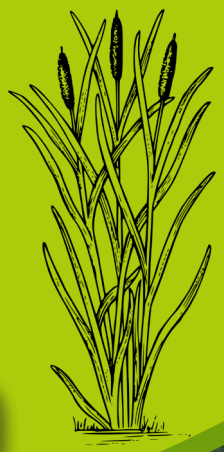
6th Grade Wetlands Curriculum



Institute for Applied Ecology

Produced by
the Institute for Applied Ecology
for the
Confederated Tribes of Siletz Indians

Confederated Tribes of Siletz Indians

6th Grade
Wetlands Ecology Curriculum

Curriculum Credits

Lesson Plans written by:
Tyler Knapp

Graphic Design:
Tyler Knapp

Content Editors:
Stacy Moore
Dionne Mejia
Carolyn Menke

Illustrations:
Amanda Devine
Jody Einerson
Pearson Scott Foresman
Barbara Gleason
Tyler Knapp
Ella Samuel
Henry Warre
Mabel Osgood Wright

Photographs:
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Confederated Tribes of Siletz Indians
201 S.E. Swan Avenue PO Box 549 Siletz, OR 97380
(541) 444-2532 http://ctsi.nsn.us/

Produced by:
Institute for Applied Ecology
563 SW Jefferson Ave. Corvallis, OR 97333
(541) 753-3099 www.appliedeco.org

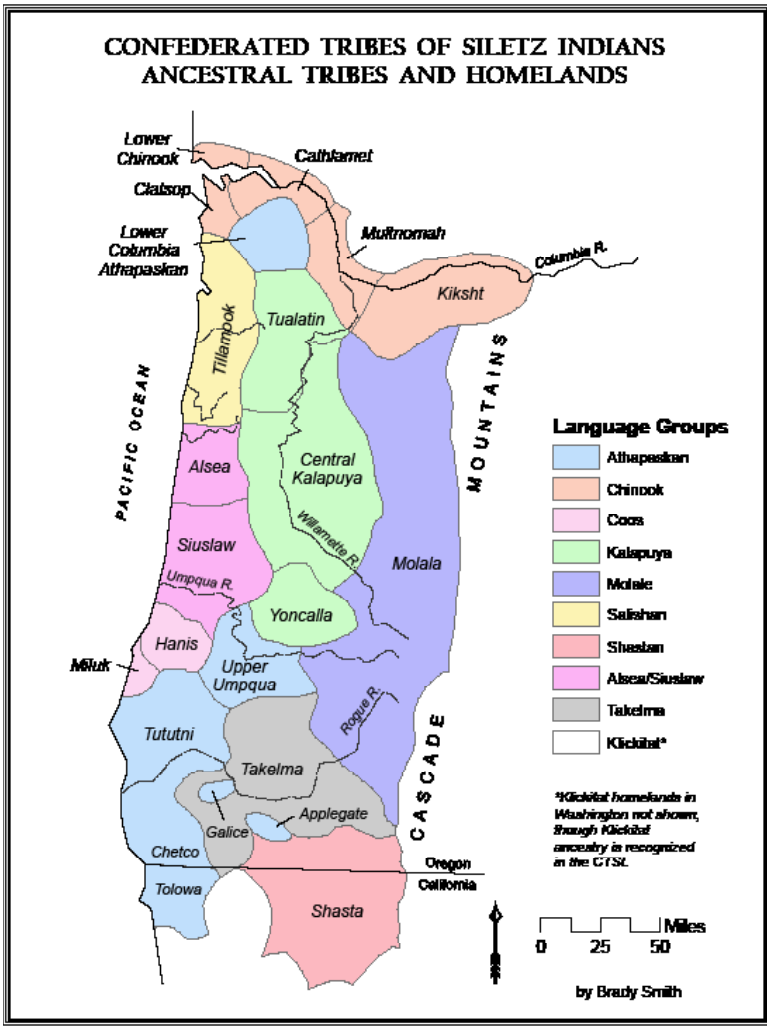
Introduction

The Confederated Tribes of Siletz Indians

The Confederated Tribes of Siletz Indians (CTSI) Is a confederation of many bands and Tribes, each with their own language and customs, whose ancestral homelands include all of Western Oregon from what is now Northern California north to the Columbia River and from the summit of the Cascades to the Pacific.

The 1.1 million-acre Siletz Reservation was set aside by President Pierce on Nov. 9, 1855, to reserve a permanent home for Tribes that had ceded approximately 19 million acres of their lands to the U.S. government under treaty agreements. After the people were relocated to the Siletz Reservation, the seven ratified treaties of the Willamette, Umpqua and Rogue Valley Tribes were ignored. The 1855 Coast Treaty was not ratified, but the Tribes held to its terms without the United States fulfilling its promises.

