the sunniest spot on a floating log. Water lilies appear on the surface A green blanket of algae coats the surface of the pond. Most of the oxygen in the water is provided by the plants, a leftover of their making energy from the sun. Fish like largemouth bass and perch use the oxygen by pumping water over their gills. The bass may grow to be as much as two feet long. Frogs, other fish may become part of its food chain.

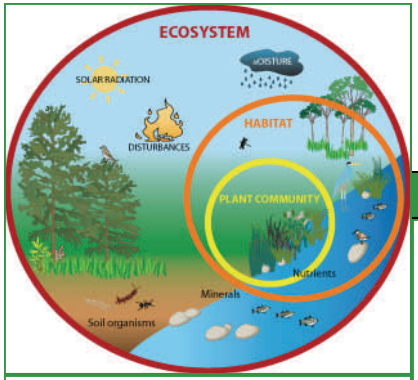
The crisp fall air chills the pond. Summer's birds are replaced by migrating geese and ducks. Small mammals feed hungrily on berries to build up fat for the cold season ahead. Many animals will not see the winter. They lay their eggs and die.

Gradually ice creeps out from the shore until one day the whole pond turns to glass. The frogs and turtles have retreated into the mud. Beavers and muskrats spend the stormiest days in their lodges. Cold-blooded fish aren't bothered by the winter. They just move more slowly, waiting for the spring to awaken the pond world.

Concepts

Teach the concept of interdependence and feedback mechanisms within the community by asking students to brainstorm characteristics that all ecological communities share in common. Examples are given below. As a class, come up with other examples for both your neighborhood and nearby forests.

They all need energy (food) to survive. A plant needs energy from the sun, water, nutrients from the soil, carbon dioxide, and space to grow. Plants also depend upon animals for pollination and seed dispersal. Animals depend on plants for food and shelter. Where do we get our food? Where do we get our clothing and shelter? (Have students trace these back to the actual source—not the store!)



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The success of the community depends on the success of the individuals. What would happen to your school if the teachers or students did not attend? (This is an example of interdependence)

The success of the individuals depends on the success of the community. What would happen to us if we didn't have hospitals, water service, schools, law enforcement, grocery stores, etc.? (This is an example of interdependence)

Organisms react to changes within their community. If your local park became very busy on Saturday afternoons, you might choose to go early in the morning instead. If a deer ate all of the grass in an area where it was feeding, it would move to a new area and probably return to the previous area once the food source replenished itself. (This is an example of a feedback mechanism)

The community changes in response to changes by individual organisms within that community. If more people moved into your town, you might see new houses being built in your neighborhood. (This is an example of a feedback mechanism)

Activity #1:
When something happens to one portion of an ecological community, everything connected to it is affected too. Demonstrate this concept by involving the whole class in one big food web.

1. Assign each student to play the role of one member of a forest community. Producers, herbivores, carnivores and decomposers should all be represented. Don't forget to include a human—humans also live, recreate, hunt, manage and use resources from the forest.
2. Give each student an index card with their organism's name on one side. Instruct them to research and write the following information on the other side of the card:

- Where specifically do they live in the forest (under a log, in burrows, do they use different

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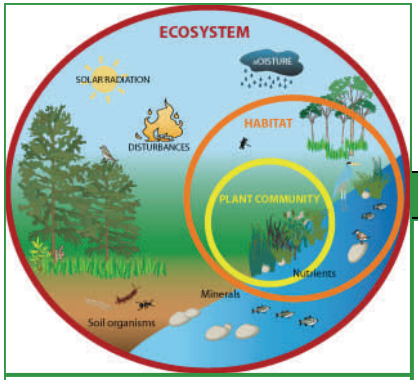

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Pre Visit

parts of the forest?

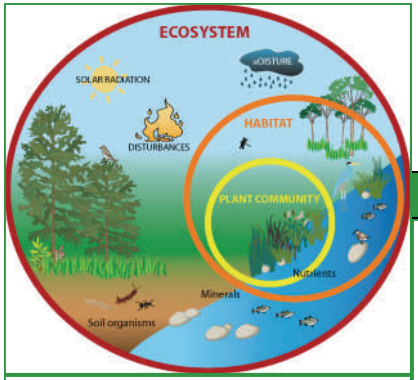
- What do they eat?
- What organisms might eat them?
- How does it interact with other animals/plants in its community?

3. After your students have finished their cards, take them outside and have everyone form a large circle.
4. Have students tape their cards to their shirts so everyone can see the different organisms that are being represented.
5. Now take a ball of string and give the end of the ball of string to one of your producers (plants).
6. Have the producer hold onto the end of the string and pass the ball to the organism that eats it, then that organism passes it onto another organism that preys upon it.
7. Pass the ball onto a decomposer which recycles waste material nutrients back to the plants.
8. Students should be sharing the information about their organism when the string is passed to them. Continue the process until everyone is interconnected.
9. Have everyone pull gently on the food web to represent the interactions that are taking place in the food web. Ask what would happen if one organism were removed from the food web? Name the other organisms that are affected. What happens if two organisms are removed, etc.?
10. Share the following quote by John Muir with the students and ask them to interpret it based on what they just saw in the web of life activity.

" When we try to pick out anything by itself, we find it hitched to everything else in the universe."

Activity #2

The number and species of organisms able to survive in an ecosystem depends on the resources that are available. Read the following two scenarios aloud. Have students work in pairs to answer the



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2. What will eventually happen to many of the stressed trees?

They will continue to weaken and will likely die.

3. What could happen to a forest that has many diseased and dead trees?

This forest is more susceptible to an intense forest fire that would kill all of the trees and degrade the watershed and wildlife habitat.

4. Can humans do anything to restore this forest to a healthy ecosystem?

Yes, forest managers are trained to use a variety of methods for managing healthy forests. We could harvest the overcrowded trees to make room for other trees to grow large and thrive. The trees that are harvested will go to a sawmill to be made into many renewable wood products such as lumber for homes, paper, furniture, cleaning products, cosmetics, etc. Forest managers must protect wildlife habitat, water quality, and ensure the sustainability of future forests before they are allowed to harvest any trees.

