UNIT 5C. WETLANDS SITE STUDY

(Adapted from Project Learning Tree: Watch on Wetlands)

TIME	LEVEL
45 minutes	Introductory
60-90 minutes	Introductory
30-45 minutes	Advanced

BENCHMARKS	
Next Generation Science Standards	MS-LS2-1 MS-ESS3-3 LS1.B HS-LS2.-2 HS-ESS3-4
Disciplinary Core Ideas	MS-LS2.A LS2.C HS-LS2.C
Science & Engineering Practices	-Planning and carrying out investigations. -Analyzing and interpreting data -Using mathematics and computational thinking -Constructing explanations & design solutions -Obtaining, evaluating & communicating information

OBJECTIVES:

- Through observation, data collection and study students will understand the properties of a wetland.
- Students will gain an understanding of the relationship between wetlands and salmon.
- Students will gain an understanding of the functions and benefits of wetlands.

INTRODUCTION:

This section provides guidelines for how to develop and implement a wetlands study near a school. The key objective is to develop an understanding of the life links between wetlands and salmon, humans, and wildlife. It is highly recommended that you obtain and use Adopting A Wetland: A Northwest Guide by Steve Yates for this section. It is an outstanding guide and resource.

KEY QUESTIONS:

What is the relationship between wetlands and streams? How do wetlands benefit salmon?
How do wetland benefit humans?
What are the properties that identify a wetland other than wetness?

MATERIALS:

- STUDENT HANDOUT 5C-1: *Wading into Wetlands*, National Wildlife Federation
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- microscopes and slides (if available)
- pH and dissolved oxygen water test kits
- camera and film
- thermometers
- clipboards
- meter sticks
- flagging material
- several jars
- graph paper
- long-handled dip net
- magnetic compasses
- a sieve
- sketch paper (rite-in-the-rain paper is best)
- a magnifying glass
- field guides
- binoculars and/or spotting scope
- water sampling equipment (buckets, nets, etc.)
- clip boards
- aquarium or large jars (if applicable)
- white enamel tray
- drawing materials
- wildlife field guides

PROCEDURE:

GETTING READY

1. Designate a local wetland as a study site that your class could visit several times during the year. Make sure to contact all adjacent landowners to make them aware of your study.

CLASSROOM PREP

2. Using the information in STUDENT HANDOUT 5C-1: Wading into Wetlands, discuss with students the characteristics of a wetland. Describe various types of wetlands. Get students to begin thinking about the relationship between wetlands and creeks, streams and rivers and the benefits that wetlands can provide to salmon as well as humans. Also, with student participation, develop a set of guidelines for "wetland etiquette" in the field so that good observation and data collection will occur and impact on the site will be minimal.

3. Obtain local topographic map(s) with the wetland site. Have students look closely at the differing elevations. Wetlands are essentially topographic low spots!

4. Before visiting the wetland site, have students gather preliminary information about it from owners or managers or from local biologists or naturalists. Assign several students to be contacts for gathering this information. They should share with the rest of the class all information they receive. The class should determine the boundaries of the area they will study. Also, assign another group of students the task of characterizing the land use around the wetland. Is it stable or changing? Are there activities on nearby land that threatens the wetland?

5. Prepare for trips to the wetland site by dividing the class into several study teams. Be sure that each team is clear about their mission. Each time you go into the field, rotate the teams' duties.

IN THE FIELD

Photo Survey Team

Materials Needed:

- at least one camera and film (preferably color)
- clipboards
- flagging material

Pre-Trip Conference:
Discuss what features of the wetland they should capture on film (for example, photos of wetland vegetation).

Mission:
When visiting the wetland, they should walk slowly around the perimeter of the designated area. Several students should tie pieces of flagging to items they want to identify in the photos (such as a particular plant, boulder, or log). One or more students will take pictures of the flagged item plus general pictures of the area. One student will keep notes about every picture taken. Remind students to remove the flagging before they leave the area.

Map Survey Team

Materials Needed:

- graph paper
- clipboards
- magnetic compasses
- flagging material

Pre-Trip Conference:
Decide how to design their map of the area and what features they should highlight on the map.