By 1875, more than 900,000 acres of the Siletz Reservation had been taken and opened to settlement without treaty agreement, recognition of rights or compensation. Starvation, violence, abuse, exposure, depression, epidemics, boarding schools and unscrupulous Indian agents took their toll. The effects of the 1887 Allotment Act continued to reduce the Siletz Tribe's sovereign jurisdiction, lands and resources.



Finally in 1954, Congress passed the Western Oregon Termination Act, severed Tribal relations and took the last scattered parcels from Tribal members. Still, the Siletz people and culture endured.

On Nov. 18, 1977, after years of effort, the Confederated Tribes of Siletz Indians became the second "terminated" Tribe in the nation and the first in Oregon to be "restored" to federally recognized Tribal status by Act of Congress. In 1980, a modest land base consisting primarily of timberlands was re-established by passage of the Siletz Reservation Act. With the Tribe's restoration began decades of growth. The Siletz Tribe now has a strong Tribal government to manage its resources, oversee and implement the many programs and services offered to Tribal members as well as an expanding variety of job opportunities. Committed to serving their people, the ninemember Siletz Tribal Council is the elected governing body of the Siletz Tribe.

Since Restoration, the Tribe has progressed from Bureau of Indian Affairs management to PL 93-638 contracting and finally to status as a self governance Tribe, allowing the Tribe to design and manage its own programs specifically addressing the needs of the Tribal membership. As a result, services to Tribal members are more efficiently managed and new programs have been developed.

The Siletz Tribe's land holdings total more than 15,000 acres, the majority of which lie in Lincoln and Douglas counties, with smaller parcels in Marion, Lane and Multnomah counties. Tribal headquarters and administrative offices are located in Siletz. Satellite offices in Eugene, Salem and Portland provide a variety of services to Siletz Tribal members within an 11-county service area that includes Lincoln, Tillamook, Linn, Benton, Lane, Yamhill, Polk, Marion, Multnomah, Clackamas, and Washington counties in northwestern Oregon.
For more information about CTSI visit www.ctsi.nsn.us and read T*he People are Dancing Again: The History of the Siletz Tribes of Western Oregon* by Charles Wilkinson (2010, University of Washington Press).

Siletz Dee-Ni Language

Each lesson includes Siletz Dee-Ni vocabulary words. Dee-Ni is part of the Athabaskan language group, and is one of many dialects. These dialects vary from region to region and even from village to village. In pre-contact times the area a person hailed from would be recognized by the dialect they spoke in. After being brought to the Siletz Reservation there were five major languages spoken there. The major language stocks were Athabaskan, Hokan, Penutian, Sahaptin, and Salish. Chinook Jargon became the language that different speakers used to communicate with as well as English. With the passage of time each successive generation found itself with an ever smaller pool of speakers. When the Siletz Tribes were Terminated by the Federal Government in the 1950's, the Tribal Government was disbanded and their lands sold, their people were dispersed far and wide. Their languages went unspoken except among Elders. It would take another 20 years and the Restoration of Tribal Status to rekindle any hope of Language Restoration. Following a tribal wide assessment beginning in 1996, it was discovered that they had lost more than 90 percent of the ability to speak the native language Athabaskan. The Tribe has made a concentrated effort to address this loss. In 2003 the Tribe made a commitment to the preservation of traditional arts and language by establishing a permanent position in the Culture Department, Traditional Arts and Language Specialist. Many linguistic archival materials have been used to guide the language teachings at the community language classes, Nuu Wee-ya (Our Words).

The website for the Siletz Tribal Language Project http://www.siletzlanguage.org/ includes many resources for learning Dee-Ni, including a talking dictionary, videos, and language lesson plans for all grade levels.

The Institute for Applied Ecology

Founded in 1999, the Institute for Applied Ecology (IAE) is a non-profit organization established to provide a service to public and private agencies and individuals by developing and communicating information on ecosystems and effective management strategies. IAE offers habitat restoration services complete with habitat management plans, site preparation, maintenance and monitoring. Our Native Seed Network connects buyers and sellers of native seed while our Conservation and Research division conducts native ecosystem research and monitoring and provides surveys for rare plants. The Ecological Education Program provides opportunities for K-12 students, teachers and the adult community in place-based education and service learning projects.

Organization of Curriculum:

The curriculum is designed to be a complete unit of study. We understand that many teachers are unable to commit to the entire unit of study, so lessons can also be used individually. All lessons start with an overview of the lesson, time estimate, teacher preperation tips, learning objectives, materials needed, and the 6th grade Next Generation Science Standards that are met. The vocabulary speech bubble includes English as well as Siletz Dee-Ni words. The "background information" section gives teachers the necessary knowledge to teach the lesson, while the "teacher directions" give step by step instructions for leading each activity. The last page of every lesson includes an "in the field!" section that suggests ways to integrate student studies into field trips or service-learning projects. The "science inquiry" section offers opporunities for further scientific inquiry as homework assignments or extensions of the lessons' activities. The "reflection" bubble offers questions to ask students at the end of each lesson, which can be useful for class discussions or journal writing. The "assessment" circle gives three challenge questions to assess how well the learning objectives were met. Finally the "resources" section lists texts or websites that were either referenced in the lesson, or that are useful for further research into each topic.

