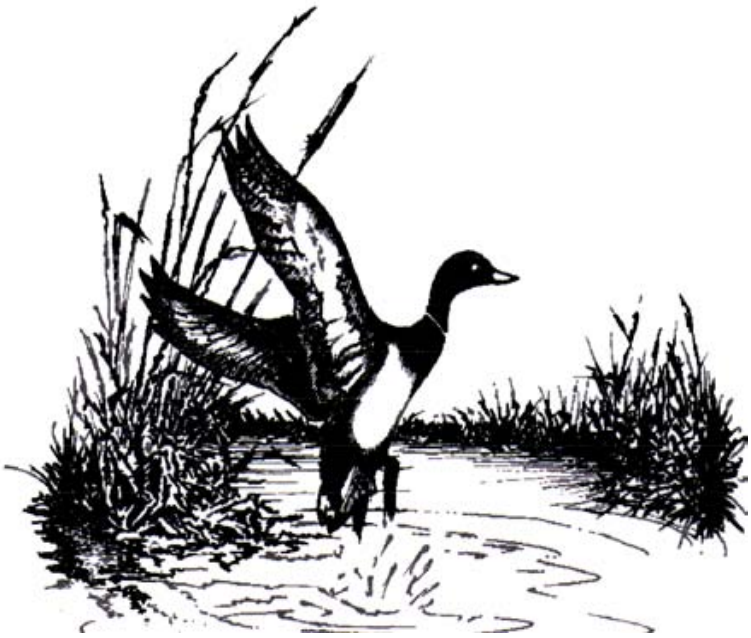
Chapter 9



Habitat Studies

Habitat Studies Overview

Theme

The place where a plant or animal lives is called its "habitat." Every habitat provides its inhabitants with food, water, shelter, and space. Some animals have developed adaptations (ways to survive) for specific habitats. Students will discover more about the refuge's habitats through a variety of investigations.

Background

Steigerwald Lake National Wildlife Refuge manages and protects five habitats: open water, freshwater wetland, field, riparian woodland, and upland woodland. The refuge was established with the primary purpose of providing a migration and wintering area for waterfowl. Other objectives include the management and protection of all wildlife species and their habitat, stressing the need to provide biodiversity. Traditionally, biodiversity is defined as the maximum number of species in a given area. Biologists have recently become aware, however, that an area with a large number of species is not necessarily rich in true diversity. Many wildlife species using a small piece of habitat in a habitat mosaic are generalists that can live in a variety of habitats or along the edge of a habitat community. Endemic wildlife species, or those which are specialists requiring larger vegetative communities, have become increasingly uncommon as wildlife habitat is fragmented by human development. Each habitat on the refuge supports a diverse group of plants and animals. The importance of these habitats is evident in the presence of threatened, endangered, or sensitive species they support. Wildlife species of concern include Canada goose, cackling goose, and bald eagle; plant species include giant trillium, Nuttall's larkspur, and fawn lily. Through habitat studies, students should learn about the importance of protecting habitats.

Dead or Alive?

Outside Grades: 5-8

Objective
Students will be able to:
• understand the role and importance of dead wood in a forest ecosystem
• make discoveries and predictions using detailed observations and drawings

Materials
• journals or paper
• hand lenses
• pencils
• clipboards

Background
Dead trees in a forest can often go unnoticed or may seem to "clutter" the forest floor, but a closer look will reveal that the wood is actually full of living organisms.
Once a tree dies, it slowly begins to decay with the help of decomposers. Insects bore holes into the wood, building nests and eating the wood as food. Birds eat some of the insects that live in dead trees. Some birds like woodpeckers bore larger holes so that they can live in the trees. Larger mammals such as squirrels and raccoons live and hide in dead trees too.
Eventually the wood becomes soft and the tree falls down.
These downed trees are called "nurse logs" because they provide a habitat for many organisms. Nurse logs provide nutrients that nourish the soil and help other trees and plants grow. Often times moss, ferns and small trees grow on top of nurse logs, which camouflage the log among other forest plants. Usually the older the log is, the harder it is to see.

Method
1. Brainstorm answers to the following questions with students. What is a "nurse log"? Is this a good name for dead trees lying in the forest? Why? How do nurse logs benefit a forest ecosystem?
2. Review definitions of vocabulary words.
3. Make copies of the "Dead or Alive?—Observation Sheet" and distribute to students before going outside. Have students briefly read through questions to verify their understanding.

Discussion
1. Ask students to share their answers to questions #8 and #9 with a partner; then discuss with the class.

2. Make a specific list of all the benefits of dead wood in a forest entitled, “Dead Wood is Good.”

Name_____

Dead or Alive? – Observation Sheet

1. Why do you think this tree died?

2. How long do you think this tree has been lying on the forest floor? Why?

3. What evidence of insects do you see?

4. How do you think that plants got started growing on the nurse log?

5. Name the producers, consumers and decomposers you can see.

Producers	**Consumers**	**Decomposers**

6. Draw a food web that includes all the organisms you found.

7. Make a detailed drawing of the nurse log on the back of this paper and label the organisms that you observed.

8. Is a tree more “alive” when it’s growing or after it dies? Explain.

9. How would this ecosystem change if all the dead trees were removed?

Meet a Tree

Classroom grades: k-8

Objective
Students will be able to:
• practice using their tactile and olfactory senses to make observations
• increase their awareness of different tree characteristics

Materials
• blindfolds

Background
At first glance, you may think all trees of the same species are alike. With closer examination, students will be able to determine differences in the trunk, limbs and bark without using their sense of sight. By covering their eyes with a blindfold, their tactile and olfactory awareness is enhanced. Students might notice the heat from the angle of the sun, sounds from close proximity to a street or creek or texture from lichen and moss on the bark. All of these characteristics will help students become better acquainted with "their tree". Once their blindfold is removed and the student begins searching for her/his tree, instead of seeing a forest full of trees, they will see each tree as a separate individual with unique characteristics.

Method
1. Go outside to a wooded area.
2. Have students find a partner.
3. Stand in a large circle and explain rules before passing out blindfolds.
    a. Help your partner put on a blindfold. Be sure it is positioned so that they can't see.
    b. Carefully turn them around a few times to disorient them.
    c. Lead them to a tree that is 20 – 30 meters away, by taking an indirect route.
    d. Remember: when you are leading someone who is blindfolded, they are trusting you to keep them from running into anything. Hold onto their hand or shoulder and slowly lead them to a specific tree.
    e. Give them 2 – 3 minutes to get acquainted with "their tree" using any of their senses except sight.
    f. With blindfold still in place, lead them back to the starting point by taking a different route.
    g. Carefully turn them around a few times to disorient them.
    h. Take off the blindfold and see if they can find "their tree".
    i. Now blindfold the other partner and repeat step 3.
    j. When both students have completed this activity, they should meet back in the beginning large circle to share what they discovered.
4. Give one blindfold to each pair of students and let them begin.

Discussion

1. Have students raise their hand if they were able to find “their tree”.
2. Was it easy or hard to find your tree?
3. What observations did you make when you were blindfolded that helped you find your tree once the blindfold was removed? (Allow time for all to share.)
4. How could this activity relate to the people standing here in this circle?

References

Cornell, J. *Sharing Nature with Children*.

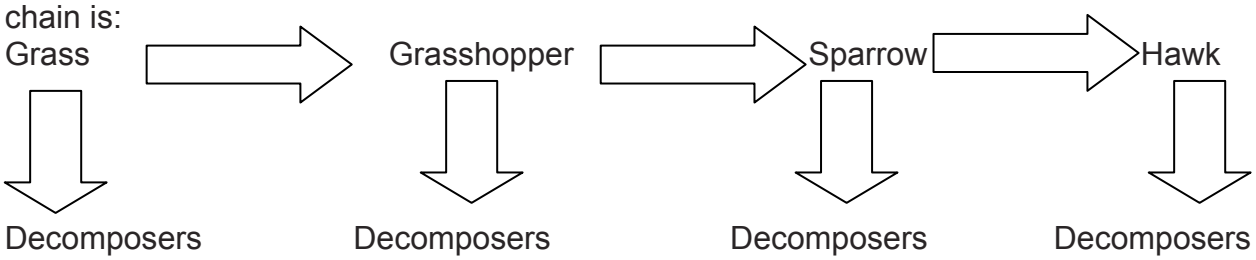
The Energy Game

Classroom Grades: 3-6

Objective
Students will be able to:
• Know that energy in a food web begins with the sun
• Know that plants, herbivores, carnivores, and decomposers gain and lose energy in a food web
• All parts of an ecosystem are interdependent

Materials
• Sunflower seeds, lima beans (or some other small hard seed) are used as “energy bundles”
• Small, re-sealable (Ziploc type) bags to hold the energy bundles
• Name tags for students to wear: “sun”, “plant”, “herbivore”, “carnivore”, “decomposer”
• Game area (the game area should be about the size of ½ a basketball court)
• Whistle to stop the game periodically

Background
The plants, animals, and physical environment of an ecosystem are interconnected and interdependent. Some relationships are direct, and simple to understand. For example, a deer has a direct relationship with the plants it consumes. Indirect relationships are less obvious. A mountain lion consumes deer, but it also has an indirect relationship with plants because without plants, the deer could not live. Because of these direct and indirect relationships, a change in one part of an ecosystem can bring changes in other parts of an ecosystem. All of these connections can together be thought of as a web of life.
Beyond understanding simply that organisms are connected with one another and their physical environment, it can be helpful to discuss their relationships more specifically. Food chains are often used to illustrate some of these relationships. An example of such a food chain is:



The various levels of the food chain can be defined in the following way:
•Producer: an organism that produces its own food (example: algae, plants, some bacteria)
•Consumer: an organism that ingests other organisms or organic matter. Consumers are divided into 4 subgroups:
- •Herbivore: an organism that feeds chiefly on plants (sometimes called a primary consumer; example: grasshopper)
- •Carnivore: a flesh-eating organism (example: sparrow, hawk)

•Omnivore: an organism that eats both plants and animals(example: raccoon)
•Decomposer: any of the various organisms that feed on and break down organic substances (such as dead plants and animals). Decomposers are involved at every level of the food chain and play an integral role in the recycling of nutrients (example: bacteria, fungi).

Expanding this food chain into a food web is simple. A grasshopper can be eaten by a number of other organisms. It may eat several types of grass. A hawk will eat multiple species of animals, not just one species of sparrow. Omnivores, by definition, eat a variety of organisms. In addition, decomposers play an essential role in all parts of any ecosystem, by returning the organic matter of dead plants and animals to an inorganic form that can again be taken up by plants.
A food web can be further expanded into a web of life by considering the role of air, water, and nutrients. While often less obvious, these components play an essential role in the ecosystem. For instance, without nutrients, plants may not grow well and may not be as nourishing for herbivores.
In the end, it is clear that the web of life has many connections between organisms and their environment. Direct and indirect connections between the components make for the incredible complexity of an ecosystem.

