5th Grade Unit "Ecosystems and Wetlands"

Objective: To introduce students to the concept of ecosytems and wetlands as a type of ecosystem. This unit was developed to be used as an extension of the Ecosystems Science Kit.

Materials and supplies to support this lesson: *

- Salt, plastic cups, paint brushes and food coloring
- Handouts or pdfs of Mighty McKenzie, Water Cycle, Eugene's 3 Water Systems, and the Water Awareness Test

Lesson 1: What is an ecosystem?

By definition, an ecosystem is an ecological community (living) and its environment (non-living) interacting and functioning together as a unit. A good example of an ecosystem is a pond. All of the organisms interact in some way and the health of the ecosystem depends on the parts themselves being healthy. Using a pond as an ecosystem can help demonstrate this concept. For example, the fish in the pond depend on clean water in order to survive. If the water (one part of the ecosystem) becomes polluted, the fish cannot survive. A breakdown in the ecosystem can set off a chain of events. If the fish die, what happens to the great blue heron that depends on the fish to survive?

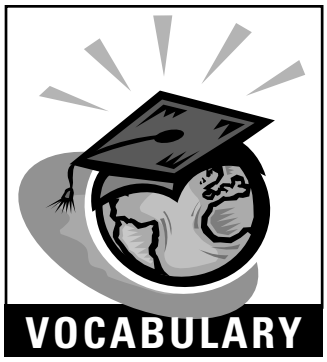
Ecosystems contain three categories of life: producers, consumers and decomposers. They represent the basic food cycle. For example, algae and green plants are producers. Animals that eat algae and green plants are consumers. When a consumer dies, some bacteria, which are decomposers, break it down into organic material that enriches the soil that feeds the producers.

Ecosystems can also be man-made. For example, using a bottle, soil, a plant and water, anyone can make a terrarium. All of the parts of the ecosystem interact. The plant depends on sunlight and water to grow. Composting leaves from the plant form an organic layer that revitalizes the soil and helps it retain water. Water from the soil is recycled by the plant through the process of transpiration. As long as every part in the ecosystem remains healthy and in balance, the entire ecosystem will thrive.

Brainstorm: Are members of an ecosystem independent, dependent or interdependent of each other?

Handout: Hand out pictures of complete ecosystems. Discuss how the parts of the ecosystem interact with each other. Explain how an organism can be either a producer, consumer or decomposer. Show examples of non-ecosystems (e.g. one animal or plant) and discuss why that individual organism does not make up an ecosystem.

* available for teachers from the City of Eugene. See end of unit to order.



ecosystem
food cycle
decomposer
hydrologic regime
riparian
organism
producer
hydric soils
anaerobic
dependent
consumer
hydrophytic plants
endangered

Activity 1: *Design an ecosystem.*

To demonstrate the fragility of ecosystems, students will create and destroy paper ecosystems that include living and non-living elements.

Materials:

- Light-weight poster board
- Pictures of animals and plants from electronic sources or old magazines
- Glue
- Scissors

Divide the class into groups (4-5/group). Using light-weight poster board and old magazines, have students choose pictures and paste them on the board to form an ecosystem. Try to include a picture of water and the sun (non-living components) in each ecosystem. Have the students identify living and non-living parts of their ecosystem and ask students to explain how the parts of their ecosystem interact with each other, identifying producers, consumers and decomposers. To demonstrate how ecosystems can be damaged, have each group remove one or two items from the boards. Pass their board to the next group. and have students try to figure out what might be missing and how it affects the living things in the ecosystem. Discuss the fragility of ecosystems and how it is hard to restore an ecosystem once it is damaged.

Brainstorm: The food chain represents the energy flow in an ecosystem or environment. Using the ecosystems they created in Activity 1, have students trace the energy flow between the non-living parts of their ecosystems and organisms that live there.

Lesson 2: What is a wetland?