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Cobra Lily
(Darlingtonia californica)

Wetlands
Lesson 1

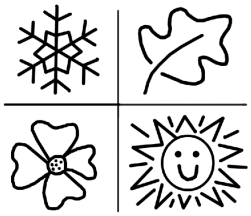
What is a Wetland?

"We are all water babies. It's never too late to save the world. Wherever you are, take care of the water—if you really want to live."

—Agnes Baker Pilgrim, Siletz Tribal Elder

Time Estimate:

60-90 minutes



Best Season:

Any- Indoor classroom

Overview

Students learn what wetlands are, including their characteristics and the different types of wetlands: swamps, marshes, bogs, and fens. Students also learn some of the Dee-Ni vocabulary that pertains to wetlands.

Preparation

- Make color copies of the provided labeled wetlands photos to pass around, or use a document camera to project them.
- Gather all of the Wetland model materials in advance.

Learning Objectives

- Describe the three main attributes of wetlands.
- List or describe the similarities and differences between different types of wetlands: swamp, marsh, bog and fen including their plant and animal composition.
- Write or say some of the Dee-Ni words that pertain to wetlands.

Materials

- Whiteboard, flip chart paper or butcher paper and markers.
- Provided labeled wetland photos: wetland, swamp, marsh, bog, and fen.
- Wetland model materials. Mix and match according to what is available:
  - * A long (roughly 13" x 9") sturdy metal or glass baking pan with a smooth, flat bottom, or a rolling paint pan from a hardware store.
  - * Clay- modeling or pottery
  - * Potential items from nature: sticks (to represent woody plants), moss, peat (from a garden store), narrow soft leaves (to represent non-woody plants), evergreen twigs (to represent evergreen trees and shrubs), ferns, grass, etc.
  - * Sponges or foam to represent spongy peat soils
  - * Scraps of astroturf or indoor-outdoor carpeting to represent grass
  - * Water in cups or bottles to represent ponds and flowing water
- Optional: "What Makes a Wetland a Wetland?" Video: https://www.youtube.com/watch?v=bRCPQebNIgA

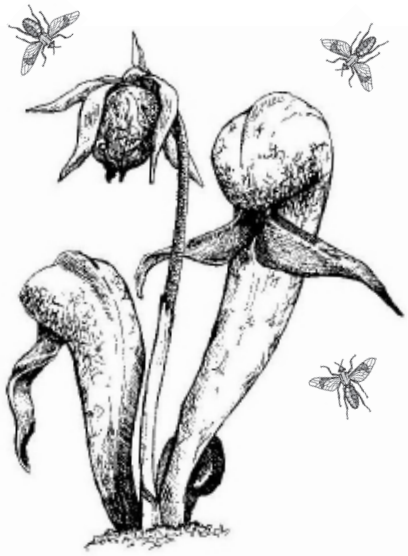
Next Generation Science Standards

This lesson meets the following 6th Grade standards:

MS-ESS2.C The Roles of Water in Earth's Surface Processes
MS-ESS2-6 Develop and use a model to describe phenomena.
MS-ESS2-4 Develop a model to describe unobservable mechanisms.

Wetlands
Lesson 1

What is a Wetland?



Cobra Lily
(Darlingtonia californica) is a carnivorous plant that grows in the bogs of Southern Oregon and Northern California.

Vocabulary

English	Dee-Ni
Wetland	Water: Tvl-xvt
Marsh	Tree: Tr'aa-me
Swamp	Swamp: Xwvtlh-srvlh
Bog	Puddle: Chvslh-mvn
Fen	Meadow: Tuu-me'
Hydric Soil	Soil: Ee
Hydrophyte	Plant: Xvm-srvn'

Background Information

Wetlands are defined as having the following components:

- **Water loving plants (hydrophytes),**
- **Water soaked land for part or all of the growing season each year**
- **Soils that developed in low oxygen (hydric soils).**

Wetlands differ from ponds, lakes, rivers, and streams because they are defined as areas having, at least periodically, waterlogged soils or standing water. Although wetlands are often wet, a wetland might not be wet year-round. In fact, some of the most important wetlands are only seasonally wet. Wetlands are the link between the land and the water. They are transition zones where the flow of water, the cycling of nutrients, and the energy of the sun meet to produce a unique ecosystem characterized by hydrology, soils, and vegetation.