Vocabulary
ecosystem – dynamic interactions between plants, animals, and microorganisms and their environment working together as a functional unit.
food chain – an arrangement of the members of an ecological community according to the order in which each uses the next (usually lower) member for food. For example: a seed is eaten by a mouse, which in turn is eaten by a snake, which in turn is eaten by an owl.
food web – the totality of interacting food chains in an ecological community.
photosynthesis – the conversion by plants of carbon dioxide and water into a sugar called glucose using sunlight energy. Oxygen is produced as a waste product.
producers – green plants that can produce food from sunlight, carbon dioxide and water (photosynthesis).
consumer – an organism that obtains its food by eating other organisms.
herbivore – an organism that only eats plants.
carnivore – an organism that only eats animals.
decomposer – any organism that breaks down dead plant and animal matter into nutrients. For example, mushrooms, earthworms, etc.

Method
<u>Preparation</u>
Prior to playing this game, the students should have a basic idea of what a food web is. Create nametags for students to identify what their role is in the ecosystem. Each student has a Ziploc-type bag to hold their “energy bundles”.
Student roles:
1. sun (one student)
2. plant (several students)
3. herbivores (fewer number than the plants)
4. carnivores (fewer number than the herbivores)

5. decomposers

A lima bean, sunflower seed, or other type of seed serves as an “energy bundle”
1. The “sun” has a large supply of energy bundles
2. The plants each get 4 energy bundles (4 seeds)
Game
1. Make sure students know the boundaries of the playing field (about ½ of a basketball court) before they begin.
2. To begin, each plant receives four energy bundles (4 seeds) from the sun. Plants must say “photosynthesis” to the sun in order to receive their energy bundles. Plants can return to the sun as often as they want to get more energy bundles.
3. The herbivores chase and tag plants and receive half of the plant’s energy bundles.
4. Carnivores tag herbivores and receive half of the herbivore’s energy bundles.
5. Tagged plants and herbivores that die – must “freeze”.
6. However, decomposers tag dead plants and herbivores to gather their remaining energy bundles.
7. After giving the rest of their energy bundles to the decomposers, dead plants and herbivores become new plants and herbivores and re-enter the game.
8. After two minutes the game stops and students tally their energy bundles. Anyone with fewer than ten seeds dies.
9. The class keeps track of the number of players that survived. Students now can examine how the game differs from a real ecosystem (what happens to the carnivores?) and can add rules or components to the game to make it more accurate to reflect a real ecosystem.

Extension
Students can make changes to the game, for instance:
1. “Night” could be added so that during a certain time period (1-3 minutes) plants could not photosynthesize
2. Omnivores, organisms that eat both plants and animals (bears, people) could be added
3. Humans could be added: with humans comes habitat loss

Discussion
Discuss with the students the balance of the ecosystem:
1. Why are there more plants than herbivores? why are there more herbivores than carnivores? What is the role of the decomposers? Imagine a world with a lot of dead plants and animals piling up - this helps students to understand the role of decomposers.
2. What if there was a population explosion of rabbits (herbivores) to this ecosystem?
3. What would happen if there was a fire in this ecosystem?
4. What if a subdivision of houses was planned for this ecosystem area?

Reference
Science and Children. Ecosystem

Oak Savanna History

Classroom Grades: 6-8

Objective
Students will be able to:
• learn the history of the oak savanna lands of the Willamette Valley and compare to Steigerwald Lake NWR
• realize that both time and humans make changes to the land
• make predictions of the future for this site

Materials
• nature journals (or paper)
• clipboards
• pencils
• pens, colored pencils (optional)

EALRs
Sci. 1.3.9, 1.3.10
SS 3.1.1, 3.1.2

Background
See "The Majestic Oak" story at end of this lesson.

Method

Tell students you are going to read a story to them about the "The Majestic Oak." It's about the history of the Oregon White Oak trees at Tualatin River NWR and the prairies, savannas and grasslands that were common in that area. (Define vocabulary for students.) As you read, tell them to picture or visualize in their mind how the area would have looked a long time ago. Were there people here? What kind of animals lived here? How has this area changed over time? Compare this to Steigerwald Lake NWR. (Read story) On the next day, when you are at Steigerwald Lake Refuge point out a oak trees on the trail and ask them to guess the age of the largest oak tree they can see. Ask for some guesses. If that tree could talk, it would tell you about all of the changes it has experienced over the years. What do you think it would tell you?
In your journal, title your page Oregon White Oak and make a drawing of the tree. On the next page, write what you think the oak would tell you about its life story.
Think about some of the things you just heard in "The Majestic Oak" story. (If you have time, students can make another drawing of what they predict this area will look like 350 years from now.)
Vocabulary
prairie—flat grassland
savanna—grassland containing scattered trees
woodland—a forested area
crown—the top branches and leaves of a tree

The Majestic Oak

Oregon White Oak **(*Quercus garryana*)**

The prairies of Oregon's Willamette Valley are some of the most endangered ecosystems in the United States. Recent research from Oregon State University and elsewhere is helping us understand the need for the conservation, management, and restoration of these fascinating ecosystems.

Oak woodlands once covered many of the foothills in this area, but today only a few remain in the Willamette Valley. As the lion symbolizes courage, the oak tree stands for strength. Nearly 2,000 years ago, the huge oaks inspired the Roman poet, Virgil, to write: "Full in the midst of his own strength he stands, stretching his brawny arms and leafy hands." (Tomorrow at Steigerwald Lake Refuge look at the huge oak. Observe "the brawny arms and leafy hands"?)

What happened to all of the oak trees and grasslands? About 10,000 years ago at the end of the last ice age, the climate in this area was much hotter and drier. Scientists think that these prairie grasslands evolved naturally in this type of climate. The prairie began changing again 4,000 years later when a huge ice dam in Montana broke, causing a massive flood (Missoula Flood) that carried tons of water, rocks and debris, which carved out the Willamette Valley as it traveled southward, on down the Columbia River to the sea.

After this event, the climate became more cool and moist, similar to the climate we have today, and the grasslands once again began to flourish. Left to its own devices, this oak savanna prairie would have eventually progressed into a dense forest, but instead humans learned to manage the land with fire.
Manipulation of habitat can benefit both humans and wildlife. Prairie and oak savannah habitats in the Willamette Valley were created and maintained by the people who lived there. Without human influence the entire Willamette Valley would have become forested.

The savannas of grassland and large, widely scattered Oregon White Oak trees thrived because of frequent, low-intensity fires set by Native Americans (Cathlapotle Chinookans). The fires removed competing brush, conifers and even oak seedlings. This made it easier for the people to collect seeds, bulbs, roots, berries and other plants they relied on for food. The burning also encouraged the growth of tender grasses and other plants that were favored by elk and deer. Fire was also used to herd deer or other prey into confined areas to make hunting easier. Without competition from other trees and shrubs, this left scattered, older oaks to grow to an impressive size, with a huge spreading crown.

When Euro-Americans arrived in the early to mid-1800's, agriculture and development put a stop to burning and much of the native prairie was plowed under, leaving the land as we Oak see it today. The oak savannas have been replaced by Douglas fir and mixed species of trees. Sadly, the savannas and oak woodlands are disappearing due to a variety of other causes too. Oak woodlands have been cut for agricultural, forestry and residential land uses and for firewood. Oak woodlands now tend to be small and isolated, and less than 1 percent of former prairie acreage now remains.

Fortunately, oak woodlands can be managed and even restored to provide wildlife habitat throughout the Valley. Land ownership in the Willamette Valley is mostly private, so the survival of majestic oak trees and the associated wildlife will depend on local voluntary efforts to preserve these trees. “Garry Oak” is another common name for this tree. Nicholas Garry was secretary of the Hudson’s Bay Company and helped botanist David Douglas, so Douglas remembered him by adding Garry’s name to the scientific name of this tree.

The Oregon White Oak in the Willamette Valley provides a unique habitat for breeding, feeding, hiding and resting for over 100 species of wildlife. Woodpeckers, owls and bats use the hollow oak cavities for nests. Squirrels and deer rely on the highly nutritious acorns for food. Migrating songbirds hide in leafy oak crowns to rest before continuing their trip. The deeply furrowed bark offers a refuge for insects and a feeding site for wildlife. The multiforked limbs allow for placement of stick nests for birds. Dead wood, especially large logs provide essential habitat for salamanders and lizards. The leaves of the White Oak have protein content nearly equal to alfalfa hay and are eaten by deer and other animals.

Mistletoe and poison oak, which grow on oak trees, provide important food for birds such as western bluebirds, cedar waxwings and American robins. However, heavy infestations of mistletoe can kill oak trees.

The spotted gall wasp is an insect that lives only on Oregon White Oak. This gall wasp is a non-stinging insect that lays its eggs on the underside of an oak leaf. The chemicals in the egg cause the leaf tissue to change and form a gall or “popper,” which is a hollow ball that serves as a protective shell around the maturing larvae. As the wasp matures, it chews its way out. In the mid-to-late summer, an oak grove that has many gall wasps may rattle with the sound of the larvae trying to break out of this protective covering.

Discussion

Ask students the following questions:

1. Why are Oregon White Oak trees so important?
2. Do you think that the people who manage the Refuge should use the practice of burning the grass like the Native Americans did? Why or why not?
3. Name some factors that have changed the balance of animal populations in this area.

References

Morris, K. *Interpretive Outline for the Tualatin River National Wildlife Refuge.*
Oregon Fish and Wildlife Department. *Oregon White Oak: A Landscape Legacy.*
Oregon State University. Willamette Valley Prairies.
Pokorny, Kim. Plain talk; The Oregonian. August 12, 2004
kympokorny@news.oregonian.com
Ross, C.R. & Jensen, E.C. Trees to Know in Oregon.

Refuge Expedition

Classroom grades: 5-8

Objective
Students will be able to:
• describe how the earth and its processes affect this ecosystem
• describe how animals interact with this ecosystem
• describe how plants are an integral part of this ecosystem

Materials
• student handouts “Expedition Data Sheets”
• pencils
• clipboards
• field guides
• hand lenses
• maps of the refuge
• hip boots, spotting scope (optional)

Background
Students will explore the refuge as if they were scientist specialized in particular field. They will use their basic understand in life, earth and physical science to fully understand the complex ecosystem found at a National Wildlife Refuge.