A wetland is an area that has standing water, or poorly-draining, water-logged soils for all or part of the year. Wetlands are characterized by certain types of soils and are inhabited by plants and animals that have adapted to life with changing water conditions. Examples of wetlands include marshes, ponds, emergent grasslands, and bogs.

Wetlands are found all over the world. Wetlands are an important and productive ecosystem with a rich variety of plants and animals.

There are three main characteristics that define a wetland. They are:

Hydric Soils: Wetland soils usually contain clay and are saturated with water for enough time during the growing season to create an anaerobic (low oxygen) state in the soil.

Hydrophytic Plants: Hydrophytic plants are plants that have adapted to and thrive in wet conditions and in soil with an anaerobic (low oxygen) content. Many of these plants have special stem and root systems that help them succeed in this environment. For example, reeds have long stems to help transport oxygen from the soil. Some trees form large, buttressed trunks that look like elephant legs to help support them in their wet habitats. There are even ferns that float in ponds (Azolla)!

A Hydrologic Regime: In simpler terms, the hydrologic regime refers to the presence of water above or just below the ground's surface. A wetland may be just damp, or intermittently flooded. It is the presence of water that leads to the development of hydric soils and the presence of hydrophytic plants.

Activity 1: *Play the wetland name search.* Using the list of wetland names below, have students research and identify what part of the United States or the world these types of wetlands are located. Write the names on the board and have

students copy them into their notebooks. Have them describe the characteristeristics of each type of wetland. If they are able, have students determine which language some of the words are derived from.

Names:

slough	playa
carr	peat bog
pocosin	mire
glade	salt marsh
muskeg	moor
fen	estuary

Lesson 3: Where are wetlands located in Eugene?

What types of wetlands are found in and near Eugene?

Hand out a copy of "Eugene's Wetlands Self Guided Tours." Using the booklet, and the following information, locate and discuss the types of wetlands found in Eugene.

In west Eugene, 42 wetland areas have been studied. There are seven types of wetlands:

1. Marsh and shallow ponds
2. Channels
3. Forested
4. Scrub-shrub
5. Prairie grasslands
6. Riparian creeks
7. Agricultural

In some places, one type dominates a large area, but in many places, the wetland types are mixed. A prairie grassland may have patches of shrubs and young trees growing among the grasses. A pond or marsh may have willows or forested wetlands growing along the shore.

Each of the seven wetland types is described below with the number of sites indicated for each type. Some general notes on wildlife and plants typical of each type are also noted.

1. Marsh and shallow ponds *(9 sites)* Common plants in these wetlands include cattails, reed canarygrass, yellow iris, water lily, bulrush, popcorn flower, and penny royal. Some of the shallow ponds are wet in spring and dry out in summer. The marshes and ponds are used by geese, ducks, herons, swallows, rails, shorebirds, nutria, beaver, dragonflies, frogs, turtles, and snakes. Danebo Pond, Stewart Pond, and Bertelsen Slough are examples of this type of wetland.

2. Channels *(2 sites)* There are wetlands in the bottoms of waterways such as the Amazon Creek and the "A-3" Channels in west Eugene. Cattails and reed canarygrass are common plants. The plant and animal life in the channels are very similar to the marsh and pond type wetland, but the channels are more disturbed and contain pollution and litter. Nevertheless, the channels provide important connections between and among west Eugene's wetlands.

3. Forested *(7 sites)* These wetlands have trees that are higher than 20 feet. The two most common trees are black cottonwood and Oregon ash. Birds using these forested wetlands include red-tailed and sharp-shinned hawks, downy woodpecker, American robin, Bewick's wren, and black-capped chickadee. Beavers enter these forests to find their favorite food trees. Forested wetlands can be found along the upper end of Bertelsen Slough and at Willow Creek.