Wetlands stay wet for any of several reasons: they are in low areas that stay saturated by rain, they are fed from below by groundwater that is at or near the surface, they are near rivers or other bodies of water that flood them periodically, or they are saturated along the coasts by the tide. Beavers can make wetlands by damming a stream. People also create wetlands unintentionally by blocking normal water flow with construction, or intentionally by flooding areas for uses such as waterfowl breeding grounds. Wetlands are among the most biologically productive ecosystems on Earth, comparable to tropical rain forests and coral reefs. They provide food sources that support a variety of species.

Wetlands found in the United States fall into four general categories – marshes, swamps, bogs, and fens.

- **Marshes** are periodically saturated, flooded, or ponded with water and characterized by herbaceous (non-woody) vegetation adapted to wet soil conditions. marshes frequently occur in poorly drained depressions, floodplains, and shallow water areas along the edges of lakes and rivers.
- **Swamps** are fed primarily by surface water inputs and are dominated by trees and woody shrubs. Swamps occur in either freshwater or saltwater floodplains. They are characterized by very wet soils during the growing season and standing water during certain times of the year.
- **Bogs** are freshwater wetlands, often formed in old glacial lakes, characterized by spongy peat deposits, evergreen trees and shrubs, and a floor covered by a thick carpet of sphagnum moss. Cranberries, blueberries, and carnivorous plants like the pitcher plant also grow in bogs. The only water source for Bogs is rainwater, and they are usually found in glaciated areas of the northern United States.
- **Fens** are freshwater peat-forming wetlands covered mostly by grasses, sedges, reeds, willow and wildflowers. Fens, like bogs, tend to occur in glaciated areas of the northern United States.

Wetlands
Lesson 1

What is a Wetland?

Teacher Directions

1. Show the students the labeled Wetlands photo and say: "Turn to the person next to you and talk about a wetland that you have seen or visited, then make a list of what plants, animals, etc you saw there and write what you think makes a wetland a wetland. You have one minute - GO!"
2. Once the minute is up say "Pencils down." Call on groups to share with the class what they wrote. Make three columns on the board or flipchart under the title Wetlands: Plants, Animals, and Attributes. As the students read off what they listed write those words in the corresponding columns on the board. Compare the words to those listed in the Dee-ni vocabulary and write those next to the corresponding English words. Leave the list up on the board, to add anything else that they learned about at the end of the lesson.
3. Share the definition of "wetlands" using the Wetlands infographic. Then go over the different types of wetlands: **Bog, Marsh, Swamp, and Fen** using the definitions from the background information while showing the students the included infographic of wetland types using a projector, document camera, or print outs. Optionally you can show the video: **"What makes a Wetland a Wetland?"** (3 minutes 44 seconds) https://www.youtube.com/watch?v=bRCPQebNIgA
4. Lead a discussion. Example questions:

- How does the group list compare with the wetland definition?
- What wetlands have you visited and where are the closest wetlands?
- What are the differences and similarities between a **bog and a fen**?
- What are the differences and similarities between a **marsh and a swamp**?
- How are wetlands different from lakes, rivers, ponds and streams?

5. **Activity: Make a Wetland!**

- Divide the class into four groups, and assign each group a different wetland type:
- **marsh, swamp, bog, and fen.**
- Hand out the pictures of each wetland type labeled with their attributes to each corresponding group. Give each group materials for making a wetland (see list in materials section).
- Instruct the students to use what they'd learned so far, and the information from the infographics to make a model of the wetland type they were assigned using the provided materials. They can put the clay down for soil, put the sticks, twigs, leaves, moss/peat into the clay to represent plants, sponges or foam for spongy soils, and scraps of astroturf or grass leaves to represent grass. They can also pour water into it to show where the water flows or pools up. Give the students the Dee-ni vocabulary words written on small pieces of paper, which they can use to label parts of their model. Give them 15-20 minutes to finish their models.
- Have a show and tell, where each group shows their model to the rest of the class and teaches them about their wetland type. Allow for questions and answers, as well as a group discussion. How are the wetland types similar or different?

6. Lesson wrap-up. Review the definition of a wetland, and the different types of wetlands. Look over the list that the class created at the beginning of the lesson, and add anything else that they learned about wetlands.

Wetlands
Lesson 1

What is a Wetland?

IN THE FIELD!

Organize a field trip to a nearby wetland and have the students analyze its' characteristics to determine if it is a bog, swamp, or marsh. Tell the students to look for wetland specific plants and animals. Ask them to observe how the plants in the wetland are different from those outside of it, and try to determine where that boundary is. They can document their observations in a drawing, journal entry, or photo journal. Recommend that the students wear rubber boots or other waterproof shoes on the field trip.