Method
1. Before arriving at the refuge, break up the students into their groups. For large classes, you will have more than one type of team. Tell the students they are going on an expedition to explore an unknown territory. They will be on an expedition team with three members. When they return from the expedition, their team will be expected to give a full report of their findings.
    a. Zoologist team – scientists who study animals
    b. Botanist team – scientists who study plants
    c. Earth science team – scientists who study the earth and its processes
2. At the refuge, hand out the Expedition Data Sheets according to the teams. Each team should have enough data sheets to do a survey at each study station. Discuss the responsibilities of each expedition member by having one student read each role description aloud (found at the top of the Expedition Data Sheets). You will also want to review the Nature Observation Skills.
3. Give the students maps of the refuge indicating the area boundaries. Go over consequences of not staying within these boundaries.
4. Students should write their answers to all of the questions on their Expedition Data Sheet so they can share when they return to school.
5. Point out the tools that the students have to help them explore their territory. The hand lenses will allow them to see plants and small animals in greater detail.
6. Remind students where they should return to after they have completed their expedition, and send them out to explore. Allow 15 – 25 minutes for exploration at each station.

Look over the Expedition Data Sheet for completeness. Remind students that they will need to refer to these sheets when reporting to the class. As scientists they will want to report as much detail about the habitat they are studying as possible.

Reference

Rhythms of the Refuge: Educators Guide. (adapted from Salt Marsh Manual: An Educators Guide)

Name _____

THE ROLE OF THE EARTH SCIENTIST
(Scientist who studies the earth and its processes)

1. Describe how the land looks. (Is it flat or hilly? Are there cliffs in the area? Is it open fields, forest, etc.?)
2. Describe the climate. (What would a typical spring, summer, fall and winter be like here? Is it mostly sunny or cloudy? How cold would it be? Would it be windy or calm?)
3. Describe the soil. (Is it coarse, medium or fine? Is the soil moist or dry? Warm or cold? What can live in this soil?)

EXPEDITION DATA SHEET – Earth Scientist

1. Describe the area:

2. Climate: For a typical year, describe what you think it would be like in the area in the following seasons. (Would it be windy, wet, dry, cold, hot, etc.?)

a. Spring

b. Summer

c. Fall

d. Winter

3. Soil (Circle your choice)

a. Texture: Coarse Medium Fine

b. Soil Moisture: Wet Moist Damp

c. The soil is cooler/warmer than the air.

d. Are layers visible?

4. What does this habitat have to offer plants and animals? Does it have areas that provide food, water and shelter?

Name _____

THE ROLE OF THE BOTANIST
(Scientist who studies plants)

1. Describe the plants in this habitat. Are they fuzzy, smooth, sticky, etc.
2. Describe the size, color and shape of the leaves and flowers.
3. What makes them different from each other?
4. How have they adapted to get enough water?

EXPEDITION DATA SHEET – Botanist

1. How do plants get their food?

2. Draw and describe the plants growing in your study area. Record the features of the plant – size, color, shape of leaves and flowers (fuzzy, smooth, woody, waxy, etc.).

3. Where could plants find water and shelter in this area?

4. How do you think the features you described above help the plants to live in this habitat?

Name _____

THE ROLE OF THE ZOOLOGIST
(Scientist who studies animals)

1. Describe animals you find by color, size, shape and body parts.
2. Look for signs of animals that live here (scat, tracks, holes, webs, etc.).
3. Name all animals that appear to live here.
    a. Describe the food chain for each animal: What do they eat? What eats them?

EXPEDITION DATA SHEET – Zoologist

1. Draw and describe the animals you found in your study area. Record special features you observe (color, size, shape, specialized mouth parts, camouflage, and protective parts like horns or quills).

2. Draw and describe any animal signs found in your study area (scats, tracks, holes, webs, etc.).

3. Where could animals find food, water and shelter in this area?

4. Draw a food chain for one of the animals you described above.

What is a Watershed?

Classroom Grades: 3-8

Objective
Students will be able to:
• learn the meaning of “watershed”
• model how polluted runoff water affects the whole watershed
• understand the importance of a healthy watershed

Materials
• notebook paper
• 8.5 x 11” white paper
• blue and red overhead pens (or other felt tip, water soluble pens)
• spray bottle full of water

EALRs
Sci 1.2.6, 1.3.10
SS 3.1.2

Background
All the land on earth is part of a watershed. A watershed is often called a drainage basin. It is the land area that drains water from high headwaters to low wetlands, ponds or streams, by a network of channels called “tributaries.”
Tributaries increase in size as the water moves downhill, collecting more water, sediment, and dissolved materials.
All watersheds have an aquatic area, a riparian area and an upland area.
“Aquatic areas” include standing water like ponds, lakes, wetlands, bogs and running surface water such as streams and rivers.
The corridor of land and vegetation next to the aquatic area is called the “riparian area.” A healthy riparian area should have abundant trees and plants to prevent erosion and filter runoff before it enters the aquatic area.
The “upland area” borders the riparian area and is farther away from the aquatic area. Uplands also help filter runoff and provide homes for many types of wildlife.
Some of the factors that affect watersheds are the area and shape of the land, slope, soil type and vegetation. Pollutants that collect or are deposited on the ground in upland areas eventually travel downhill through tributaries to streams and rivers.
Each watershed is part of a larger watershed whose downstream portion is affected by upstream activities. Everyone depends on the resources watersheds provide.
As the human population continues to grow, the demand on those resources intensifies. Humans and their influences play an important and essential role in protecting watersheds.

Vocabulary
watershed—an area of land that drains water through soil and vegetation to the lowest point, which is usually a wetland, pond, stream or river.
headwaters—the ridge line or top of a mountain where a creek or stream begins.

tributaries—a network of channels of water which drain the land.
aquatic area—pond, lake, wetland, bog, stream, river.
riparian area—the strip of land (20 m or more) that borders a pond, creek, river or other aquatic area.

Method

Defining "watershed"

Have students work in teams of 4. Each team should get out one sheet of notebook paper and a pencil. Write the word "watershed" on the board or overhead.

Have students brainstorm the meaning of "watershed" with their team. After 3 – 5 minutes when students are finished discussing, tell them that someone in the group should write one sentence explaining the meaning of the group's definition for "watershed" and draw a picture of a "watershed." Call on teams to read their definitions and show their drawings. As they do this, write key words from their definitions, on the board and circle commonly used words (water, shed, land, etc.). When all teams have shared, review the circled words and come up with a definition.

"A watershed is an area of land that drains water through soil and vegetation to the lowest point, which is usually a wetland, pond, stream or river."

<u>Model watershed</u>

Give each team one piece of white paper and two pens, one blue and one red.

Have one person in the team wad up the white piece of paper.

Then uncrumple it part way and spread it out on the desk so that parts of the paper still stick up. This represents a landform with mountains. Have a student use the blue pen to draw along the top "ridge line" of the mountains. The blue ink will represent the headwaters of the creek or river below. Use the red pen to put 5 spots of ink in various places (high and low) on the landform. The red ink will represent pollutants such as oil, fertilizers or other chemicals.

"Let's see what happens when it rains."

The teacher should go from team to team and spray some "rain water" on top of each landform. Students should watch what happens as the water and pollutants travel downward through the watershed.

Remind students that a watershed includes soil, water and plants. The purpose of a watershed is to filter runoff before it is added to a stream or river. Is the pollution confined to one area or does it affect the entire watershed?

Help students understand that anything that happens within a watershed affects the whole watershed.

Discussion

1. The next day, have each student draw a picture of a watershed and write three sentences describing it.
2. Why is it important for us to protect our watersheds?
3. What are some activities that humans can do to have a positive impact on their watershed?

References

Oregon Department of Fish & Wildlife. The Stream Scene: Watersheds, Wildlife & People.

Where Have All the Wetlands Gone?

Outdoors Grades: 3-8

Objective
Students will learn how the loss of wetland habitats may cause plants and animals to become endangered.

Materials
1 long rope (to mark "wetland" boundaries)

Food pieces (15 fish, 15 insects, 15 snails, 10 marsh plants, and 10 small mammals and reptiles)
Small plastic Ziploc bags (one per student to represent their stomach)

EALRs *Science:SI01 1.2.1, CH03 1.3.7, 1.3.9, 1.3.10*

Background

A wetland is defined as an area that is saturated or covered by water at least part of the year. Wetlands are more familiarly known as fresh- and saltwater marshes, estuaries, swamps, mudflats, and bogs; they may contain fresh, brackish, or salt water. Wetlands support a number of valuable ecosystems that provide habitats for plants and animals. People also benefit from wetlands because wetlands filter water, control flood water, and provide educational and recreational opportunities.

Among the many diverse facets of a wetland, one of the most important is the habitat it provides for plants and animals. In the United States, nearly 35 percent of all rare and endangered species either depend upon or inhabit wetlands. Millions of waterfowl use wetlands as a migratory stopover or as breeding and nesting grounds. Wetlands are home to an overwhelming number of species of marine and freshwater plant and animal species. In the United States, more than 50 percent of our mature wetlands have been altered or filled in to satisfy the needs of a growing and expanding population. Much of this is attributable to the fact that historically, wetlands have been viewed as vast wastelands. Few people realized that the "wasteland" was home to hundreds of living things. This activity examines the relationship between wetland animals and the wetland habitats. The effects of habitat loss and food shortage on animals will be observed.

Methods

Before starting this activity, have the students brainstorm a list of different kinds of wetlands and the plants and animals that may live there. Tell them they are going to pretend to be muskrats, great egrets, dowitchers, tree frogs, and northern harriers. All of these animals live in and depend upon the marsh. When the wetlands are destroyed, these animals must find another marsh or lose their lives.

Place the rope on the ground in any shape, as long as the ends of the rope meet.
This identifies the wetland habitat. Have the class sit around the outside of the “marsh.” Divide the group into animals by counting off — there should be five groups. Give each animal a bag to use as his/her stomach. Using the food chart at the end of this activity, explain the specific diet of each animal; make sure the students understand they can only eat the food their animal eats. Their job is to forage (feed) in the marsh. They should put the food pieces in their stomachs as they collect them.

For the first round, sprinkle all the “food” pieces throughout the “marsh” area. Allow the animals to forage for 30 to 60 seconds or until the food is gone. When time is called, all animals must stop foraging and return to the outside of the marsh habitat.
Check each stomach. If any are empty or only have one piece of food, those animals have starved to death and they should remain sitting around the marsh. (You may use this opportunity to explain that when the animals die they decompose and return to the bottom of the food chain and there help other organisms grow.) The “dead” animals could chant “decompose, decompose, decompose . . ..” Collect all the food.