Ecosystem #2

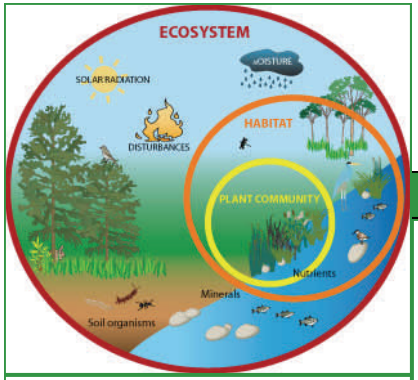
An area of the forest has lots of small shrubs and seedlings. It has very few large trees. It is a perfect home for mice. Since owls love mice, this is also a good hunting ground for owls. Over time the seedlings and saplings in this area grow into older, taller trees and shade the forest floor from the sun. They compete successfully for sun, water, and nutrients (food) and suppress the shrubs, grasses and seedlings trying to grow in this area.

1. What happens to the mice as shrubs, grasses and seedlings disappear?

They find new homes in other areas that provide more food and safety.

2. What happens to the owls?

They will need to hunt in other areas where they will be able to find mice.



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3. What will happen to the trees if they become over-crowded?

They become stressed and are more likely to die of disease, insect attacks and fire.

4. What happens if some of the trees are harvested?

The trees that remain will be healthier. More sun, water, and nutrients will reach smaller plants as pockets of the forest are opened up. The smaller plants will bring back the mice. The return of the mice will bring their predators, like the owls, back into the area.

Enrichment Activity

Use the set of flashcards at the end of the lesson to demonstrate the relationship between animals and how they acquire their food. This is a great supplemental resource for teaching about food webs and food chains.
Some concepts covered are: herbivore, carnivore, omnivore, insectivore, predator, parasite, and scavenger.

Fish is a great game for practicing this vocabulary. Just make two copies of each card and paste them onto some poster board and then cut them out. You'll need about one deck of cards for every four or five students.

A: Do you have an omnivore?
B: Yes, I do. (Or: No, I don't. Go fish.)

If the answer was 'Yes, I do.'
A: Is it a bear?
B: Yes, it is. (Or: No, it isn't. Go fish).

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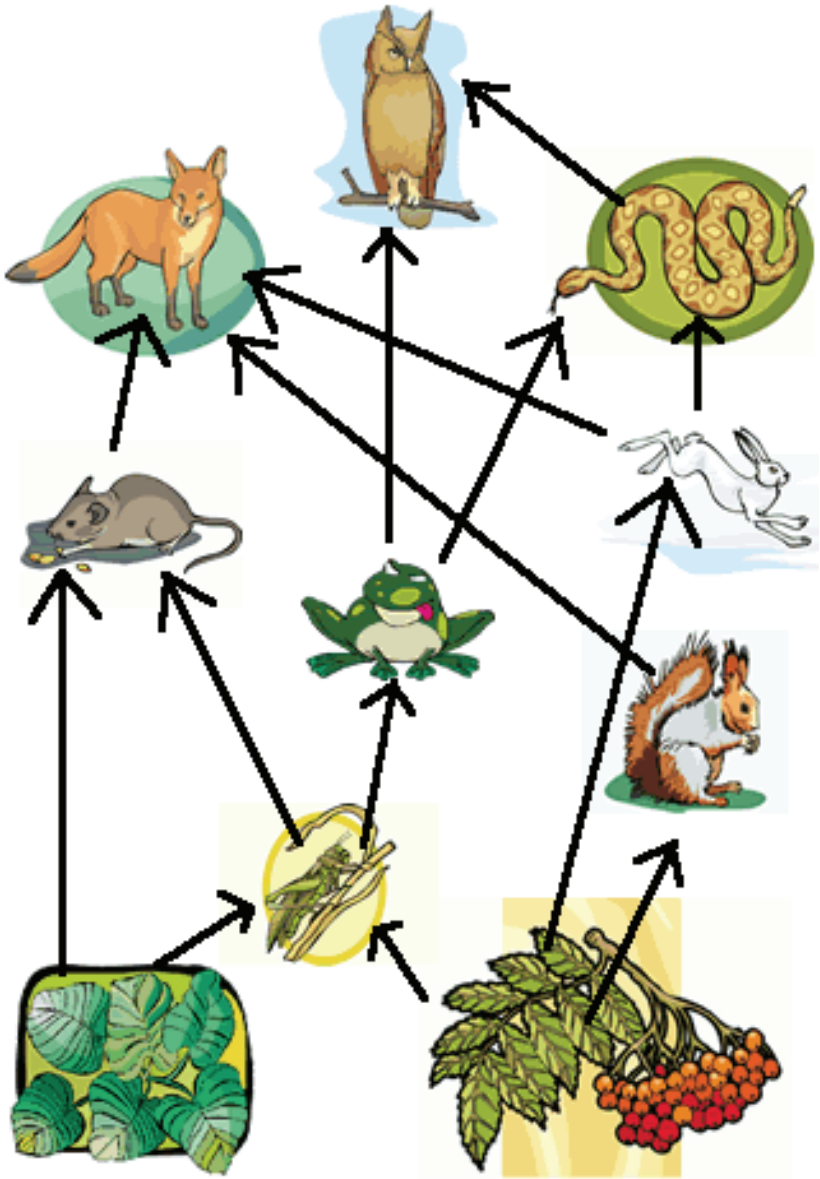
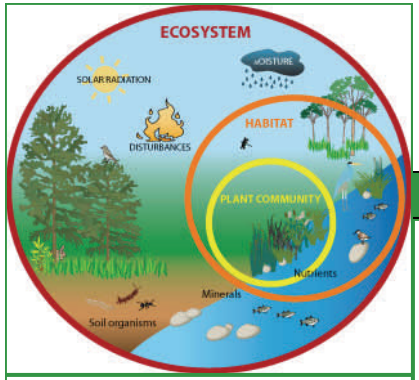


Identify the:

1. Producers
2. Primary Consumers
3. Secondary Consumers
4. Herbivores
5. Carnivores
6. Omnivores
7. What elements are missing from this food web?

On the back, **Construct a Food web** using the following animals. You do not have to draw pictures, you can just use the animal names and draw arrows between them.