SCIENCE INQUIRY

Homework Assignment: Think about a wetland that you have visited in the past. Make a hypothesis of what kind of wetland you think it is and why, write this down. How many acres do you think the wetland covers? Find that wetland on the National Wetland Inventory (NWI) map. https://www.fws.gov/wetlands/data/mapper.html Record the data that is listed for that wetland, including the classification, wetland type, and acres. How does this data differ from the hypothesis that you wrote down? How are the categories for wetland types similar or different from what you learned in the classroom lesson? Research and then make a vocabulary list with definitions for: Palustrine, Estuarine, Riverine, and Lacustrine.

Reflection

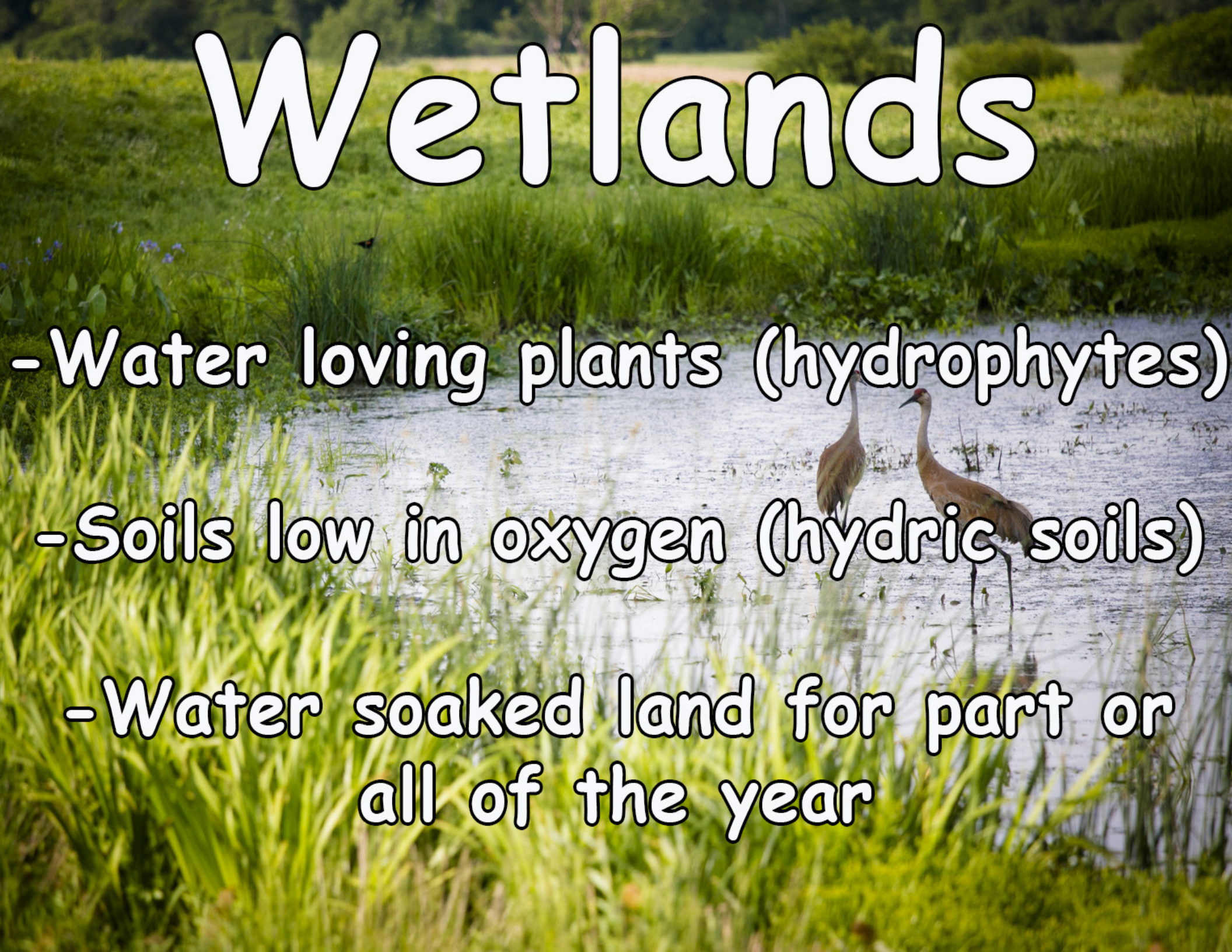
Think about a wetland that you have visited. How do you know it was a wetland? What type of wetland do you think it was? What is the water source for the wetland? How did you feel when you were there? Make a drawing of the wetland from your memory, a photo, or by visiting it again. Make a map of the wetland using your memory, a paper map, or an online map.

Assessment

1. Name the factors that define a wetland.
2. List the four types of wetlands.
3. Say or write one wetland specific Dee-ni word.