Now tell the class that part of the marsh is being filled in so a road can go across it.
Take in some of the rope to make the marsh smaller. You should also remove three snails, insects, and fish and one marsh plant, small mammal, and reptile from the food supply; set them aside. Explain how loss of habitat also means loss of food for many animals. Scatter the remaining pieces of food around the marsh and send the animals off to forage. (Remember, the animals who starved to death do not forage again) Repeat the feeding sequence — shrink the marsh, remove food, forage — until only a few animals are left. You will want to use different reasons for the shrinking of the marsh. Ask the students what reasons they think might cause people to want to fill in the marsh. Here are some suggestions:

- The marsh was filled to build houses, airports, office buildings, and/or garbage dumps.
- A sewage spill from upstream enters the marsh.
- The marsh is filling up with silt from developments upstream.
- A company dumps toxic waste in the marsh, thereby contaminating the food sources.

Discussion

It is important to conclude an activity like this one with a follow-up discussion. Here are some questions you may discuss:

Q: What is the effect of a shrinking habitat on an animal that depends upon it?
A: Loss of shelter, food, water, and space.

Q: Is it necessary to build marinas, housing developments, or garbage dumps in wetland areas? What are some of the alternatives?
A: This is a sticky situation because if we don’t clear away some area, — where will people live? Housing developments might take priority over marinas, but even still, a lot of discussion should occur before these decisions are made. We, as humans, should not take the fate of a species lightly, simply because we have the ability to control that fate.

Q: Why don’t these animals go somewhere else to live, such as a forest? Discuss the needs of each animal.
A: Each species has specific requirements in order to live. Wetland animals can find these

in the marsh, but they may not be able to find them in other habitats, such as a forest.
Q: Why can't the animals exist in smaller, but more crowded marshes?
A: Competition for food, shelter, water, and space would be too great, causing many species to become diseased or to die from the crowding.

Q: What needs to be done to help animals such as these?
A: Education, heightened awareness, increased interest, etc.

Q: How can you help endangered animals?
A: Make efforts to learn more about them, write letters to your Senators and Representatives, and Adopt-an-Endangered Species.

Food Chart for Wetland Inhabitants

Food Animal	Marsh Plants	Fish	Insects	Snails	Small Mammals and Reptiles
Muskrat	x				
Great Egret		x	x	x	x
Dowitcher			x	x	
Tree Frog			x		
Northern Harrier		x			x

Adopted from Nature Scope's Picky Eaters Activity and Project Earth

Plant Diversity

Outdoors Grades: 3-8

Objective
Student will be able to:
• describe at least two differences between plants that live in different habitats
• describe how these differences allow the plants to thrive in their habitats
• explain two reasons for plant diversity

Materials
• copies of student handout
"Plant Diversity"
• pencils
• clipboards
• meter sticks
• hip boots (optional)

Background
The diversity of plant life exists partly because environmental conditions differ from habitat to habitat and change throughout the year. One of the major factors influencing plant adaptations is the amount of water available in a particular area. This can easily be seen by comparing the structures of plants that grow in open water, at the water's edge, in an oak savanna, and in a riparian forest.

Open Water
These plants must survive very wet conditions and have a mechanism for either floating above the water to get sunlight (sometimes called floating plants), or being able to survive in the water column below the surface (sometimes called submerged plants), using diluted sunlight. For example, water lilies grow on the surface, and elodea grows below the surface.

Water's Edge
The dominant plants are those that can keep their roots wet during the high-water time of the year, and then survive dry conditions when the water is low. At least part of the plant is above water level (sometimes called emergent plants). Cattails are an example of plants found in this zone.

Oak Savanna
These plants must suck up moisture from the ground through their roots, and then give off water vapor through their leaves (transpiration). They must be able to stand upright without the support of surrounding water. Some of these plants have woody, not soft, trunks and branches.

Riparian Forest
The forest is distinct for its layers of plant habitat. The canopy plants must suck up moisture from the ground through their roots, and they compete with each other for sunlight. The

shrubs and bushes below rely on the forest canopy for shelter and moisture, but if the canopy is too dense, lack of sunlight will kill most of these plants. Mosses and lichen thrive on the moist environment provided by the canopy. Low-lying plants and vines do well in shaded, nutrient-rich soil available in the riparian forest.

Method

1. Tell the students they are going to go on a discovery walk to learn about plant diversity. They will be looking at the conditions in which plants live and how their structural adaptations help them to live there. Help the students brainstorm a list of some of the different conditions in which a plant could live (e.g., moisture levels, wind conditions, temperature, oxygen levels, amount of sunlight, nutrient levels, etc.).
2. Divide the students into teams of 2 –3. Give each team a copy of the Student Page. Have them answer the questions on the first page.
3. Send the students to investigate the plants in the different habitats found at each study site. Remind them to carefully record their observations.
4. After students have visited the sites, bring the group back together. Discuss the environmental conditions found in each area. Help them to draw the connections between the structure of the plants and the conditions in which they grow. How does this tie in with plant diversity? Do not get caught up in identifying plants – focus on plant adaptations.
5. Repeat this activity at each station.

Extension

If your group has been working on plant identification, have students examine features of the plants that they think might aid in identifying the plant. Have the students key out a few of the plants using a guide.

Make exploration more quantitative by having the students walk (and wade) a transect line that goes through the different habitats and count the plants touching the transect line, noting their basic characteristics.

Discussion

Access student responses to Student Page –“Plant Diversity”

Have students use photographs to compare/contrast the structural adaptations of plants that live in other habitats (for example: tundra, rain forest, and desert).

Reference

Rhythms of the Refuge: Educators Guide. (adapted from Salt Marsh Manual: An Educators Guide)

Plant Diversity

Before you go and look at the plants, answer the following questions about where the plants live:

	Open Water	**Water's Edge**	**Oak Savanna**	**Riparian Forest**
Soil: Is the soil in this area usually wet, usually dry, or sometimes wet and sometime dry?				
Sunlight: How much sunlight can a plant get in this area?				
Design a plant: Design and draw a picture of a plant that could survive in these conditions. Label two of the adaptations that would help your plant survive in this area.				

Now start exploring and record your observations:

	Open Water	Water's Edge	Oak Savanna	Riparian Forest
How many different types of plants do you see? Do not try to name the plants just note the difference.				
Draw or describe the most numerous plants in the area. (How tall is it? What shape are its leaves? Does it have woody stems?)				
How tall are the tallest plants in this area? How short is the shortest plant in this area?				
Other Observations?				

Bird Adaptations

Outdoor Grades: 6-8

Objective
Students will be able to:
• identify specific adaptations in observed bird species
• describe and explain several of the adaptations of the birds that live in the wetlands

Materials
• student handout "Bird Adaptations"
• binoculars
• bird field guide
• pencils

Background
Species develop adaptations that help them survive in specific environments. Animals need to adapt to different environments for a variety of reasons. It may be to find a new food source or nesting ground.
We can see a wide variety of birds that are specifically adapted to their environments. Ask students what different traits or variations they see in different bird species. Why do we see such variations? Why is it advantageous for species to be different? Then ask students to list adaptation or differences among different bird species for these variations. You may want to have students focus on beaks, feet, legs, wings and coloration. For example, some birds have long wingspans while others have shorter wingspans. What would a longer wingspan enable a bird to do compared to a species with a shorter wingspan? Make a list and discuss these adaptations with them before you go out to the field, using the chart below as a guide. This can be done in conjunction with an art collage where students cut and paste birds from magazines listing their specific adaptations.

	Adaptations	**Advantages**
BEAKS	Pouch-like	can hold fish
	Long, thin	can probe swallow water for mud insects
	Pointed	can break and probe bark of tree for insect
	Curved	can tear solid tissue like meat
	Short and stout	can crack seeds and nuts
	Slender and long	can probe flowers for nectar
FEET	webbed	aids in walking on mud and moving though water
	long toes	aids in walking on mud
	clawed	can grasp food when hunting

	grasping	aids in sitting on branches and roosting
LEGS	flexor tendons	aids perching and grasping
	Long and powerful	aids in running
	Long and slender	aids in wading
	Powerful muscles	aids in carrying prey
WINGS	large	soaring for long periods
	Short	short bursts of flight
COLORATION	bright	helps males attract females
	Same as environment	helps with camouflage

Method (in field)

1. Have students locate 2 to 3 different bird species. This may require binoculars depending on the time of year. Field guide books may also be necessary.
2. Explain to students that they will be examining the specific characteristics of the birds they choose and making a prediction of how that characteristic might be used in this bird's lifestyle/niche. Observations should be recorded on the Bird Adaptation Worksheet.

Extension

1. Students can do further research to determine whether or not their prediction was correct. This can either be a short one paragraph response or a report that goes into more detail about the species of bird.
2. Once in the classroom ask students to list the different bird species and adaptations they saw. Have them work on classifying them into groups based on shared characteristics. They can further research how closely their classification scheme matched up with ornithologists.
3. Have students design their own species of bird based on specific habitat and food restraints.

Discussion

Have students share their finding with pairs or groups. Then have students share one bird they found interesting with the class. Collect handouts.

Reference

Kavanagh, J. *Pocket Naturalist: Guide to Portland Birds*.
Stokes, D., & Stockes, L. Stokes *Beginner's Guide to Birds: Western Region*.
National Audubon Society. *The Sibley Guide to Bird Life and Behavior.*

Bird Adaptation

Directions: Look for two different species of birds. If you can, identify the bird by its correct name. Make observations about the following bird characteristics. You can either write out your answers or illustrate. Try to identify the purpose of this feature for the bird.

Bird_____

Shape of beak: Purpose:

Shape of feet and legs: Purpose:

Shape of wings: Purpose:

Coloration pattern: Purpose:

Bird_____

Shape of beak: Purpose:

Shape of feet and legs: Purpose:

Shape of wings: Purpose:

Coloration pattern: Purpose:

Field, Forest, and Stream

Outdoors Grades: 4-8

Objective
Students will

1) investigate/measure components in three different ecosystems

2) describe similarities and differences they observe among three ecosystems

3) identify ways that the non-living components of an ecosystem affect the living components.