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Ecosystems of Petersburg National Battlefield

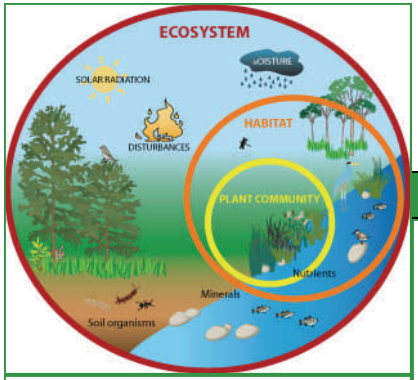
Petersburg National Battlefield plays host to a diverse number of inhabitants and ecosystems. Located between the Atlantic Coastal plain and the Piedmont region of Western Virginia, Petersburg National Battlefield's 2,659 acres varies from the wetlands of Hatcher's run at the Five Forks Battlefield to the combination of mixed hardwood/pine forests and open fields that encompass the park's Eastern Front. City Point, a 22 acre unit at the confluence of the Appomattox and James Rivers, provides yet another uniquely beautiful asset to Petersburg National Battlefield.

Petersburg National Battlefield consists of a number of different habitat types. These habitats include upland coastal plain, piedmont forest, old field, managed field, marsh, and riverine vegetation. This diversity of habitats allows for a large, varied plant population. To date, 170 species of vascular plants have been documented within the park.

The park is located within two drainage basins; the Chesapeake Bay and Albermarle Sound. The confluence of the James and Appomattox Rivers occurs at City Point, and, because of the James' eventual outlet into the Chesapeake Bay, the park is included in the Virginia Coastal Zone.

Numerous streams and rivers drain the different park areas, creating a network of habitat for many different species of animals. Wetlands make up a portion of the battlefield's area. These transitional areas play an important role in the park's interconnected ecosystem, serving as a buffer and providing habitat for many unique species of animals

Vernal (or temporary) ponds are numerous. These ponds form in low points in especially wet seasons. These



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ponds play just as important of a role in the park's natural habitat as do the year-round ponds. They provide breeding ground and habitat for many types of amphibians and insects, and act as a source of food for other animals.

The most notable year-round body of water is present in the Five Forks unit.
The pond has been created by a beaver dam that blocks Hatcher's Run. It teems with life, as can be seen in the number of fish species that occupy its waters.

Five streams drain the Eastern Front, and they are all within the Chesapeake Bay drainage basin. Poor and Harrison Creeks are the largest. Taylor's Creek is a tributary of Poor Creek, and Branch Creek and an unnamed creek are tributaries of Harrison Creek. All of these creeks drain into the Appomattox River, and, after that, into the Chesapeake Bay.

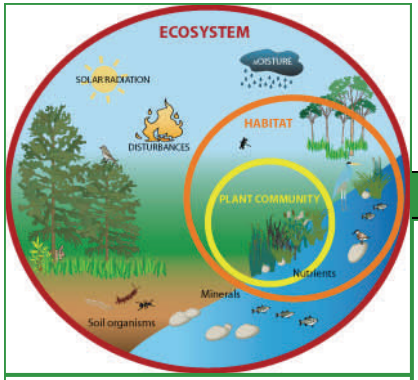
The park's Western Front lies in Dinwiddie County. This site is drained by Rohoic Creek, which eventually empties into the Appomattox River. Five Forks is drained by Hatcher's Run and Chamberlain's Bed Creek. These creeks drain into the Nottoway River, which drains into the Chowan River, and ultimately reach the Atlantic Ocean.

The waterways of Petersburg support at least 22 different species of fish, although they are relatively small in size and number. The most notable body of water lies in the Five Forks Battlefield area of the park. Here, a beaver dam has been built across Hatcher's Run, creating a large pond and wetland area. This diverse habitat is home to a number of larger fish species, such as Bowfin, Bluegill, Chain Pickerel, and Largemouth Bass.

In the creeks of the Eastern Front, made up of a network of two larger creeks and three tributaries of these creeks, a number of smaller fish species have been documented. These shallow, slow-moving systems are home to the Blacknose Dace and Rosyside Dace.

Lesson 1

Life in an Ecosystem



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Standards of Learning:

Life Processes K.6, 1.4, 2.4, 3.4

Living Systems 2.5, 3.5, 3.6, 4.5, 6.7

Resources 3.10, 3.11, 4.8

Life Sciences LS.4-LS.14

Cross Curriculum:

1. Ecology
2. Art
3. Language

Pre Visit

Today, the park's units are more wooded than they were during the siege of Petersburg in 1865, and in 1926 when the park was established. Almost ninety percent of the park is currently wooded. Pests, extreme weather, and invasive exotics have changed, and will continue to change, Petersburg National Battlefield's wooded makeup over the years. The dominant tree species include Yellow Poplar, Sweet Gum, White Oak, and Loblolly Pine.

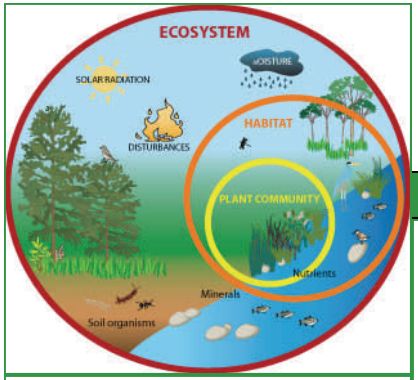
Many different species call Petersburg National Battlefield home, although their presence is not always easily observed. In the fields where soldiers once charged forward, trying to avoid enemy fire, the White-footed mouse now searches for its dinner while trying to avoid the Gray fox and the watchful eye of the Red-tailed hawk. This mixture of cultural history and animal life make the battlefield an intriguing place to visit.

Rabbits, opossums, shrews, foxes, and raccoons are some of the more visible residents of the battlefield. Eastern White-tailed Deer and Gray Squirrel are two of the most obvious mammals that live in the battlefield. Their presence is easily observed during the day, as they forage for food throughout the park.

Petersburg National Battlefield is also home to several predators, including the Gray Fox, Coyote, and Bobcat. These predators are rarely seen, though, as they shy away from human interference and are very adept at remaining hidden

The combination of wooded and open field habitats attracts a variety of avian species such as Cardinals, terns, and hawks. Visitors can also observe Osprey along the Appomattox and James Rivers.

There are also many different species of amphibians and reptiles in Petersburg National Battlefield. These include large communities of Five-lined skinks, Eastern fence lizards, and Spade-footed toads. The Eastern box turtle and the Eastern worm snake also have very large populations within the park.