Resources

- *Project WET Curriculum and Activity Guide*. 1995. Project WET, 301 N. Willson Ave. Bozeman, MT 59715. projectwet.org
- *WOW! The Wonders of Wetlands*. 2003. Environmental Concern INC, PO Box P, St Michaels, MD 21663. wetland.org
- *Types of Wetlands*. 2001 EPA. https://nepis.epa.gov/Exe/ZyPDF.cgi/200053PZ.PDF?Dockey=200053PZ.PDF
- *Discover Wetlands*. 1995. WA Dept. of Ecology. https://fortress.wa.gov/ecy/publications/documents/8816a.pdf



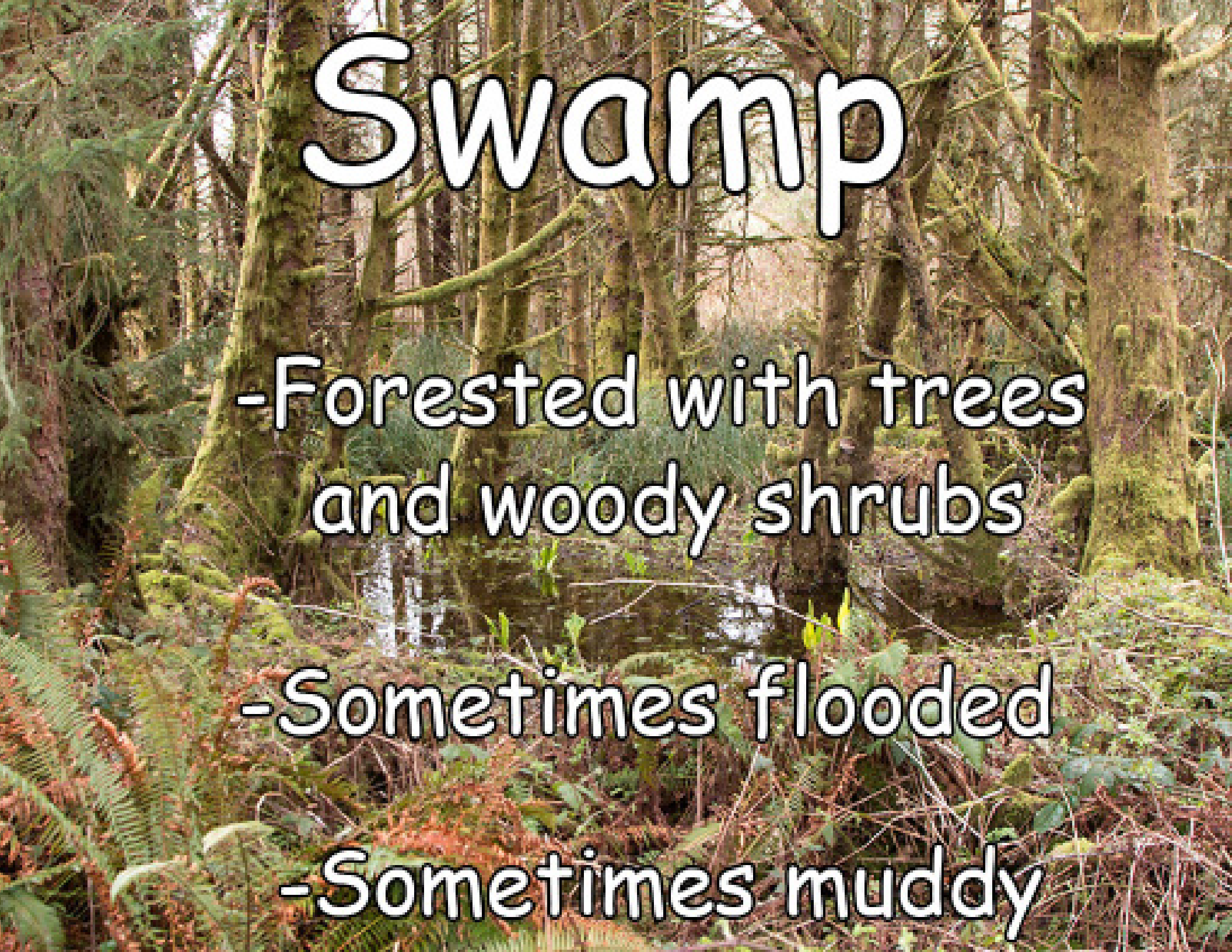
Wetlands

-Water loving plants (hydrophytes)

-Soils low in oxygen (hydric soils)

-Water soaked land for part or all of the year


Marsh
- Often flooded
- Seasonal ponds
- Non-woody, soft-stemmed aquatic plants


Swamp
-Forested with trees and woody shrubs
-Sometimes flooded
-Sometimes muddy


Bog
-Peat (spongy soil)
-Evergreen trees
-Rainwater fed
-Often has cranberries, blueberries
& carnivorous plants


Fen
-Peat (spongy soil)
-Groundwater fed
-Meadows
-Covered with grasses, sedges, and reeds

Wetlands
Lesson 2

Identifying Wetland Plants and Animals

"We are all speaking to an unseen world, speaking for our Mother Earth, trying to stop our spiritual blindness. We speak for the animal kingdom for those in the waters, for the four-leggeds and the one-leggeds (trees) and the creepy crawlers. I pray our Creator hears us. The creatures have a right to be."