Materials
Butcher paper
Marking pens
Paper for recording observations
Trowel or stick
Photographic light meter or photosensitive paper
Thermometer
Small strip of paper
Compass

EALRs *Science:*
PC031.1.5,
SI01.1.2.1,
CH03 1.3.9,
IQ01 2.1.2,

Background
An ecosystem is a community of different species interacting with each other and with the chemical and physical factors making up its nonliving environment. It is a system of interrelationships among organisms and between organisms and the physical environment. In a specific environment, plants and animals interact with each other in various ways. For example, plants may depend on insects or birds to pollinate flowers and on earthworms to aerate the soil; animals may depend on plants for food or shelter. However, plants and animals also interact with the nonliving elements of their environment. In a local environment, physical factors such as sunlight, moisture, temperature, and wind influence the suitability of an area for particular organisms. Those factors determine the kinds of plants and animals that live there. Physical factors may be determined by the environment's water, its elevation, or its geological features. In addition, the resident organisms (particularly plants) may affect the sunlight, moisture, temperature, and wind of the area. For example, the tall trees of a redwood forest tend to block sunlight and thus create a dark, moist environment, or micro climate, on the forest

floor that is suitable for shade-loving plants but is too shady for other kinds of plants. Micro climate refers to special conditions of light, moisture, and temperature that occur in a narrowly restricted area within an ecosystem; for example, under a bush or in a small woodland opening.

Preparation

Find three study sites that are somewhat different from each other in terms of sunlight, air temperature, soil moisture, wind, and number and types of plants and animals living there. If possible, select one site that is open, like a field or lawn; one that has trees; and one that contains water. Possible study sites include a school lawn; a park, playground, or other area with many trees; a flower bed or vegetable garden; a vacant lot; a pond, stream, or marsh; an open field; and/or a forest.

Steigerwald Lake National Wildlife Refuge offers excellent sites for this activity. Plan to visit the sites on the same day or on different days at about the same time each day. Obtain any necessary permission to take the students to visit the sites you have chosen.

Arrange to have at least one parent volunteer, aide, or older student help supervise a team of no more than five students during outdoor investigations. This person will help the activity go smoothly, ensure students' safety, and don't damage to the sites. Photocopy the team chart for each team to record their observations. Using butcher paper and marking pens, prepare a large chard for compiling each teams data.

Methods

1. Ask students to think of a place they enjoy visiting. (It might be a park, a grandparent's house, or a library.) Ask them to think about these questions:

   What did you enjoy about the place? The people? The physical space?
   What did you do?
   What living things (people, plants, animals) made your place enjoyable?
   Name any nonliving things (water, mountains, climate) that made your place enjoyable

Help students see that any place has both living and nonliving parts working together to make an ecosystem. Explain that students will investigate ecosystems at three different study sites to find out how living and nonliving elements affect each other.

2. Divide your group into six teams. Explain that each team will investigate and record observations of a different component of three different study sites. (If you have a large group, divide students into twelve teams, with two teams studying each component, then average their data.) Give students instructions, a copy of the team chart, and materials as described below. Later, teams will transfer their observations to the class data chart.

Team 1 — Soil

Ask this team to determine the soil moisture at the study sites. Students can use a trowel or stick to scrape the surface of the ground and to obtain a small sample of soil from underneath the surface. By feeling the soil, they should be able to tell whether it is wet, moist, or dry. (Moist soil will stick together.) They should examine the soil for

other characteristics such as texture, color, and smell. They should also note plant material organisms in the soil.

Team 2 — Sunlight

Ask this team to determine how much sunlight reaches the ground at each study site. Students may determine light intensity at each site by using a photographic light meter or photosensitive paper. If these items are not available, they can use relative terms such as shady, dark, medium light, or bright; or "site 1 is brighter than site 2, and site 2 is brighter than 3."

Team 3 — Wind

Ask this team to use the small strip of paper to determine the wind movement at each site. One student can hold the paper away from the body, while the others observe whether it hangs straight down or blows at an angle. Ask students to use the compass to determine the direction the wind seems to be blowing.

Team 4 — Temperature

Ask this team to measure each site's temperature at ground level, 1 inch (2.5 cm) deep in the soil, and 1 yard (.9 m) above ground. If one site is a pond, stream, or lake, have the team measure the temperature just above the water, 1 inch (2.5 cm) deep, and 1 yard (.9 m) above the water.

Team 5 — Plant Life

Ask this team to observe the various kinds of plants at each site (large trees, small trees, shrubs, small plants, grasses — no need to identify species).
Suggest that students record the most common types of plants found in each location and to note especially where each grows relative to the others.

Team 6 — Animal Life

Ask this team to note the various kinds of animals at each site (insects, birds, reptiles, fish, frogs, tadpoles, etc.) Students should note evidence of animals such as scat, tracks, burrows, or leaves that have been chewed.

3. After teams have had sufficient time to investigate each location, have them all come together to present their findings and to share what they have learned.

4. Each team should listen to the reports of the other teams and use this information to complete its team chart.

5. Ask teams to enter their data on the large class chart you prepared. Use this chart as a basis for discussing difference between the locations and any interactions students observed among the elements. Ask the following questions:

□Which ecosystem had the greatest number of plants? Animals? Which had the least of each? How do you explain this difference?

□ How are plants and animals the same at different sites? How are they different?

□ Which site had the highest air temperature? The lowest? The most wind? The least?

□ Which had the wettest soil? The driest?

□Do plants seem to affect the light intensity, air temperature, and soil temperature in an area?

□ How does water seem to influence the soil temperature, air temperature, and soil moisture?

□ What relationship does light seem to have with air temperature? With soil

moisture? With plants?

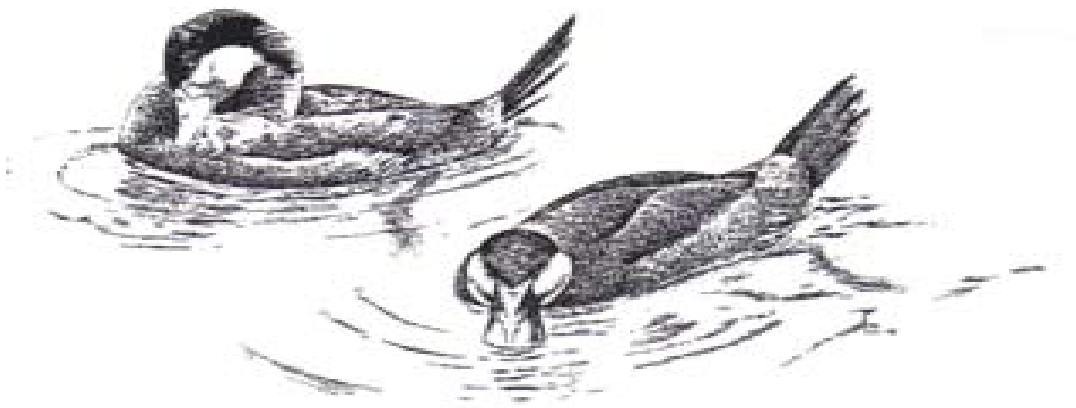
□ Which of the six elements we studied seems most important for determining the character of the environment at each site? What makes you say so?

1 Visit each site again at a different time of year and repeat your investigations. Compare your results: How has the soil changed? The temperature? The wind? The plants and animals? What factors influenced each change?

2 Revisit each location to look for ways humans have affected it. Students might look for things such as litter, damaged plants, new animal arrivals, polluted or cleaner water, or improved path. Discuss these questions:

- Which human actions have harmful effects on these ecosystems? Which are beneficial?
- Are these short-term or long-term effects?
- What might we do to keep further damage from occurring?
- What might we do to encourage more beneficial or protective kinds of actions?

3 It's easier than you think to bring the outdoors inside! Create a class terrarium of a local ecosystem or have teams of students create terrariums of various ecosystems.



Teams	**Habitat 1**	**Habitat 2**	**Habitat 3**
Soil Moisture			
Sunlight			
Wind			
Temperature			
Plants			
Animals			

Run for the Border

Classroom Grades: 5-12

Objective
Students will make observations about the differences in plant communities to determine where wetland boundaries exist, and to discuss conditions for wetland existence.

Materials

"Wettable" footwear

Per Team: *Wetland Observation Worksheet*

Wetland Investigation Guide

Clipboard

Pencil

Towel

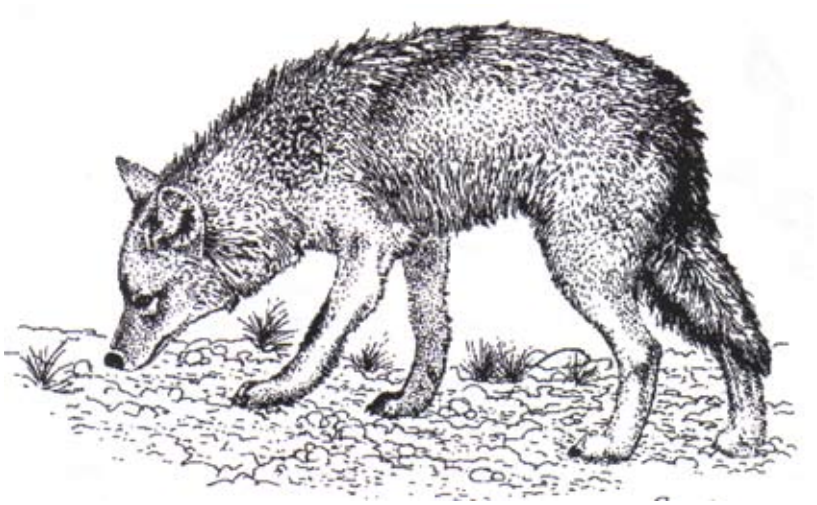
Science: PC03 1.1.5,
CH03 1.3.9,
IQ01 2.1.2, NS03 3.1.3

Background
Where does a wetland begin and end? Sometimes it is hard to tell where the boundaries lay, since wetlands gradually fade into upland at one limit and a waterway at the other. Scientists delineate (draw the boundaries of) wetlands by looking closely at the makeup of the plants, soils, and "wetness" in the area. Generally, where wetland plants (certain species used as wetland indicators), wetland soils, and a certain degree of wetness occur, the area is called a wetland. Where these things do not occur, the area is called an upland.
There is a very fine line between the two - one that is not always definitive. In this activity, students will be looking at the most obvious indicators of the wetland/upland border — changes in plant communities and different degrees of wetness. Students do not have to be skilled in identifying species of plants; they will only need to recognize physical differences among plants. With a little practice you can easily distinguish between plant types. The conditions of an area predetermine which plants will grow there — the type of soil, slope of the land, climate, amount of sunlight that falls on the area, and hydrology (wetness). Many plants may share an area with the same conditions — this is called a plant community. Plant communities are usually obvious: a forest is one type of community, a field is another, and a cluster of cattails and rushes is a community distinct from one containing mainly shrubs.