Mission:
When they arrive at the site, pairs of students will use clipboards and graph paper to make rough maps of the area from different vantage points. Students should estimate the distances as best they can or use a long tape measure. They should use a compass to indicate directions on the map. Afterward, with colored markers and symbols, the team should use the pairs' rough maps to create a large, detailed map of the wetland on a piece of poster paper.

Plant Survey Team

Materials Needed:

- clipboards
- basic field guides for trees, plants, and grasses
- sketch paper (rite-in-the-rain paper is best)

Pre-Trip Conference:

Decide how they will categorize and record the plants they observe (tall trees, small trees, shrubs, tall grasses, short grass, flowers, water plants). For their plant survey, they will set up a chart that has columns for describing each plant, its immediate environment, and its location. Rather than spend a lot of time thumbing through field guides, have students sketch the plants and use time in class to identify.

Wildlife Survey Team

Materials Needed:

- several jars
- long-handled dip net
- a sieve
- a magnifying glass
- binoculars and/or spotting scope
- clip boards
- white enamel tray
- wildlife field guides

Pre-Trip Conference:

Decide how they will locate and record wildlife. Remind them to look for insects and other invertebrates in addition to birds, mammals, amphibians and reptiles. For recording wildlife, they should make up a chart that has columns for descriptions, immediate environment, and location.

Mission:

At the site, have students use binoculars, spotting scopes and magnifying glasses to look for wildlife. They can isolate aquatic creatures by dragging a dip net through the water or by gently straining wet mud. They can observe organisms in a white enamel tray or white plate partially filled with water. Students should describe or sketch these creatures as best they can and should use field guides to identify them.

Water Quality Team

Materials Needed:

- pH testing kit or litmus paper
- dissolved oxygen test kit
- thermometer
- meter stick
- clipboards

Pre-Trip Conference:
Practice using the testing equipment. Assign pairs to perform tests at different locations (in the water, at the water's edge, at five meters from water).

Mission:
When at the site, the pairs should gather information about water quality at various locations. Tests should include measuring the depth of standing water in various spots, along with describing the water's color, smell, and movement, or the soil's moisture.

Back in class, they should transfer their data to a chart that has columns for various water quality factors and for the location where factors were tested. Remember that sight and smell are not reliable indicators of water quality; low pH and low dissolved oxygen are more significant but also need to be analyzed by an expert.

POST SITE VISIT

- After teams make one or more data-collecting trips to their wetland site, have them prepare data charts, reports, or maps. Each team should take 20 minutes to brief the group on their team's findings, lead a class discussion on the general features of the wetland, and give an impression of the area's ecological health.

- Ask students to use the data presented so they can discuss whether some environmental warning signs in this wetland need further attention (such as low oxygen content in the water, oil in the water, trash in the area, lack of wildlife, etc). They should document why there might be problems and then should contact the owners or managers of the area to discuss ideas on how they might help improve the situation. Often, students can get permission to clean up a site or can take on more complicated projects under the supervision of those who manage the area.

EXTENSION ACTIVITIES

1. Ask your students to study a stream near their school or home. They draw or map a 500-foot length of a stream, then draw in and identify features or conditions that will benefit fish. Once a week for four weeks, they record observations on changes in the stream. These changes can be in the plants, animals, water level, water quality, or streambed. At the end of the four weeks, students draw their map again, and present both maps to the class, explaining changes they have observed.

2. If you plan to have your students sample for macroinvertebrates during the field trip, then do Aquatic Organisms, Stream Scene, pp. 143-168. This unit explores the place of macroinvertebrates in the watershed, and their use in determining water quality. This is a good unit, and presents the student with a water quality determination methodology that is used across the United States. It is relatively simple to do, and gives the student a good hands-on experience in the watershed.

3. Have your students complete Puddle Wonders! Project Wild Aquatic, pp. 114-117. Students predict where puddles will form and observe organisms that live in or near puddles. They then measure and records amounts of water in puddles and make inferences about the kinds of organisms which might occupy puddle habitats.

4. California's Salmon and Steelhead, Our Valuable Natural Heritage, p. 23 and pp. 78-81, contain readings, which can be used to teach some adaptations to anadromy and long migratory routes. Pages. 87-93 contains readings that can be adapted to teach the habitat requirements of salmonids.