—Agnes Baker Pilgrim, Siletz Tribal Elder

Overview

Students learn how to identify some of the common wetland plants and animals using natural items as well as wetland animal and plant cards to play various matching and guessing games.

Time Estimate:

60-90 minutes

Best Season:

Any- Indoor classroom

Preparation

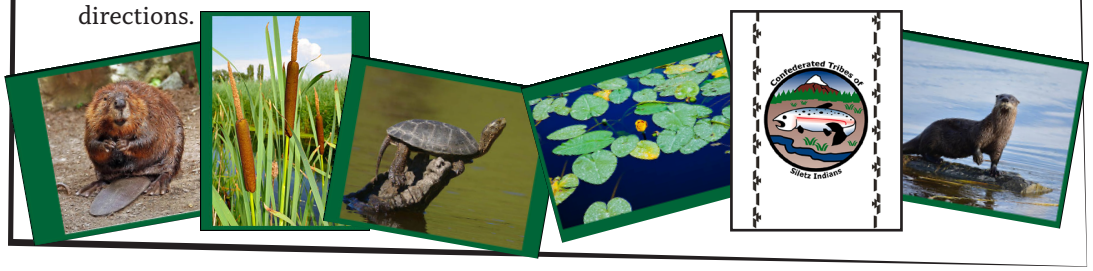
- Collect the natural materials, and print out the cards beforehand. Print the cards on cardstock or laminate them.

Learning Objectives

- Differentiate between several species of wetland plants and animals.
- Be able to match pictures of wetland plants and animals with their corresponding names and descriptions.
- Describe how wetland plants and animals differ from non wetland plants and animals.

Materials

- **"Wetland in a Bag" materials**- Here are examples of some of the natural items you can use for this activity. These items can be collected at a nearby wetland, park, your yard or borrowed from nature centers, OSU Extension Service, or US Fish and Wildlife offices.
  - An opaque bag: this could be a pillowcase, paper grocery bag, or reusable tote bag.
  - Blindfold or eye mask
  - Cattail stalk and flower (the part that looks like a hot dog)
  - Leaves- Cattail, Juncus, Skunk Cabbage, Yellow Pond Lily, Wapato, Tule, etc.
  - Flowers- Skunk Cabbage, Yellow Pond Lily, or any other flowers you can find.
  - Seeds or Roots- Wapato, Yellow Pond Lily, Skunk Cabbage, or other seeds.
  - Twigs- Willow, Cranberry, Bog Huckleberry, Black Cottonwood
  - Bird Feather
  - Turtle Shell
  - Fur- pelt, small piece, fake fur, or a stuffed specimen. Wetland mammals preferred.
  - Tap water- in a small container
  - Wetland Mud- in a small container or bag that can be opened to reach into.
  - A toy frog, fish, insect, duck, turtle etc.
  - Snake skin or toy snake
  - Bird's nest (only one that has fallen from a tree)
  - Egg Shells- from a chicken
- **Wetland Plant and Animal cards**- the print outs for these can be found at the end of this lesson plan. Print the cards preferably on cardstock paper or laminate them. There are several options for printing these cards, depending on which activities and games you would like to do with the students. Printing directions are listed with each game's directions.



Next Generation Science Standards

This lesson meets the following 6th Grade standards:

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

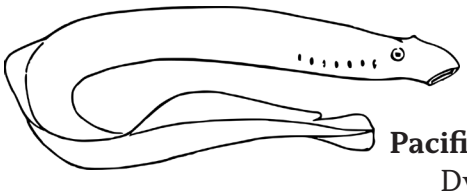
RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS3-2)

Wetlands
Lesson 2

Identifying Wetland Plants and Animals

Dee-Ni Vocabulary

Otter: Naa-ghaa-t'u'-ne
Cattail: Chaa-'ak-t'i
Frog: K'wee-lhin'-chu
Salamander: Tee-li~-ch'e'
Turtle: Ts'ee-nntelh
Willow: Gee-lish
Goose: Haa~-chu
Tule: Ch'uu-sutlh
Lamprey: Dvsh-xa~
Skunk Cabbage: Daa-chuu-se's
Mink: Mvlh-yaa-'islh-ghelh-ne
Beaver: Chii-nn'telh



Pacific Lamprey
Dvsh-xa~
Entosphenus tridentatus

Background Information

Wetlands are not only diverse in their types, but in their biology. There are an abundance of plants and animals that prefer, or can only live in wetlands. Many of these have been harvested and used for millenia by Native Americans for weaving, food, medicine, and clothing. The wetland plant and animal activity cards that are included in this lesson provide most of the background information needed for this lesson.