Procedure
Explain to the class that they will be going to a wetland to investigate how it is organized. Review the wetland observation worksheet and discuss how students will go about making those observations working in teams. Then, practice distinguishing between pairs of photos

or samples of plants (even houseplants). Ask: "Is this plant the same as this one? Why not?" Describe both plants in as much detail as you can. Discuss the things that plants need and “prefer” for growth — use houseplants as an example, since some require direct sunlight, while others grow best in shade and some need more water than others. Ask: "Would a cactus grow in a wetland? Would a water lily grow in the desert? Why not? " Explain that these are the sorts of things that students should keep in mind when making their observations and looking at changes in plant communities. By making these observations, they will essentially be determining where edges or borders of the wetlands lie. Review the wetland investigation guide on.

Note
This activity is merely a lesson in observation and understanding that wetland conditions are not always obvious. Accurate wetland delineation is something best left to wetland science professionals. Students’ inferences on boundaries need not be proven right or wrong.



Coyote

Wetland Observation Worksheet	
Scientific observations are descriptions of what we actually see, hear, feel, taste or smell. We make inferences when we use logic, or even guesses, to interpret or explain our observations. One set of observations may lead you to many inferences or none. This observation guide suggests where to direct your observations in order to make some logical inferences about a wetland.	
1. Are all the plants in the wetland the same kind? If not, how many kinds are there?	5. Is the same amount of water visible everywhere? Is the soil everywhere equally damp?
2. Are the plants distributed evenly, randomly, in clumps, or in some pattern?	6. Are some specific types of plants usually found close to the water or in the dampest soil?
3. Are some kinds of plants always found close together?	7. Are some types of plants never found close to the water or found only in the driest soil?
4. Are some kinds of plants never found close together?	8. Write any other observations on the back of this sheet which your team will need to answer the investigation questions.

Wetland Investigation Guide		
Investigation Questions	**Relevant Observations** Write the observation that led you to your explanation	**Explanation** Possible Answer
1. Where do you think the upland ends and the wetland begins? How can you tell?		
2. Does the wetland have another boundary? If so, what is it?		
3. What seem to be the conditions necessary for a wetland to thrive?		
4. Where might the wetland be changing or being destroyed by nature or man?		
5. What indicates that the wetland might be part of an aquatic food web?		
6. What indicates that the wetland is important to land and water animals?		

For the Instructor — Suggested Answers to Investigation Worksheet

Q: Where do you think the upland habitat ends and the wetland begins?

A: The upper limits of wetlands are usually marked by changes in vegetation and soil. In many marshes, there is a clear transition from trees and shrubs to tall grass like plants, such as cattails, sedges, or rushes. The vegetation changes are less clearly defined on the upper edges of forested wetlands, such as swamps. There, soil color and moisture changes might be the best clue. Unless it has rained very recently or there has been a prolonged dry spell, wetland soil will be noticeably wetter, often squishy or even inundated.

Q: Does the wetland have another boundary? If so, what is it?

A: The lower limit will usually be the adjacent waterway. Some wetlands may be bound on all sides by uplands or seem to stretch on indefinitely.

Q: What seem to be the conditions necessary for a wetland to thrive?

A: By finding the upper and lower limits to wetlands, students can infer conditions wetlands require (i.e. an abundance of water but not deep or swiftly moving water).

Q: Where might the wetland be changing or being destroyed?

A: Over geologic time, wetlands are very dynamic places, undergoing rapid change. Trapped sediments (whether natural or increased by human activities such as development) can fill wetlands. Rising sea level can flood coastal wetlands and erosion can wash them away. Only erosion may be readily apparent. This is best observed along the lower limits of wetlands bordering swift tidal creeks, streams that flood during heavy rains, open bays or rivers.

There may be any of a variety of human caused changes or destruction. Some observable changes include:

- *Damming the waterway downstream might flood wetlands.*
- *Damming the waterway upstream may dry them up.*
- *Drawing water from the waterway for irrigation, or lowering the water table with (too many) nearby wells, could dry up a wetland.*
- *Cutting a ditch across a wetland may drain it.*
- *Pushing dirt onto a wetland, as for preparing a construction site, would fill it in and obviously destroy it*
- *Dramatically disturbing the soil on the nearby upland might cause sediment to wash onto the wetland to fill it in.*
- *Repeated wakes from excess boat traffic could destroy a marsh by erosion.*

Q: What indicates that the wetland might be part of an aquatic food web?

A: Encourage students to observe the abundance of dead plant material (detritus) in the wetland (most obvious in marshes). Detritus is one of the "basics" of a food web. If necessary, point out that most of the detritus along the waterway edge is likely to be washed into the waterway and into other connected bodies of water. From this, students might deduce the importance of wetland plants as a major component of aquatic food web. They may also have made other observations such as animals

feeding in the water or evidence of such activity in the wetland vegetation itself (e.g., plants cut or chewed off near their bases by a muskrat).

Q: What indicates that the wetland is important to land and water animals?

A: Wildlife benefits can be inferred by observing animals present, such as turtles, snakes, insects and birds, and by finding their signs, such as droppings, tracks and nests. Other wildlife values can be identified by noting whole plants, seeds, fruits, and small animals that might be used as food by other animals.

Northern Harrier

Adapted from "Marsh March" Your Backyard Classrooms, pg. 87-92 and WOW!: The Wonders of Wetlands. Environmental Concern Inc.

Four Directional Plots

Outdoors Grades: 3-5

Objective
Students will be able to begin ecological observations in within a habitat area and apply knowledge gained from pervious activities.

EALRs
Mathematics 1.3 Understand and apply concepts and procedures from geometric sense. Construct simple shapes using appropriate tools.
5.2 Relate mathematical concepts and procedures to other disciplines.
5.3 Relate mathematical concepts and procedures to real life situations.
Science 2.1.2 Understand how to plan and conduct simple investigations.
Geography 1.1.1b Use basic mapping elements to construct a map that displays information about school grounds, a neighborhood, or a local community.

Materials
One per group
- Twine
- Tape measure
- Copy of role card and plot map
- Survey stake
- Indelible pen or metal tag to label stakes

Pencil
Plot journal

Before Activity: Consult with refuge staff to determine best location and size of student plots. Determine whether students can assist with stewardship activities such as non-native plant control, mulching, and planting enhancements. Determine whether plots are to be circular (best for plot studies in existing restorations or habitat areas with minimal stewardship activities), rectangular or square (best when doing a new restoration requiring all areas to be planted and maintained). Establish a demonstration plot for use while teaching about the activities. Seek assistance from refuge staff in helping to layout plots with students.

Activity
• Create 'plot stewardship teams' of students that will work together throughout the plot stewardship activities.
• Pass out a 'Role Card' and 'Plot Map' to each team. Have students choose who shall be Marker, Measurer, Surveyor and Mapmaker.
• Demonstrate to students in a 'Demonstration Plot':
  - How to layout and mark their plots
  - How to locate the four directions.

- How to create a plan map of their plot identifying the four directions

• Have students layout and mark their plots, locate the four directions and create a plot map. Provide assistance as you move from plot to plot, reviewing for accuracy, appropriate name, etc.
• Ask students to evaluate the ‘aspect’ of their plots and make predictions about the influence of aspect on plants and wildlife in their plots. Have students enter their predictions in their plot study journals.
• Gather students together to compare differences and commonalties between their plots. Ask them to share their predictions about the influence of aspect on their plots. Discuss how their evaluation of aspect is relevant to their stewardship activities.
• Check to make sure stakes are clearly marked and installed well. Have students return tools to the proper place. Leave center stakes in ground for all future activities.
• Student Journals: write an expository entry: Why they chose the name of their plot, a description of the plot and its physical characteristics, including its aspect.
• As students write in their journals, record location of plots on a project map in the event stakes are removed and lost.

Four Directional Plots

Plot Stewardship Team
Roles and Responsibilities

All Team Members
Shall Work Together to:

• Name their plot
• Assess the aspect
• Make predictions about how the aspect will affect plants and wildlife.

Each Team Member Shall Take Responsibility for One of the Following Tasks

Marker:

Shall place and pound the stake in the center of the plot and write the name of the plot on the label or stake.

Measurer:

Shall locate the boundaries of the plot.

Surveyor:

Shall locate the four directions of the plot and place natural objects to mark the four directions.

Mapmaker:

Shall create a drawing of the site, write the name of the plot, and mark the four directions on the drawing.

Circular Plots

Plot number: Plot team:

Date:

Stewardship activity: Plot name:

Square or Rectangular Plot

Plot number: Plot team:

Date:

Stewardship activity: Plot name:

Native Vs Invasive

Classroom grades: 5-8

Objective
Students will be able to:

1) *Use field guide to identify native or invasive plants*
2) *Decide whether the plant is native or invasive*
3) *Determine how the plant is spread*

Materials
Native or invasive worksheet
Plant field guide or Information sheet provided
Pencil

Background
Invasive species are becoming more common throughout the county. Invasive species can out-compete the native species for resources causing a decline in population. If a native plant no longer has the resource to strive it can mean the loss of habitat and food for other wildlife.

Method
As you walk through the refuge use the invasive and native plant information sheet provided to find several of the plants located on the refuge.
Have the students answer the questions on the worksheet to determine if the plant is native to this area or not.

Extension
Using a field guide students can find other plants on the refuge to name and classify as native or invasive.

Name: _____

Native or Invasive

Examine the plant to decide if it is native to the northwest or if it is invasive?

1. Name of plant:_____

2. Look at the plant and guess (circle) if your plant is: Native or Invasive

Score the following categories.