4. Scrub-Shrub *(Mixed with other sites)* These wetlands have trees and shrubs less than 20 feet tall. Common plants include young Oregon ash, black hawthorn, wild apple, willow, wild rose, and Douglas' spiraea. These wetlands border ponds and drainageways; are mixed among forested wetlands; and are scattered among the native prairies. This

type of wetland is often mixed with other wetland types and does not dominate any west Eugene site. Sparrows, wrens, finches, and rufous-sided towhees use these wetlands for food and cover. Scrub-shrub wetlands can be found at Willow Creek and at the old Danebo drag strip site on Danebo Avenue (the Balboa site).

5. Prairie grasslands *(13 sites)* This is one of the most important wetland types in west Eugene. Common plants include tufted hairgrass, (*Deschampsia cespitosa*), reed canarygrass, rushes, sedges, and forbs such as smartweed, sloughgrass, mint, and gumweed. In spring, common camas provides a showy blue flower in these wet, native prairie grasslands. Green-winged teal, mallard, and American wigeon are ducks that feed on plants and seeds in these fields. Mice and shrews live in these grassy areas and provide food for the short-eared owl, northern harrier (marsh hawk), and American kestrel (a small falcon). Common snipe and western meadowlarks frequent the grassy wetlands. Gophers and garter snakes also hunt in these areas looking for rodents. Red fox can be found hunting for mice in the open prairies.

Prairies once covered about 750,000 acres in the southern Willamette Valley with an estimated 300,000 acres of wet, native prairie grasslands. Infrequent natural fires and fires set intentionally by the Kalapuya Indians kept the forests and scrub-shrub woody plants from encroaching on the prairies. The Kalapuyas used fire to make it easier to hunt and to harvest bulbs, seeds and berries. Camas bulbs were used as a major part of their diet. Today, many of the prairie grasslands have been drained and converted to agricultural use. In the past few years, naturalists have been experimenting with fire at Willow Creek and throughout the west Eugene wetlands as a tool to maintain the prairies by controlling the woody plants that encroach on the grasslands.

There is less than one-tenth of one percent of the original prairie grassland wetland type left in the Willamette Valley. Most of them are concentrated in Benton and Lane Counties. In the Eugene vicinity, there are several grassland sites in west Eugene, some near Fern Ridge Reservoir, and a few in Camas Swale south of Eugene along Interstate-5. These prairies can also be found at Willow Creek, along West 11th Avenue between Belt Line Road and Greenhill Road, and along Highway 126 between Fisher Road and Coyote Creek. This wetland type provides habitat for three rare plants: Bradshaw's desert-parsley, a federally listed endangered plant; the Willamette daisy, also a federally listed endangered plant; and Aster curtis, a white-topped aster, a plant considered for listing. Tufted hairgrass (*Deschampsia cespitosa*) is the dominant plant in the wet prairie plant community. Tufted hairgrass forms raised mounds (hummocks) and reaches heights of 3-6' in west Eugene.

6. Riparian creeks *(1 site)* This wetland type is found only along Willow Creek. Riparian means streamside, and this type is found along the creek channel. Most natural creeks in west Eugene have been channelized (for example, Amazon Creek). Black cottonwood, Oregon ash and willows are common trees along Willow Creek with Oregon white oak growing in drier places. There are beaver dams along the creek, and the forests provide cover for black-tailed deer. Important songbirds found in these riparian areas are willow flycatcher and yellow-breasted chat. Western screech-owl, downy woodpecker, northern flicker, purple finch, mourning dove, and black-capped chickadee live in the wet forests, as do pacific tree frogs. Many riparian areas are former creek channels that were cut off when the creeks were channelized. They are still an important habitat for many species.

7. Agricultural *(10 sites)* Most of these disturbed wetland sites are planted in grass seed crops. Many kinds of waterfowl and shorebirds use these wet fields for feeding and resting in winter and early spring. This is a time when tender grass shoots are an important food for waterfowl, especially Canada geese. Although these fields do not support native wetland plants, many have pockets of standing water and wetland soils that are saturated through spring. Most agricultural fields would be much wetter if not for drain tiles and ditches. If farming ceased and drainage was stopped, many of these fields could be restored to true, functioning wetland status. Many of these same fields were native prairie grasslands 100 years ago.