Lesson 1

Life in an Ecosystem

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There are several species of snakes in the park, such as the abundant Eastern Worm, Eastern Rat and the Eastern Garter. Snakes are very shy and stay mostly hidden throughout the day. The Battlefield is also home to the poisonous Northern Copperhead. This snake can be found throughout all units in almost any habitat. Although this rarely happens, if you do come across a Copperhead, just slowly back away.

To date, the park has inventoried 20 species of mammals, 22 species of fish, 22 species of amphibians, and 26 species of reptiles. Inventories are ongoing, and adjustments will undoubtedly be made to these numbers.

In 2003, a pair of Bald Eagles came into the park to nest and raise their young. From mid-December to mid-July a section of the outer loop trail is closed to provide optimal conditions for the birth of this rare and majestic species.

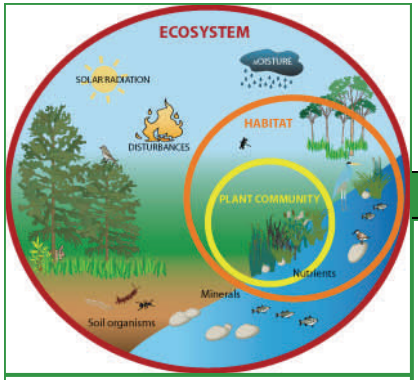
129 avian species have been recorded at Petersburg National Battlefield (all Units combined). Many of these species are migratory, stopping at the battlefield during the spring or fall as they travel along their migration routes. Others, like the Pileated Woodpecker, make their homes in the park year-round.

Osprey, Caspian Terns, Bald Eagles, Merlin, and the state bird of Virginia, the Cardinal, are often seen at the City Point Unit of Petersburg National Battlefield. Located at the confluence of the James and Appomattox Rivers, this area is the perfect natural habitat for these beautiful specimens.

Birders can share the bird species they observe at http://ebird.org. Simply create an account, find the location (Birding Hotspot) you visited, and what species you observed. The City Point Unit is listed under: Location: Petersburg National Battlefield Park—City Point Unit, Country: US, State: Virginia, County: Hopewell.

The Eastern Front Unit's grasslands and forests provide habitat for an abundance of birds. These include the Great Horned Owl,

Lesson 1
Life in an Ecosystem



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Life Sciences LS.4-LS.14

Cross Curriculum:

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the Red-bellied Woodpecker, and the American Goldfinch. On http://ebird.org the Eastern Front Unit is listed under: Location: Petersburg National Battlefield--Eastern Front Unit, Country: US, State: Virginia, County: Prince George. Even the 8.7 acre Poplar Grove National Cemetery Unit, where 6,142 soldiers (mostly from the Union side) are interred, plays host to many bird species. The Downy Woodpecker and Eastern Phoebe are two of the species that are known to frequent this hallowed ground.

Petersburg National Battlefield Nature Poster

Petersburg National Battlefield Nature Poster

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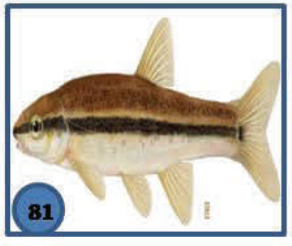
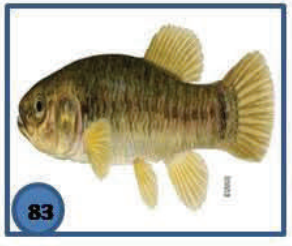
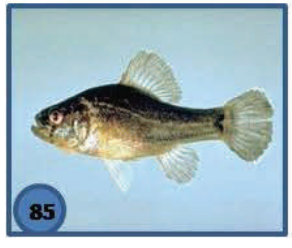
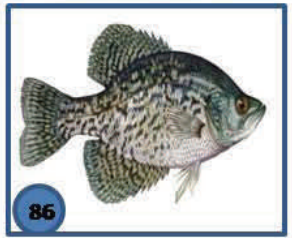
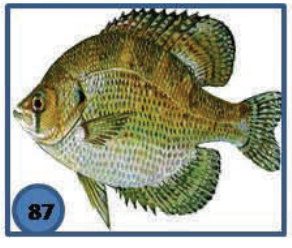
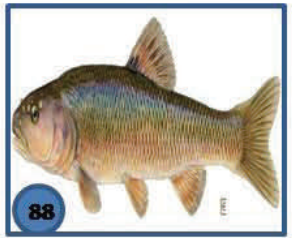