3. Valuable to wildlife 1 2 3 4 5
not really somewhat valuable

4. How do animals use this plant?
_____

5. Speed that plant spreads 1 2 3 4 5
fast medium slow

6. How does this plant spread**?** *(circle all that apply)*

animals eat seeds	new plants grow from roots
sticky seeds	produces millions of seeds
seeds shoot from plant	able to clone itself
plant flowers after 2 years	seeds can remain dormant

7. Found only in the western US? 1 2 3 4 5
no maybe yes

8. Where does this plant grow?
_____

9. Total points (add each category): ____+___+___ =
If you score 10 or more points your plant is **Native!**

Invasive vs. Native Plant Information Sheet

To be used with Invasive vs. Native Worksheet

Himalayan Blackberry-*Rubus discolor*

Roots: giant root balls, extensive, shallow root system, difficult to remove, plants can sprout from roots
Leaves/Flowers: 3-5 toothed leaflets per leaf, mostly evergreen, dark green on top, light, whitish green underneath; thorny stems; white flowers May-August
Seeds: tasty berries start out red, turn dark purple – black
Growth Pattern: grows into giant, shrubby patches
Wildlife Value: once Blackberry has developed a dense patch it is of very little habitat value to animals; birds and other mammals will eat the berries
Range/Habitat: imported from Asia, found all over US - west coast especially in moist and/or disturbed areas
Interesting Info: Himalayan Blackberry can clone itself

Canada Thistle-*Cirsium arvense*

Roots: deep & wide-spreading horizontal
Leaves/Flowers: alternate, lance-shaped, irregularly lobed, spiny-toothed, hairless or green above, densely white-hairy below; flowers pink-purple (some white), small heads of disk flowers ½ - ¾ inch wide, male & female on different plants
Seeds: 1/8 inch long, somewhat flattened, brownish with a tuft of hairs at the top
Growth Pattern: stems leafy, fairly thin but rigid, 11-60 inches tall, highly branched above, without spiny wings
Wildlife Value: Low
Range/Habitat: native to southeastern Eurasia, introduced to Canada as a contaminant crop seed
Interesting Info: each stalk dies after each growing season; this aggressive weed is difficult to control. Breaking up the roots by plowing only serves to increase the number of plants

Reed Canarygrass - *Phalaris arundinace*

Roots: form a thick mat
Leaves/Flowers/Seeds: eaves ¼ - ½ inch wide and up to 12 inches long, blue-green when fresh, straw-colored when dry; flowers (then seeds) clustered in alternating groups on stalk
Growth Pattern: stems robust, smooth, up to 6 feet tall
Wildlife Value: low food value once it has dried, sometimes used for cover
Range/Habitat: native of Eurasia; most invasive grass species in wetlands in the Pacific Northwest, will not tolerate being wet for entire growing season nor being in full shade
Interesting Info: was planted for erosion control and in pastures

Indian-plum-*Oemleria cerasiformis*

Leaves/Flowers*:* alternate, deciduous, pale-green, broadly lance-shaped up to
4 ¾ inches long, not toothed, strong cucumber smell when crushed; small greenish-white flowers that dangle in clusters, male & female flowers on separate plants
Seeds: large pit in a tiny, peach-colored ripening to bluish-black plum in clusters
Growth Pattern: grows as a shrub or small tree, up to 30 feet tall, bark purplish-brown
Range/Habitat: Pacific Coast from British Columbia to northern California; dry to moist, open woods, stream banks; low elevations fruit is eaten by birds who also use it as nesting habitat; berries are also edible by humans though bitter
Interesting Info*:* one of the first plants to flower in spring, female flowers smell good, male flowers smell like cat urine

Nootka Rose-*Amelanchier alnifolia*

Leaves/Flowers: alternate, deciduous, compound with 5-7 toothed elliptical leaflets most under 2 inches long; flowers pink, 1 ½ - 3 inches across typically solitary at the branch tips
Seeds: fruit purplish-red, referred to as 'hips'
Growth Pattern: pair of prickles at the base of each leaf, spindly shrub that can form thickets, rarely to 10 feet tall
Wildlife Value: berries eaten by wildlife, flowers attract bees and butterflies

Range/Habitat: Alaska to northern California and in the Rockies south to Colorado and Utah; variety of generally open habitats at low or middle elevations
Interesting Info: plant is fire resistant and somewhat deer resistant

Snow Berry-*Symphoricarpos albus*

Leaves/Flowers: opposite, deciduous, elliptic to oval; leaves of a single plant can vary from smooth to coarsely toothed to lobed; flowers can be pink or white in small clusters
Seeds: each white, waxy poisonous berry contains only two seeds
Growth Pattern: shrub that grows from 3-6 feet tall, older plants grow lots of thin opposite-branching twigs.
Wildlife Value: many birds eat the fruits, which are available through winter, herbivores, such as deer, also eat on the twigs and foliage
Range/Habitat: Western states, edges of woodlands where light is more available.
Interesting Info: berries are considered poisonous (a general rule is that white berries are poisonous)

Credits: Informational sources: Lower Columbia River Estuary Partnership (format and some information), USDA NRCS PLANTS
Database, by Pojar and MacKinnon, Clark County (Washington) Weed Management Department booklet (white cover) *Plants of the Pacific Northwest Coast*
Illustrations - Brendan Addis

Wetland Metaphors

Classroom Grades: 6-8

Objective
Students will be able to:
• describe the characteristics of wetlands
• evaluate the importance of wetlands to wildlife and humans

Materials
• large pillowcase, bag, or box
• sponge
• small pillow
• soap
• eggbeater or mixer
• small doll cradle
• sieve or strainer
• paper coffee filter
• antacid tablets
• small box of cereal

Background
Wetlands are many different things to many different people. Some people have never heard or thought about wetlands. Others are working actively to protect wetlands because of their importance.
Wetlands include freshwater and saltwater marshes, wet meadows, swamps, lagoons, bogs and prairie potholes. All wetlands, whether coastal or inland, provide special habitats that serve areas far beyond their boundaries. Wetlands are uniquely important to plants, animals, humans, and the total environment. Because of the abundance of food, vegetative cover (shelter), and water found there, most wetlands are rich with diverse wildlife species.
Coastal and inland marshes, for example, provide breeding, resting and wintering habitats for thousands of migratory birds –including ducks, geese, swans, cranes and shorebirds. Many species of fish that are important for commercial and personal use by humans reproduce and spend part, or all, of their life cycles in fertile wetlands adjacent to larger, more open bodies of water. These fish species include bass, salmon, walleye, perch and pickerel. A wide variety of reptiles, amphibians, insects, and crustaceans also breed and live in wetlands. Frogs and toads, turtles of all kinds, salamanders, snakes, dragonflies, water striders, and crayfish flourish in wetland habitats.
Many mammals – from muskrats and beaver to whitetail deer and moose – also depend on wetland areas.
Wetlands are often referred to as “nurseries” because they provide critical breeding and rearing habitats for countless numbers and kinds of wildlife.
Wetlands also have the unique ability to purify the environment. They act as natural filtering systems and have been shown to be extremely effective. For example, they can trap and neutralize sewage waste, allow silt to settle, and promote the decomposition of many toxic substances.

The importance of vegetation associated with wetlands cannot be overlooked. Plants absorb nutrients and help distribute them through food webs. Plants also keep nutrient concentrations from reaching toxic levels. Plants slow down water flow, causing silt to settle out. Through photosynthesis, plants add oxygen to the system and provide food to other life forms.

Of great importance to humans are the flood control characteristics of wetlands. When runoff from rains and spring thaws is high, wetland areas absorb excess water, thereby helping the runoff gradually drain away down streams and rivers and through the soil. Acting as buffers, healthy wetlands reduce flooding and erosion. In drier periods, wetlands hold precious moisture after open bodies of water have disappeared.

The many activities that take place in wetlands make them among the most productive ecosystems in the world.

As remarkable and resilient as wetlands are, these unique areas have limits. Their destruction and/or abuse can have devastating effects on wildlife, humans, and overall environmental quality.

Wetland habitats are being converted to other uses (agriculture, roadways, housing developments) or otherwise being altered (drained for pest control or polluted) at the rate of about a half million acres per year. And although many wetlands are protected by Federal and State laws, there still appears to be a significant need to create a greater understanding of the importance of wetlands as ecosystems and as wildlife habitat.

Before you Begin

Many of the major attributes of wetlands can be explored through the use of metaphors. To use a metaphor is to apply a word or phrase to an object or concept that it does not literally denote, in order to suggest a comparison between the two. A metaphor represents a concept of idea through another concept or idea. “A tree is a home” and “Books are windows of thought” are two examples. In this activity, a variety of everyday objects are used to represent the natural functions of wetlands. For example:

Object	Metaphoric Function
Sponge	Absorbs excess water caused by runoff; retains moisture for a time even if standing water dries up
Pillow/Bed	A resting place for migratory birds
Mixer/Egg Beater	Mixes nutrients and oxygen into water
Cradle	Provides a nursery that protects and feeds young wildlife
Sieve/Strainer	Strains silt, debris, etc. from the water
Antacid	Neutralizes toxic substances
Cereal	Provides nutrient rich food
Soap	Helps cleanse the environment

The major purpose of this activity is for students to develop an appreciation and understanding of wetlands through the power of metaphor linking the characteristics and natural functions of wetlands to the familiar realm of everyday life.

Method

1. Prepare a “Mystery Metaphor Container” (pillowcase, bag or box). It should be possible for students to put their hands into the container and pull out an object without being able to see inside the container. Educators may want to collect as many as one metaphoric object per student, but at least have enough for one per group of four students. Put the container aside to use later.
2. Discuss the variety of wetlands found in your local area, state, country, etc. Then invite the students to sit quietly and close their eyes. Ask them to picture a wetland. Have them “examine” what it looks like. Have them “look” carefully at the plants and animals, including insects and small creatures. What does the air “feel” like? How does it “smell”?
3. Invite the students to tell what they imagined. Compile a list of their offerings. Encourage discussion and mutual sharing.
4. With their lists as a point of reference, help the students identify which plants and animals are most likely to be found in a wetland. If possible, have them classify the plants and animals according to the kind of wetland in which they would be found. State or Federal wildlife officials and representatives of private conservation or nature-related organizations can be helpful.
5. Next, provide the students with background information to serve as an overview of the basic ecological activities that characterize the wetland habitat. For example, educators might include the following:
    a. Sponge effect - absorbs runoff
    b. Filter effect – takes out silt, toxins, wastes, etc.
    c. Nutrient control – absorbs nutrients from fertilizers and other sources that may cause contamination downstream
    d. Natural nursery – provides protection and nourishment for newborn wildlife

Suggest that these activities, and many more that they could probably think of, are taking place in wetlands all the time.

6. Bring out the “Mystery Metaphor Container”. Tell students that everything in the container has something to do with a wetland. Have students divide into groups of four. Announce that when it is their turn, a representative of each group will draw an object from the container. Then, as a group, they must figure out how the object could represent what a wetland is or does.
7. Have the designated student reach into the container and withdraw one object. When each group has an object, ask them to work as a team to describe the relationships between the metaphoric object and the wetland. Encourage the students to build on each other’s ideas. You can also assist by strengthening their connections. Note: allow the students time to discuss their ideas with each other before doing so in front of the entire class.
8. Ask each group to report their ideas to the class.
9. Following the discussion and review of the functions represented by each metaphor, ask the students to summarize the major roles that wetlands perform in contributing to habitat for wildlife.
    a. List the ways in which wetlands are important to humans.
    b. Why do humans convert wetlands to other uses?

c. Ask the students if their own attitudes about wetlands are different now. If yes, how? If not, why not?

For the final part of this activity, encourage the students' understanding of how the wetlands' condition depends on each of us. Many kinds of wildlife depend upon wetlands. Our own wellbeing requires wetland ecosystems. Strengthen the students' understanding of how humans are connected to wetlands. Recreation, aesthetics, utilitarian uses, environmental quality, and nature study are but a few of the connections we each have with wetlands.