5. Look up the World Wide Web address, http://www.streamnet.org/, for a very useful source of information about salmon. This is the StreamNet home page that contains an online database of information about salmon, the life history and ecology of species, color species of a male and female of each species listed, and extensive data on salmonids and their habitats. It might be used to organize Units 1-3 for your students.

6. If you cannot take your students away from the school, find a standing puddle on the school grounds, or bring the aquatic environment into the classroom by filling an aquarium with water and sediments from a local pond. (Wetland ponds usually provide a good assortment of living organisms, and they are not as fragile as streams, especially spawning grounds. You can fill one or two 5-gallon plastic buckets, and provide enough material for all of the work in this section.) Before going to a wetland, discuss "wetland etiquette" with your students. With student participation, make a very short list of guidelines, which will ensure a good set of observations, yet leave the environment unharmed, and ensure students' safety.

   Have student groups maintain pond water in 2-quart peanut butter jars. (Should you choose to maintain an aquarium in your classroom, it is best to leave it unattended. It may not look pretty from time to time, but it will provide your students with a rich source of aquatic organisms, as well as water to test.) These jars can be set in windows, and used when needed.

EXTENSION ACTIVITIES

(An interesting alternative to bringing pond water into the classroom is to collect a small part of a dried pond or pool and add it to tap water which has been left standing overnight. Eggs and spores contained in the collected material will provide a representative set of aquatic organisms within a few days. Two materials to collect are the sediments on the bottom and the pond "scum" that drapes in sheets over the grass and stubble at the edge of water bodies as they dry up. A small piece of plastic pipe can be used to take up sediment on the bottom, and this sample transferred to water; pond "scum" can be dispersed by simply punching out a "dot" with a paper punch into a test tube or baby food jar of water!

UNIT 5C: WETLANDS SITE STUDY-STUDENT HANDOUT 5C-1

Wading into Wetlands

Published by the National Wildlife Federation

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The water's up to your ankles and a pungent smell reaches your nose. You move along slowly, watching a great blue heron search for its lunch. When you round a bend, you're startled by a flock of ducks as they take off from the water. A dragonfly zips past your head as you watch the ducks fly off over trees.

You could be in a swamp. Or a salt marsh. Or one of many different types of wetlands. In this teacher's guide you'll learn what we mean by the word "wetland"—and why wetlands are so special.

There are many kinds of bogs, marshes, swamps and other wetlands. But all wetlands share some characteristics that set them apart from other kinds of habitats.

Most ecologists define wetlands as areas that, at least periodically, have waterlogged soils or are covered by shallow surface water, which supports plants and animals that are adapted to living in a watery environment.

Various factors can create wetlands. Since most wetlands are located in low-lying areas, rain and runoff help to keep them saturated. Some wetlands lie where groundwater is at or very near the surface of the Earth and feeds the wetlands from below. Other wetlands stand next to rivers or other bodies of water that regularly overflow. In coastal areas, tides keep many wetlands saturated.

Some wetlands start with a little outside help. Beavers, for example, turn meadows into marshes or parts of forests into swamps by damming streams. People create wetlands, too. For example, a state wildlife agency might flood an area to create fish and wildlife habitat.

SALTWATER WETLANDS

Because they exist along coastlines, the major kinds of saltwater wetlands—salt marshes and mangrove swamps—support rich networks of life adapted to dynamic environments. Twice each day along most of the world's coasts, the tide rises and falls, exposing coastal wetlands to a rapidly changing environment. The plants and animals that live in these wetlands must be able to adapt to shifting water levels, fluctuating temperatures, periodic exposure to air and increases and decreases in the salt content, or salinity, of the water.

Salt Marshes

Found primarily along the Atlantic and Gulf coasts, but also in scattered locations along the U.S. West Coast, salt marshes are open areas filled with a sea of grasses or grass-like plants. Often they're found in the inner reaches of coves, inlets and bays since this protects them from the full force of the pounding surf. Sediment brought in on the tides and nutrient-rich silt carried by rivers can settle in these calmer areas, giving marsh plants an ideal place to

sprout, grow and spread.

Because of all the food salt marshes have to offer, they support a considerable amount of wildlife. But many salt marsh organisms are small or even microscopic. Few larger animals make the salt marsh their permanent home, and many migrating birds make only brief stopovers.