Activity 1: *Take a tour of the west Eugene Wetlands.* Have students keep a journal of what they saw, what they heard, what they touched, and what they smelled. Also have students note in their journals what type of wetlands they observed (forested, scrub-shrub, prairie grassland).

Activity 2: *Write a story or poem.* Following the wetland tour, have students write a story or poem about their experience in the wetlands. They may use the information they wrote in their journals.

Lesson 4: Why are wetlands important?

Many wetlands in the United States and the world have been filled, drained, or polluted. Why should we care about the wetlands that are left? Because wetlands have many important values—second only to tropical rain forests, wetlands are some of the most productive environments on the earth's surface. Among the things wetlands provide are:

1. Home for plants. Many kinds of plants, including many rare plants, live in wetlands. In one study in west Eugene, 144 species of plants were identified, and 52 of them lived in wetlands most of the time. At the Willow Creek Natural Area in southwest Eugene, over 200 kinds of plants have been found, including three kinds of rare plants.

2. Home for animals. Many kinds of animals live in wetlands including birds, mammals, fish, reptiles, amphibians, shellfish, insects, spiders, and other small animals. These animals live on plants, under the ground, and in water. In west Eugene, the rare Fender's Blue butterfly (federally listed as endangered) lives near Willow Creek.

3. Flood control. Because of their capacity to hold water, wetlands act like sponges and store water from winter storms. Wetlands also help control floods. When wetlands are destroyed, floods can be much worse. Some wetlands, like the Amazon Creek, are part of the City of Eugene's Public Works storm drainage system.

4. Clean water. Wetland plants slow down water flowing in streams; slowing the water allows small bits of dirt in muddy water to be trapped by plants and to settle to the stream bottom. This cleans the muddy water. Wetland plants also soak up pollutants along with water and nutrients. Wetland plants can actually use some of the pollutants in dirty water to help them grow without being harmed. However, those same chemicals can hurt fish, so the plants help clean the water for other living things. For example, cattails use a chemical called phosphorus which is common in soaps that we use to wash dishes, clothes, and cars. Too much phosphorus is harmful to many animals that live in streams, ponds, and lakes.

5. Cool water. Wetland plants shade the water and help keep the water cool in the summer. When the water gets too warm, oxygen in the water is reduced, and many animals that live in the water,

like fish, cannot get enough of the oxygen they need to live.

6. Groundwater recharge. This is a fancy term that means that wetlands trap water above the ground's surface (like a sponge) and then slowly let that water seep down into the soil to replenish the water supplies underground.

7. Protect soil. Wetland plants and their roots hold soil in place and keep dirt from being washed away by fast-moving water during floods and storms.

8. Recreation. People enjoy playing in and near wetlands to fish, canoe, boat, swim, bird watch, hunt, study plants and animals, take photographs, paint, bicycle, hike, and jog along trails near wetlands.

9. Open space. Wetlands are sometimes so wet that they are too expensive to build on or develop. So, they remain as natural, green spaces in cities or on farms. These natural areas are especially important because they are some of the last "wild" areas left in cities. They are valuable to people for a pleasant walk, a place to read a book, sit and think, listen to bird and insect sounds, watch the bees and butterflies, or just enjoy the rain or sunshine away from busy city life.

10. Economic development. Wetlands are a tourist attraction. Also, people will often pay more to have a home or business located near a wetland so they can see birds and green, open spaces from their windows, decks, and yards. By protecting water quality, keeping soil from eroding, and controlling floods, wetlands have economic value.