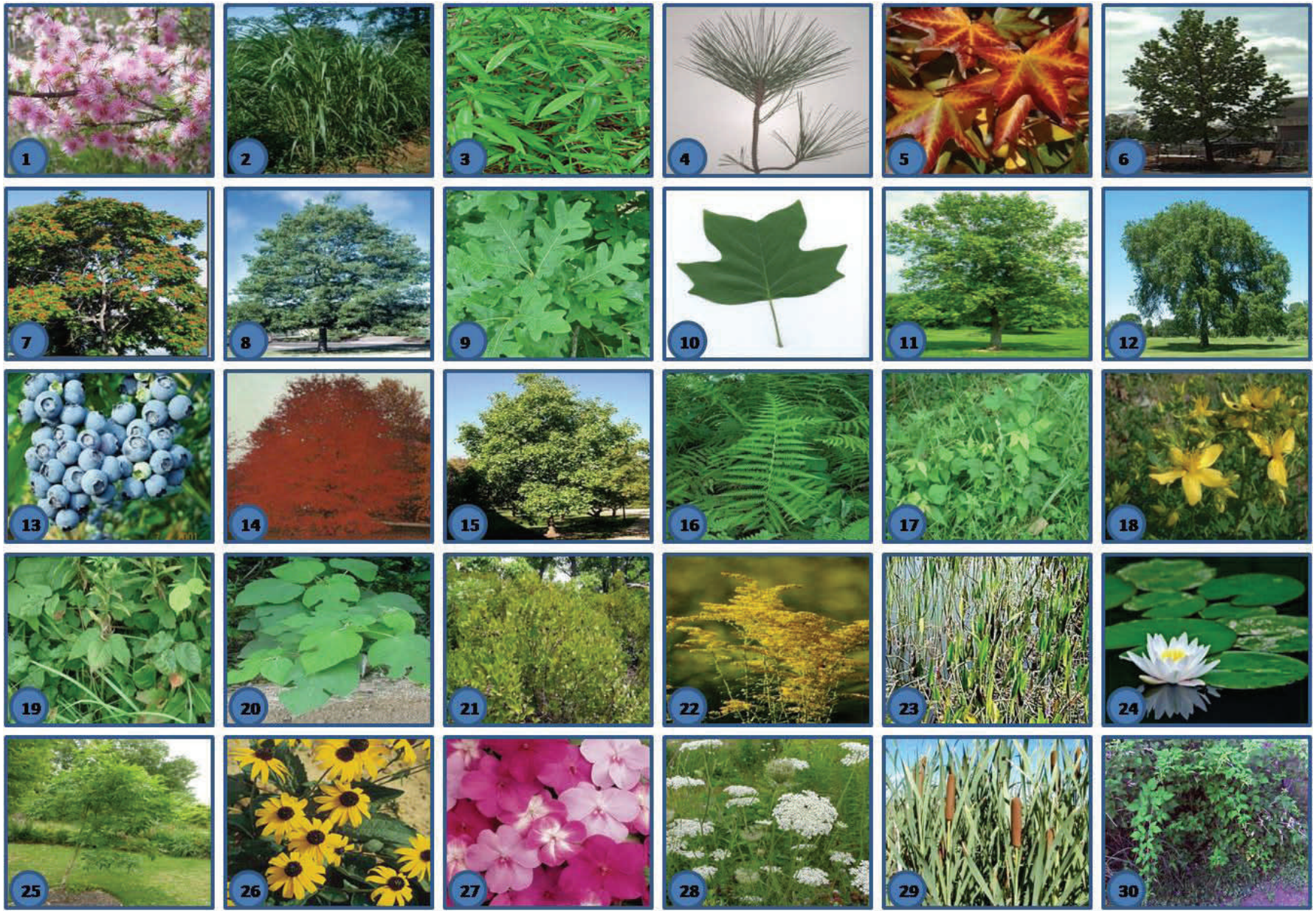


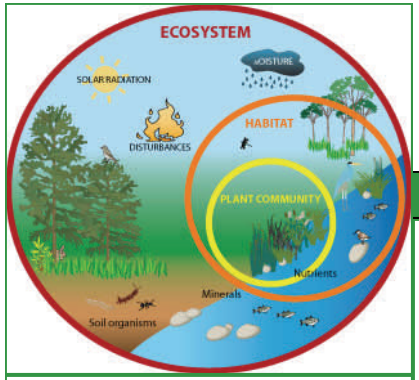






Petersburg National Battlefield Nature Poster





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Life Sciences LS.4-LS.14

Cross Curriculum:

1. Ecology
2. Art
3. Language

On Site Visit

Lesson 1

Life in an Ecosystem

What Makes a Pond a Pond? Grades K to 3

Objective

The students will examine features of a pond to learn how scientists use these components to classify ponds.

Time

40 minutes

Materials

- Student Page
- Measuring tape
- String
- Weight
- Thermometer

Pondering the Activity

The students often hear the word *pond* used to describe a body of water. However, many of them do not know why a body of water is a pond instead of a lake, river, or bog. In this activity, the students will learn the attributes of a pond and how to recognize these attributes in a pond environment.

Preparing for the Activity

Display several photographs or magazine pictures of different bodies of water around the classroom. Share these pictures with the students as you help them understand what makes a pond a pond.

Procedures

1. Show the students the pictures of different bodies of water and ask them what these bodies of water might be called. Words could include *pond, lake, river, ocean, sea, puddle, slough,* and *canal.*

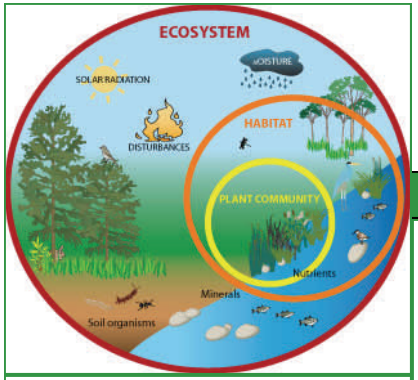
2. Escort the students to the pond. Ask them which word they think best describes the pond and why. Have the students make a list of features that might make ponds different from other wet places.

3. Explain that scientists use four features to define a pond. If any of these features are true for a nonflowing body of water, then it's a pond.

4. Hand out the Student Page to illustrate these features. Did your students come up with any of the same features? Discuss how you could determine if your

Lesson 1

Life in an Ecosystem



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Life Sciences LS.4-LS.14

Cross Curriculum:

1. Ecology
2. Art
3. Language

On Site Visit

pond is truly a pond.

5. Challenge the students to answer the four questions on the Student Page using the string, measuring tape, weight, and thermometer. Each student can record his or her findings on the Student Page. You might have to go out on a blustery day to answer the last question.

6. Summarize by explaining that if the answer is "yes" to any of the four questions, your schoolyard body of water fits the definition of a pond.

The Quality of Water Grades 4 to 12

Objective

The students will conduct three simple tests to gather information about the quality of the water in the pond.

Time 50 minutes

Materials

• Student Page

• One pencil per student pair

• One of the following per group of six students:

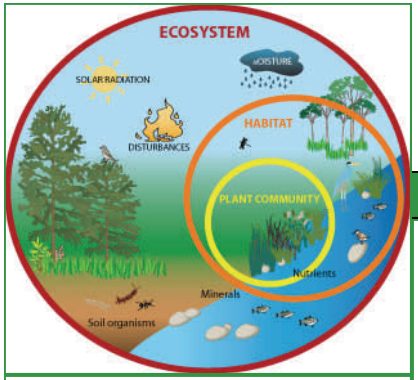
- White or very light Frisbee with 3/8-inch hole poked through the middle (in advance, hammer a Phillips screwdriver through the center of each Frisbee)
- Black permanent marker
- 1/8-inch-thick, 8-foot-long rope or heavy twine
- 6-foot measuring tape
- Ruler
- pH test kit
- Thermometer
- Plastic bucket

Pondering the Activity

How do you know if a pond is healthy? No single test can assess the overall quality of pond water, but the students will have a pretty good idea of water quality when they conduct and compare results from three tests.

Background Information for Water Transparency Test

The Secchi (SEC-key) disk is a fun, surprisingly simple way to measure the transparency



Lesson 1

Life in an Ecosystem

On Site Visit

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of a body of water. It is a rough estimate of how much light penetrates the body of water. Scientists have been using it since Professor P. Secchi invented it in 1865. A Secchi disk is usually 8 inches across, has alternating black and white quadrants, and has a rope attached to its center. Researchers lower the disk into the water, often from the side of a boat, until it disappears from sight and then slowly raise it until it is just visible again. At the point where the disk reappears, they mark the rope at the surface of the water.