Mangrove Swamps

Mangrove swamps are the tropical counterparts to the salt marshes of cooler climates. They reach their most lush growth in the United States along the coasts of southern Florida. With their jungle of roots and dense leaves and branches, mangrove trees are the dominant plants in these swamps. They are great storm breakers, in addition to being popular places for wildlife.

Certain animals, like some oysters, cling to mangrove roots. Others, such as shrimp, fish and crabs, hide and feed among the roots submerged by high tide. And in the mangrove branches, storks, herons, egrets and a dozen other birds nest or roost. The swamps are also the last stopover for birds migrating across the Gulf of Mexico in the fall and the first stop for those returning in the spring.

FRESHWATER WETLANDS

Many ducks and geese, with numbers in the tens of millions, along with numerous shorebirds and other types of wildlife, start their lives in a marshy wetland area, better known as prairie pothole country. It covers more than 300,000 square miles throughout parts of the Dakotas, Minnesota, Montana, Iowa and Canada. Prairie potholes, which are numerous small ponds created by glaciers long ago, and other types of freshwater marshes along with swamps and bogs make up freshwater wetlands.

Marshes

From small cattail marshes along major highways in California to huge expanses of sawgrass in Florida to prairie potholes, freshwater marshes are a common sight throughout much of North America. Thick clumps of soft-stemmed plants such as grasses, sedges and rushes are abundant, along with cattails and water lilies. According to some biologists, freshwater marshes make up about 90 percent of our wetlands.

The water in a marsh fluctuates from season to season, rising during heavy rainfalls and often disappearing during dry periods. Seasonal or ephemeral wetlands are overlooked by people as vital areas because they may only be saturated with water for short periods during the year. The importance of these areas for migratory birds and flood control is often discounted simply because they don't look like typical wetlands.

Bogs

Bogs are freshwater wetlands that usually contain a huge build-up of peat—rich organic material that is made up of partially decayed plant material. Peat forms as plants die and their parts fall into the water.

Bogs are usually found in wet areas of the colder regions of the world where there is very little water flowing in or out. The high acidity of the peat, the cold year-round temperatures and the limited oxygen supply due to poor water circulation discourage bacteria and other decomposers from breaking down plant material, so peat layers grow year after year, becoming up to 40 feet thick.

Some bog plants, such as black spruce, have root systems adapted to low-oxygen supplies and waterlogged conditions. Others, such as some orchids and heath plants, have symbiotic relationships with fungi that help them get nutrients they need, which are in short supply in most bogs. Many bog plants, such as bladderworts, pitcher plants and sundews, trap and digest insects and other tiny animals as a source of nutrients.

Swamps

Swamps are wetlands dominated by shrubs or trees. They are usually saturated with water during the growing season but may dry out later in the summer. Swamps can have anywhere from a few inches to a few feet of water.

Two groups of freshwater swamps predominate. Forested swamps are often associated with major river systems, such as the Mississippi, and they often occur on river floodplains. These swamps are famous for their huge trees and contain stands of enormous bald cypress, overcup oak and water tupelo. On the other hand, shrub swamps are characterized by scrubby, low-growing vegetation. These swamps often form in poorly drained areas on the edges of lakes, forested swamps, marshes and streams.

WETLANDS AND WILDLIFE

Wildlife benefits from wetlands in many ways. Some examples follow:

Migration

While traveling between winter and summer homes, geese, herons, egrets, sandpipers, plovers and other birds converge on wetlands to "refuel" on rich food supplies before resuming their journeys. Many birds nest and winter in wetlands, too.

Natural Nurseries

The young of certain fish, crustaceans and other creatures spend their earliest days in wetlands, taking advantage of the rich food supply before moving to open waters. Thick wetland vegetation also provides a good place to hide.

Habitat and Breeding Grounds

Wetlands provide hundreds of kinds of plants and animals vital habitat in which to live. In particular, the health of our nation's waterfowl population is directly tied to these areas. Seventy-five percent of all waterfowl breed only in wetlands.

Havens for Rare Species

Wood storks, snail kites, whooping cranes and American crocodiles are all endangered species—and they all live in wetlands. In fact, about 43 percent of U.S. threatened and endangered species either live in wetlands or depend on them in some way for their survival. This means that almost half of the nation's rare animals and plants are inseparably linked to areas that, altogether, make up only about five percent of the total land area in the lower 48 states.