Much of the debate over wetlands in the United States is about how easy it should be to develop (fill or drain) a wetland. How do you define wetlands and how do you tell where they start and stop? For example, how do you tell a wet prairie from an upland prairie? If a wetland is wet only part of the year, how do we tell if it is a wetland? How important is such a wetland compared to a marsh that has water in it all year long? How much protection should be given to wetlands when city development (homes, businesses and roads) or farming development (growing crops or grazing animals) is needed on private land? These are difficult questions to answer when wetland values are compared to other values. During the past few years, there have been many arguments about these questions, and many laws have been discussed to try to settle these disagreements.

Activity 1: *Consider the problem of urban growth and protecting wetlands.*

How can our cities continue to grow without destroying wetlands?

Have the students work in groups to come up with a solution to this situation that would benefit the community while preserving wetlands. Have each student write a report based on their group's solution.

Lesson 5: How does stormwater pollution affect local wetlands?

Many of the small creeks and streams that flow through Eugene eventually reach the west Eugene wetlands. The most obvious example is Amazon Creek. Fed by many smaller creeks originating in south Eugene, Amazon Creek flows through the city, through the west Eugene wetlands and finally into Fern Ridge Reservoir. Amazon Creek also serves as a stormwater drainage channel in Eugene. So, any pollutants that are carried into the stormdrains near the creek will flow with the creek all the way to Fern Ridge Reservoir, down the Long Tom River and into the Willamette River. Polluted stormwater can also be deposited in wetlands areas directly from nearby sources.

Stormwater pollution can affect wetlands in many ways. Oil, gasoline and other deposits from automobiles can kill fish and invertebrates living in ponds and streams. Excess fertilizer from our yards can cause "algae blooms" in creeks and

ponds. This excessive growth of algae uses up valuable oxygen, making less available for fish and aquatic organisms to breathe. Pet wastes pollute water with bacteria that can make water unsafe to drink or swim in. Phosphorus from soaps and detergents can also harm aquatic life. Dirt and debris from construction sites can clog waterways and make the water too muddy for fish to breathe. Birds and animals that feed on fish, aquatic organisms and plants are also harmed by stormwater pollutants. As in any other ecosystem, the destruction of one part can lead to a chain of events that can doom the entire ecosystem.

Is there anything other than rainwater that should go down a storm drain? NO! If you won't eat it or drink it, don't put it down a storm drain!

Activity 2: *Wetland Metaphors.*

Use this fun exercise to test student's comprehension about wetlands and their function.

Define "metaphor" and use the list below as examples of wetland metaphors. After reviewing the list, have students work in groups or pairs to brainstorm more wetland metaphors. It may help to make copies of Lessons 3 and 4 for students to use as a reference. Have each group share their metaphors with the rest of the class and ask the class to provide explanations for each metaphor.

Sample metaphors:

Metaphor
A wetland is a sponge.
Explanation
Wetlands soak up water and prevent flooding.
Metaphor
A wetland is a pillow.
Explanation
It's a resting place for migrating birds and salmon.
Metaphor
A wetland is an egg beater.
Explanation
In some wetlands, salt water and fresh water get "mixed."
Metaphor
A wetland is a cradle.
Explanation
Many plants and animals use wetlands for nurseries.
Metaphor
A wetland is a strainer .
Explanation
Plants filter out sediments and pollution.
Metaphor
A wetland is a can of soup.
Explanation
Wetlands provide food for wildlife and humans.
Metaphor
A wetland is a boat.
Explanation
Wetlands provide recreational opportunities.
Metaphor
A wetland is a book.
Explanation
People can learn a lot from wetlands.

Note: Be clear in your use of metaphors. Be careful not to confuse metaphors with similes. Similes use the word *like*, i.e. "A wetland is like a sponge because it stores water."

SPLASH!
Stormwater Pollution: Learn and Share

SPLASH! classroom materials are online at happyrivers.org

SPLASH! was developed by the City of Eugene Stormwater Management program to support education about water quality in our community. This program is funded by City of Eugene stormwater user fees.

* For more information or supplies for use with these lessons contact jeffrey.j.flowers@ci.eugene.or.us or call 541-682-8482 (Eugene schools only)