The distance from the disk to the mark on the rope is the Secchi depth. As a general rule, light can penetrate to a depth of two times the Secchi depth. As light penetration increases, so does the amount of plant growth and oxygen produced by algae and aquatic plants.

Background Information for pH Test

Another simple way to assess water quality is with a pH test. pH means potential of hydrogen. The more hydrogen in the water, the more acidic the water. pH is measured on a scale of 1 to 14. Low numbers are more acidic, high numbers are less acidic (more "basic"), and numbers in the middle are more neutral. A pH of 7 is the most neutral. Typical ponds have a pH range of 6 to 11, which is slightly acidic to very basic. Most wildlife have difficulty surviving in waters with a pH outside of this range. For example, a pH of 4 is acidic enough to dissolve nails!

Background Information for Temperature Test

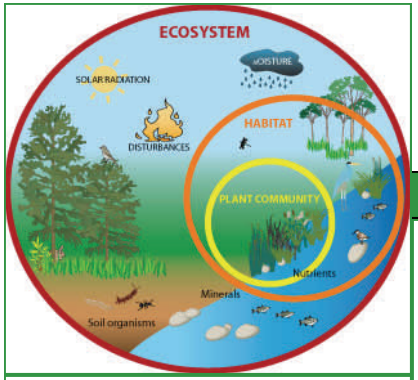
A third way to test the pond's health is much like the way you test your own health: take its temperature. You must leave the thermometer in the water long enough to get an accurate reading (about 90 seconds). The temperature of a healthy pond is related to the temperature of the surrounding environment. However, an unusually warm pond can indicate an overabundance of decomposing algae, which produces heat.

Procedures

1. Instruct the students to divide into groups of four to six and find a partner within

Lesson 1

Life in an Ecosystem



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On Site Visit

their group. Tell them that each group will conduct three different water quality tests. Assign each group a number, which they will enter on their data sheet, and assign each pair primary responsibility for one of the three tests: the transparency test, the pH test, or the temperature test.

2. Explain that before the students can go out to the pond, they must first make one of the testing devices . Show them a premade Secchi disk, explain how it's used, and ask them to discuss how measuring the Secchi depth could be useful in assessing water quality. (See "Background Information" above.) Ask them questions about water quality and transparency. What do plants need to grow? What happens if the pond is so murky that sunlight can't shine through and reach aquatic plants? What happens to the animals if the plants die off?

3. Give each group a marker, rope, ruler, and Frisbee. Tell them to use the ruler and marker to make quadrants on the inside "cup" of the Frisbee. Have them color in two opposite quadrants with the black permanent marker. Demonstrate how to thread the rope through the hole in the center of the Frisbee and hold it in place by tying a knot in the end, under the cup. When holding the rope, the disk should dangle, colored quadrants facing up.

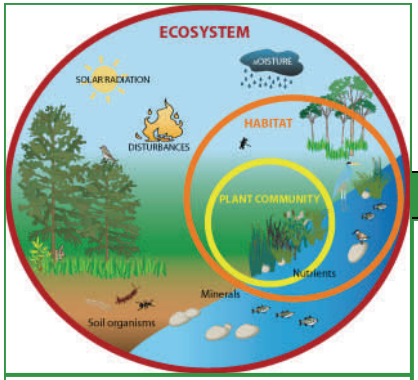
4. Hand out the Student Page, then take the students to the pond. They should bring the disk, the black marker, the measuring tape, and the data sheets. You should bring all of the other materials listed above.

5. Since weather influences light penetration and water temperature, ask the students to describe the weather conditions as indicated on their data sheets.

6. Tell each group to find a place around the pond. Review how to measure the Secchi depth. Tell the students to lower their Secchi disks into the water, allowing the Frisbee cup to fill with water so that the disk slowly sinks. Ask the pair of students within each group that is in charge of the transparency test to measure the Secchi depth and record it

Lesson 1

Life in an Ecosystem



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on their data sheet.

8. Gather the group together and ask the students to compare their results. Were the readings the same? If not, why? Discuss how readings taken in the shade would differ from those taken in the sun.

9. Explain that it is now time to conduct the next two tests of the day: pH and temperature. Distribute a bucket and pH test kit to the pair within each group that is responsible for the pH test. Distribute the thermometers to the pair responsible for the temperature test.

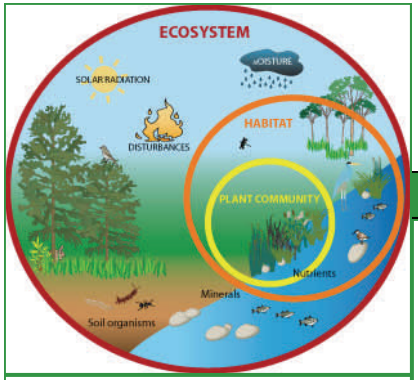
10. Explain or demonstrate how to conduct the pH test. (Refer to the directions provided with the kit.) Have the students circle the appropriate number on their data sheet.

11. Explain or demonstrate how to take the water temperature by inserting the thermometer into the bucket. The students should wait 90 seconds, then record the temperature on their data sheet.

12. Invite the students to return to the same spot where they conducted the transparency test and complete the other two tests.

13. Gather the group together at the pond's edge or back in the Education Shelter, then review and discuss the results. Ask the following questions: Based on the results, is your pond healthy? Why or why not? Are these three tests comprehensive enough to determine the total health of the pond? What other types of tests could inform you about the health of your pond?

14. Explain that recording changes over time in the amount of various pond plants and animals is another excellent way to determine the health of a pond.



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Post Visit

Lesson 1
Life in an Ecosystem

The Pond Poet

Grades 4 to 12

Objective

To help the students better use their senses to record their experiences from the pond, then turn that experience into a pond poem.

Time

40 minutes

Materials

- Student Page
- Pen and paper

Pondering the Activity

The pond is a fascinating place that gives the students an opportunity to use all of their senses--sight, sound, touch, and smell--to experience the wonders of the pond. By writing about these experiences, the students will be better able to articulate their feelings and thoughts about the pond.

Procedure

1. Ask your students to close their eyes, then read them the poem from the Student Page. Ask them which images stuck in their mind. Do they think the poem captures the elements of their pond visit ? Could they write what they consider a better poem?