Extension

Visit a wetland to verify the appropriateness of the metaphors explored in the classroom. Identify and discuss any limitations to the appropriateness of these metaphors. Identify what seem to be the most compelling attributes of the metaphors in helping you understand the characteristics and nature of the wetland. Expand your understanding of these metaphors. Identify new and appropriate metaphors.

Discussion

Explain why wetlands are called one of the world's most productive ecosystems. (Wetlands are important to a range of organisms in the animal kingdom, from zooplankton to humans. Select five species of animals and describe how wetlands are important to each.)

Reference

Rhythms of the Refuge: Educators Guide.

Wildlife Inventory

Outdoor Grades: 6-8

Objective
Students will be able to:
• classify animals by observing specific characteristics
• determine the diversity and abundance of wildlife on the Refuge
• make predictions about yearly fluctuations of animal populations

Materials
• binoculars
• clipboards
• pencils
• field guides
• student handouts “Wildlife Inventory,” “Refuge Animals,” and “Classifying Animals”

Background
The wetlands, ponds, savannah grassland and forested areas found on the Refuge provide homes for numerous animals. Some of the animals migrate in the fall or spring while others stay here year round. Wildlife can be seen more frequently in the early morning hours. It is important to be quiet while moving through the Refuge since the animals are easily disturbed by people in their habitat.
Using binoculars to spot a moving object can be difficult for even the most experienced naturalist. If you have binoculars available at your school, it would be helpful to let students practice viewing moving and non-moving objects before you arrive at the Refuge.
Before you arrive, use field guides and/or websites to view pictures of the animals listed below that have been seen on the Refuge. Help students be aware of the similarities and differences in the bird species such as size, coloration, beak and wing shape, movement, etc.

Method
Give students the “Wildlife Inventory Data Sheet,” “Refuge Animals,” and “Classifying Animals” sheets and other materials. Have students spread out and sit alone, quietly in one place for at least 20 minutes to observe wildlife. They should make tally marks in the “Number of Individuals Observed” box on their data sheet to keep track of how many animals they see. Be sure not to count the same animal more than once. If students have problems identifying specific species, have them record “Additional Information” such as habitat, coloration, sound, etc. to help identify them later.

Discussion
Ask students the following questions:
1. Which type of Refuge animals did you see most often?
2. Why do you suppose this type of animal is so abundant on the refuge?
3. Would you expect the number of animal populations to change throughout the year? Why or why not?

4. Do you think that all the animals on the Refuge are native to this area? Why or why not?
5. Do non-native animals have an effect on native populations? Why or why not?

References

Oregon Department of Fish and Wildlife. *The Stream Scene: Watersheds, Wildlife and People.*
Sherwood Middle School Refuge Club. *Tualatin River National Wildlife Refuge Field Guide:* by Kids – for Kids.
National Audubon Society. *The Sibley Guide to Bird Life and Behavior.*

Refuge Animals

Songbirds	Black-capped Chickadee Marsh Wren American Robin Common Yellowthroat	Red-wing Blackbird Downy Woodpecker Barn Swallow Western Bluebird
Upland Birds	Mourning Dove Quail Pheasant Western Meadowlark	
Wading Birds	Great Blue Heron Great Egret	
Waterfowl	Western Canada Goose (large) Crackling Goose (small) Mallard	American Coot Northern Pintail
Shorebirds	Sandpiper Yellowlegs Killdeer	
Raptors	Red-tailed Hawk Peregrine Falcon Osprey Common Barn Owl	Bald Eagle American Kestrel
Reptiles	Northwestern Garter Snake Common Red-spotted Garter Snake Alligator Lizard Painted Turtle	

Amphibians	Rough-skinned Newt Chorus Frog Long-toed Salamander Red-legged Frog- *native species of concern; prey of Bullfrogs, short breeding period, needs both aquatic and forested habitats for survival* Bullfrog- *non-native problem species; eat Red-legged Frogs and tadpoles, adaptable to many habitats*	
Mammals	Beaver Black-tailed Deer Mink Coyote Nutria	River Otter Raccoon Vole Little Brown Bat

Classifying Animals

Songbirds
Body Adaptations: small, often colorful birds; called “perching birds” since the shape of their feet and toes are adapted to holding onto branches.
Habitat: live mainly on land, in trees and vegetated wetlands.
Food: eat a variety including insects, seeds, berries, nectar and fruit.

Upland Birds
Body Adaptations: range in size; rounded, plump body; long toes, and legs for walking and scratching.
Habitat: live in dry, grassy, brushy areas on the ground; adapted to ground nesting.
Food: eat seeds and insects.

Wading Birds
Body Adaptations: range in size; rounded, plump body; long toes, and legs for walking and scratching.
Habitat: live in dry, grassy, brushy areas on the ground; adapted to ground nesting.
Food: eat seeds and insects.

Shorebirds
Body Adaptations: small to large in size, long toes, tapered wings, bill shapes vary—very long, short, curved, straight, flat; long legs with no webbing between toes.
Habitat: usually live near water such as wetlands, beaches or river banks; sometimes grasslands.
Food: eat crustaceans, aquatic invertebrates, worms, insects, seeds.

Waterfowl
Body Adaptations: heavy body, large head, flattened bill, short tail, webbed feet and long wings; males often colorful and females gray and brown (to camouflage with surroundings) depending on age and species.
Habitat: live in aquatic habitats such as seasonal wetlands, ponds, lakes, and rivers.
Food: eat aquatic grasses, pond weeds, wetland seeds, tiny crustaceans and fish eggs.

Raptors
Body Adaptations: medium to very large in size; usually colored to camouflage with surroundings; strong legs with large, powerful, grasping feet with sharp talons for catching prey; large hooked bill to tear prey; binocular vision that is 4 – 8 times better than humans; excellent hearing in order to detect prey.
Habitat: live in open country in a variety of habitats—forests, deserts, wetlands, pastures, fields.
Food: carnivores; birds of prey that eat a wide variety of living or dead animals—fish, birds, reptiles, amphibians, mammals.

Amphibians

Body Adaptations: cold-blooded with thin, smooth, moist skin; usually colored to camouflage with surroundings but poisonous ones are colorful; develop from egg in water, then can move onto land as adults.
Habitat: aquatic or damp areas such as wetlands, ponds, forests.
Food: eat insects, worms.

Reptiles
Body Adaptations: cold-blooded with thick, scaly dry skin; usually colored to camouflage with surroundings.
Habitat: varies depending on species—dry desert areas, aquatic areas, grasslands.
Food: eat insects, worms, fish, eggs, plants (crocodiles and alligators eat turtles, birds and mammals).

Mammals
Body Adaptations: warm-blooded, vertebrates, with hair and mammary glands, variety of shapes and sizes
Habitat: live on all continents of the world; habitats and climate range varies—desert, tundra, mountains, ocean, grassland, tropics, etc.
Food: can eat meat and/or plants depending on the species.

Wildlife Inventory Data Sheet

Location: _____ Observer: _____

Date: _____ Weather: _____

Time: _____ _____

Category	Number of Individuals Observed (Make tally marks)	Species (Optional)	Additional Information
Songbirds			
Upland Birds			
Wading Birds			
Shorebirds			
Waterfowl			
Raptors			
Reptiles			
Amphibians			

Mammals			

Riparian Forest

Classroom grades: k-8
Objective
Students will be able to:
• identify and discuss characteristics of a riparian area
• discuss the importance of riparian areas to both humans and wildlife, and the need to maintain these areas for future use
• make observations of wildlife and record it in their journal

Materials
• journals
• pencils

EALRs
1.3.10, 1.1.5

Background
A riparian zone is an important natural area next to a waterway such as a river, stream, lake or pond. Riparian areas are important for animal and plant life, providing food, shelter and space in which to live and grow. In a riparian area, you will observe many different types of plant and animal life. Students may observe a range of animal life from tiny insects to large deer. There is a variety of plant life from grassy banks of a river to large trees and bushes nearby. Riparian areas are filled with plant and animal life, so students will have to make careful observations in the water, on the banks of the river or creek, in bushes, in tree tops, etc.
Riparian areas are also important recreational areas for people. These areas are often used for fishing, boating, camping and picnicking. Many laws are in place to protect riparian areas to preserve them for wildlife as well as future recreational use. Students need to be reminded to leave any natural area the way that they found it.

Method
1. Walk students around a riparian forest. Discuss with students what a riparian area is and how important this area is to humans and wildlife. Have students stop and make quiet observations of any plant or animal life around them. Remind students to look all around in the water, along the banks of the water, in bushes and trees and even in the tree tops. Have students stop and listen for signs of life around them. Have students smell the air to see if they can find any differences between this and other areas they

have visited. Remind students to stay on pathways to protect the plant and animal life and that they are not to go in the water.

2. Discuss with students their observations. Be sure to include what they saw, heard, or were able to smell. Ask students why this area looks, sounds or smells different from a city street or open field. Tell students that the banks of a riparian area store water and that in a riparian area you will find much more vegetation than in other areas. The heavy vegetation provides food and shelter for many animals, so in this type of area you will also find an abundance of wildlife.
3. Have students draw their observations in their journals. Allow time for sharing of their pictures.
4. Discuss with students what they think people could use this area for. Discuss the many recreational uses like boating, fishing, picnicking and just enjoyment of the beauty.
5. Have students draw in their journals or on the worksheets ways that people can use riparian areas.
6. Have students share their drawings of human use of riparian areas and discuss ways that we can use these areas without destroying the plant and animal life. Let students come up with ideas on how to preserve these areas. Remind students that there are laws that help preserve areas for wildlife and that we must be careful that we leave natural areas the way that we found them.

Discussion

1. What is a riparian area?
2. Why are riparian areas important to people and wildlife?
3. What are some animals you might find in a riparian area?
4. What are some plants and trees you might find in a riparian area?
5. What uses do people have for riparian areas?
6. What can people do to preserve riparian areas?

Extension

1. Have students come up with a plan to develop a park in a riparian area. Have them plan what would be needed to make it a fun area for people while keeping the area nice for the wildlife.
2. Have students do a Venn diagram comparing a riparian area to a city street or their school yard.
3. Have students pick out a favorite animal that may live in a riparian area. Have students write a story about what that animal might do for one day in its life.
4. Place students in groups to discuss different plant and animal life that they observed while visiting the riparian area. Have students each do a part of a watercolor mural that shares the importance of a riparian area for plant and animal life.

References

Project Wild Aquatic Education Activity Guide
Animals and Habitats - On land, ponds, rivers and oceans Draw, Write, Now; Maurie Hablitzel & Kim Stitzel