WETLANDS AND PEOPLE

Wetlands provide people with countless benefits. Here are a few:

Flood Busters

Sponging up excess water, wetlands offer an easy and cheap way to control floods. Because they lie in low spots or depressions, wetlands function like giant, shallow bowls. Water flowing into the bowls spreads out and slows down, which helps to reduce flood damage to the natural and human environment.

Natural Pollution Filters

As Mother Nature's maid, wetlands and the aquatic plants that grow there provide free cleaning services by removing excess nutrients, heavy metals and other toxic chemicals from polluted runoff water. Contaminants adhere to vegetation and sediment that settle on the wetland floor. In this way, wetlands help protect the nation's drinking water.

Silt Trappers

When wetlands slow flood waters, the silt and other sediments in the water settle out among the roots and stems of wetland plants. This helps to protect streams, lakes and other bodies of water downstream from a build-up of sediment that could stifle aquatic plants and animals.

Storm Breakers

Coastal wetlands buffer the effects of the ocean's strong winds and waves on shoreline communities of people and wildlife.

Groundwater Rechargers

The nation's groundwater can be replenished and recharged by wetlands. Surface waters that feed into groundwater systems recharge or refill these systems. Water migrates downward through wetlands to maintain groundwater levels.

Stock for Fisheries

Wetlands support the commercial fishing industry because they provide fish and shellfish with food and a place for breeding and raising young.

Recreation Hot Spots

Hunters and anglers of wetland-dependent species rely on intact wetland ecosystems to support and nurture their recreation. Many more Americans seek wetlands as retreats to birdwatch, photograph and otherwise appreciate wetland species and habitat.

WATCHING OUT FOR WETLANDS

Wetlands are highly sensitive to disruption caused by human activities. Since the first European settlers colonized North America, we have lost well over 50 percent of our wetlands. And the latest reports put the losses at up to 290,000 acres of wetlands every year.

As wetland areas have become more populated, development has crept farther and farther into these critical areas. More channels, dikes and diversions have been installed. Much of the rich peatland that had taken hundreds of years to form has been drained and turned into farmland. Other former wetland areas have become pastures for livestock. Fertilizers from farms and lawns seep into our water, reducing its quality.

Wetland areas are in trouble all over the country. Here are some examples:

Everglades

One of the largest marshes in the world, the Everglades once covered most of South Florida. Disrupting the balance of alternating wet and dry seasons, urban and agricultural development since 1900 have put the entire Everglades ecosystem in jeopardy, including the 1.2 million acres that lie in Everglades National Park.

Prairie Potholes

Only 5.3 million acres remain of the 17 million acres of prairie wetlands that once dotted North Dakota, South Dakota and Minnesota. About 33,000 acres of prairie potholes continue to disappear each year.

Great Lakes

Marshes along the Great Lakes have decreased 90 percent. These marshes not only provide habitat for fish and wildlife, but also help to prevent shoreline erosion and minimize the destructive effects of storms.

California

Less than 450,000 acres of California's original 5 million acres of wetlands remain.

Lower Mississippi Valley

Only about 15 percent of the bottomland hardwood wetlands that once covered the lower Mississippi Valley still exist.

TAKING CARE OF WETLANDS

From local zoning laws to state wetland acquisition to provisions in the national Clean Water Act, wetlands have some protection at all levels of government. But because of lack of support and money, much of the legislation for wetlands protection is poorly enforced, and some of it has been offset by conflicting legislation that encourages wetland destruction.

Two of the most effective wetland-protection programs are the Federal Migratory Bird Stamp Program (known as the Duck Stamp program) and Section 404 of the Clean Water Act. The Duck Stamp program, administered by the U.S. Fish and Wildlife Service, requires waterfowl hunters over 16 years of age to purchase a duck stamp annually. The funds raised help buy valuable wetland habitat. Section 404 of the Clean Water Act helps prevent wetland destruction while still allowing certain development under a permit program.

Although these and other programs have given wetlands a helping hand, many conservation groups feel that much more wetland protection is needed. The National Wildlife Federation and other groups are working to establish a national wetland policy that would: prevent any additional loss of wetlands; restore wetlands that have been dredged, drained and overdeveloped; construct artificial wetlands as needed; support wetland research; and strengthen existing wetlands legislation.