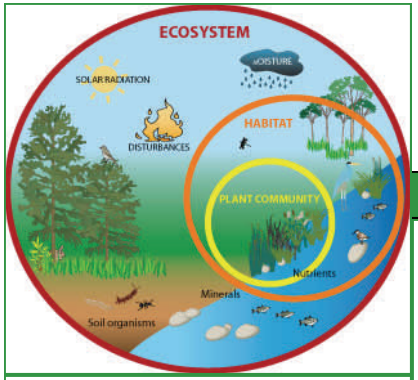
2. Explain that they are going to participate in a poetry slam about the pond. A poetry slam is a game in which people compete by reading their best poems. It's a loud, raucous affair where the audience cheers after each poem is read.

3. Each student will write and read a poem that he or she thinks best captures some element of the pond. Encourage the students to think about different ways they can sense a pond: through sight, sound, touch, and smell.

4. Remind students of their visit to the pond and give them time to gather thoughts for their poem. Give them a few days to work on refining their work.

5. Encourage the students to give animated, active performances as they read their poems during the poetry slam.

6. Poetry slams typically use audience response to select the best poems. You can have the students clap, vote



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Life Sciences LS.4-LS.14

Cross Curriculum:

1. Ecology
2. Art
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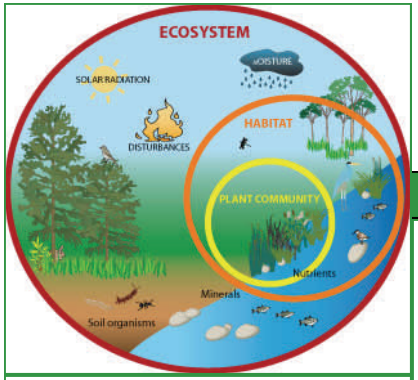
by hand, or use written ballots to select the three best poems. Or, for a noncompetitive event, just have the audience express appreciation for each reader. The more animated the poem, the louder the response from the audience. The goal is to make poetry reading a participatory event.

7. The winners can be asked to create a new pond poem for the following week, when they can compete against each other or against winners from another class.

Pond Life
by
Margaret Lindsay Holton

while handsome bullrushes finally spear up
as drooping willows listfully weep
and a miniature tree frog chorus bellows
at a throaty red-winged black bird swaying
while big mud turtles freeze frame
as daring dragonflies whiz by
and feverish minnows hopefully charge
at long-limbed water spiders skating
while wood ducks snort green algae
as black-eyed snakes weave ribbons
and Queen Anne ruffles her fine lace
at a common thistle braying
while merry buttercups pucker up
as delicate bluebells dingle dangle
and a Great Blue Heron stares
at a prickly porcupine playing
while broad leaf burdocks brood
and Canadian geese back paddle
at a coyotes wet shadow fleeting
while a young buck antlers tilt
as several barn swallows swoop
and mysterious brown bats dervish
at mosquitoes buzzing flourish
– this pond lives on
I had it all
As I recall.



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Life Sciences LS.4-LS.14

Cross Curriculum:

1. Ecology
2. Art
3. Language

Landscape Design Challenge Grades 4 to 12

Objective

The students will research the process of pond design and use their research to design their own ponds.

Time

120 minutes

Materials

- Student Pages
- Large sheets of paper
- Regular and colored pencils
- Ruler
- Computer with Internet access

Pondering the Activity

Pond construction is an excellent metaphor for how art and science are integral to so many human endeavors. For this activity, the students will experience the challenge of matching the needs of an imaginary client with the science and the math behind pond construction.

Procedures

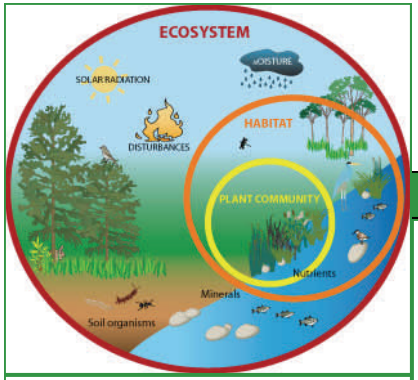
1. Inform the students that their job is to take on the role of pond designer and builder and that they will be designing a pond. What do they think goes into the pond design process? What issues must they deal with? Read with them the Student Page , which explains the types of questions that must be answered in the process of designing a pond.

2. Arrange the class into groups of approximately four students. Instruct the groups to use the Internet and your pond binder to research information on pond construction, especially the Aquascape Designs, Inc. approach. The students will need to be familiar with basic elements of the pond--liner, biofalls, skimmer, etc.--to proceed.

3. Each group of students needs to select a potential client whose needs they must meet. The client could be a parent of one of the group members, a different homeowner, or a teacher in the school. An interview with the client will establish the scope of the pond and answer many of the questions on the Student Page.

4. To complete the assignment, the students will need to present a "bid" to their

Lesson 1
Life in an Ecosystem



Objectives:

1. Understand the concept of an eco-system
2. Understand the interdependence of members of an ecosystem.

Standards of Learning:

Life Processes K.6, 1.4, 2.4, 3.4

Living Systems 2.5, 3.5, 3.6, 4.5, 6.7,

Resources 3.10, 3.11, 4.8,

Life Sciences LS.4-LS.14

Cross Curriculum:

1. Ecology
2. Art
3. Language

Post Visit

client. (students can experiment with rope or a garden hose to estimate dimensions) The bid will include a plan, rough elevation, and cost estimate. The Student Page shows examples of the first two. One Student Page shows a bid sheet. The bid sheet requires the students to calculate the various amounts of material they need based on the size and characteristics of the pond. Establish a timeline for completion of the project. Major milestones include completing the interview, completing the plan, and completing the cost estimation.

5. Have groups share their designs with the class, ideally with the client present to critique the approach and how well it fits the budget. If the client isn't available, another student or teacher can stand in.

A carnivore

*an animal that eats only other animals.

Bull Shark

A carnivore

*an animal that eats only other animals.

Nile Crocodile

A carnivore

*an animal that eats only other animals.

Gila Monster

A carnivore

*An animal that eats only other animals.

Piranha

Cleaner

*An animal that eats the parasites off of other animals. This is called a symbiotic relationship.

Cleaner Wrasse

Cleaner

*An animal that eats the parasites off of other animals. This is called a symbiotic relationship.

Remora

Cleaner

*An animal that eats the parasites off of other animals. This is called a symbiotic relationship.

White-striped Cleaner Shrimp

Cleaner

*An animal that eats the parasites off of other animals. This is called a symbiotic relationship.

Plover

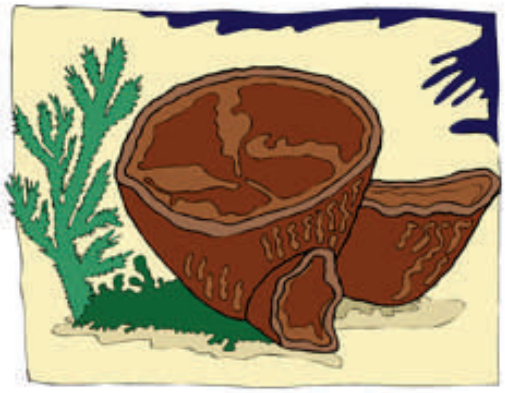
A Filter Feeder

*An animal that filters water to collect many small organisms to eat.

Giant Clam

A Filter Feeder

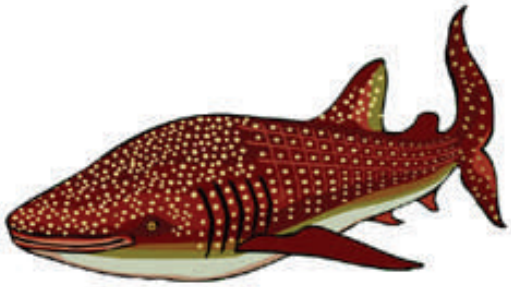
*An animal that filters water to collect many small organisms to eat.



Sea Sponge

A Filter Feeder

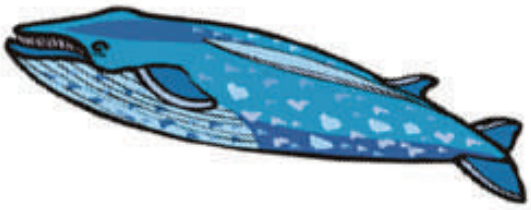
*An animal that filters water to collect many small organisms to eat.



Whale Shark

A Filter Feeder

*An animal that filters water to collect many small organisms to eat.



Blue Whale

A herbivore

*An animal that eats only plants.

Panda

A herbivore

*An animal that eats only plants.

Rabbit

A herbivore

*An animal that eats only plants.

Deer

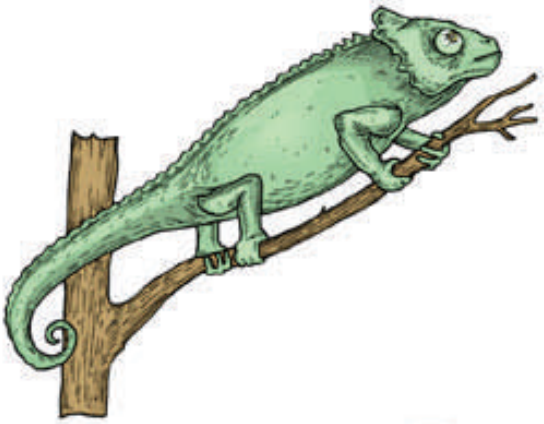
A herbivore

*An animal that eats only plants.

Grasshopper

An insectivore

*An animal that eats mostly insects.



Chameleon

An insectivore

*An animal that eats mostly insects.

Hedgehog

An insectivore

*An animal that eats mostly insects.

Anteater

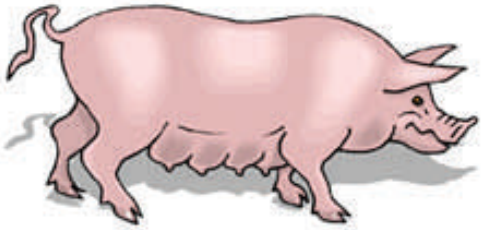
An insectivore

*An animal that eats mostly insects.

Spider

An omnivore

*An animal that eats both plants and animals



Pig

An omnivore

*An animal that eats both plants and animals

Raccoon

An omnivore

*An animal that eats both plants and animals

Human

An omnivore

*An animal that eats both plants and animals

Bear

Parasite

*An animal that lives on or in another animal and eats that animal to live. The parasite usually doesn't kill the host animal.

Leech

Parasite

*An animal that lives on or in another animal and eats that animal to live. The parasite usually doesn't kill the host animal.

Flea

Parasite

*An animal that lives on or in another animal and eats that animal to live. The parasite usually doesn't kill the host animal.

Tick

Parasite

*An animal that lives on or in another animal and eats that animal to live. The parasite usually doesn't kill the host animal.

Louse

Predator

*An animal that hunts and kills other animals to eat.

Killer Whale

Predator

*An animal that hunts and kills other animals to eat.

Wolf

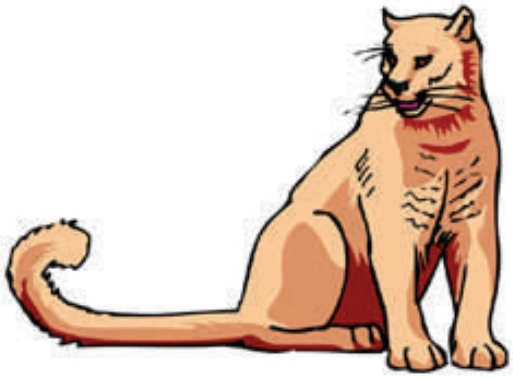
Predator

*An animal that hunts and kills other animals to eat.

Lion

Predator

*An animal that hunts and kills other animals to eat.



Cougar

Scavenger

*An animal that eats other animals that are already dead.

Striped Hyena

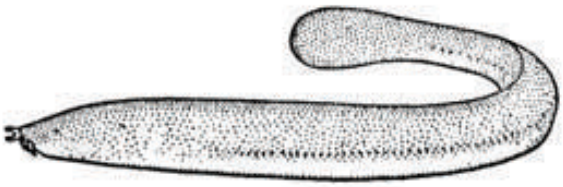
Scavenger

*An animal that eats other animals that are already dead.

Crow

Scavenger

*An animal that eats other animals that are already dead.



Hagfish

Scavenger

*An animal that eats other animals that are already dead.

Vulture