-The wetland **animal** cards list: **Name** (English, Dee- Ni, and Latin), **Length**, **Weight, Description, Consumes** (what it eats), **Makes** (if it alters the landscape, like a beaver dam), and **Human use** (includes known historic and cultural Native American uses).
-The wetland **plant** cards list: **Name** (Dee- Ni, English, and Latin), **Description** (general growth form and height)**, Leaves** (size, shape, and color)**, Flowers** (size, shape, color, and bloom time)**, Habitat** (wetland type)**, and Human use** (food, medicine, weaving, clothing, etc.**)**

Warm-up Activity: Wetland in a Bag

Start the lesson by grabbing the students' attention with this tactile activity. Use the list from the **Materials** section to prepare this activity ahead of time. Place the materials you were able to acquire inside the bag. Here are the activity procedures:

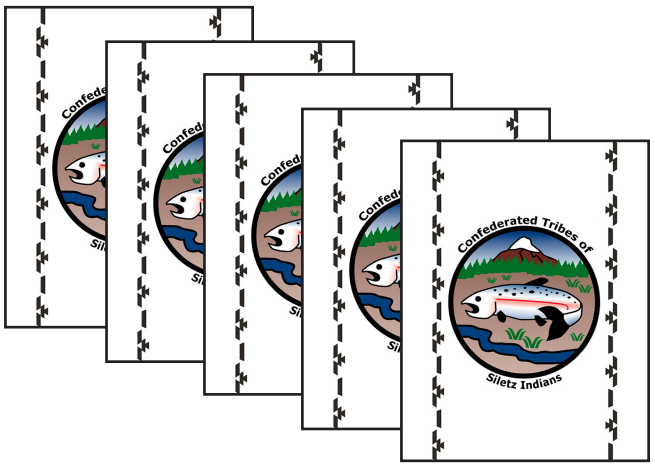
1. Call a volunteer to the front of the room, and then put a blindfold or eye mask on them. Tell the students that the blindfolded person will be guessing what the item is, but no one else should say what it is so the answer isn't given away.
2. Hold the bag of items open for the volunteer, and have them reach inside it to remove one object. Or you can reach into the bag to pick an item of your choice and place it in the student's hands. Have the student lift up the object so that the rest of the class can see it.
3. Ask the volunteer to use their senses of touch and smell to investigate the object. **Have them describe what they sense to the class using descriptive words.** Give them examples of descriptive words if need be: smooth, slimy, rough, slippery, soft, etc. Only after describing the object may they try to guess what it is. If they need extra help they can get hints from the teacher or the class.
4. Remove the blindfold or eye mask so the volunteer can see the object. Ask them questions like: Did you know what it was right away? If they guessed correctly: How did you know what it was? If they didn't guess it: Were you surprised when you found out what it really was?
5. Repeat the process for several more volunteers. Once an item is removed from the bag don't put it back in.
6. Activity debrief: Ask students to review all of the objects they felt in the bag. Which ones were plants? Which ones were animals? Ask the students why they think the objects in the bag belong in a wetland or not. Would any one of the objects also appear in a dry area? Why or why not?

Wetlands
Lesson 2

Identifying Wetland Plants and Animals

Teacher Directions

- **Wetland in a Bag**- Begin the lesson with this warm-up activity. Directions are on the previous page.
- **Wetland Plant and Animal Card Activities:** The printing directions for the cards differ depending on what activities or games you want to do. Refer to the directions listed for each game. Here are some of the possibilities for using the cards, but feel free to improvise and make new activities with them.



Cattail
Dee-Ni: Chaa-'ak-t'i
Typha latifolia

Description: 3- 8 ft (2.7 -7.3m) tall. Grows in large stands. The interlocking leaves are spongy inside.

Leaves: 0.4 -1 in (1- 2.5 cm) wide, grayish green, alternate, flat, long and narrow (somewhat grass-like).

Flowers: Cylindrical, brown "hot dog" shape on top of tall stalk. Blooms from late June through August. Sometimes called "Corn Dog Grass" or "Swamp Sausage." The light, fluffy, cotton like seeds are carried by the wind.

Habitat: Shallow, standing or slow-moving water of marshes, lagoons, sloughs, lakes, ponds and pools, and roadside ditches.

Human use: The roots are edible if growing in clean spaces, and the stems and leaves can be woven into mats, clothes, etc. Seed fluff used for stuffing pillows, mattresses, diapers, and fire starting.

❧ **Guessing Game.** This game is adapted from the "Water Address" activity in the "Project WET Curriculum and Activity Guide." For this game you will need to print:

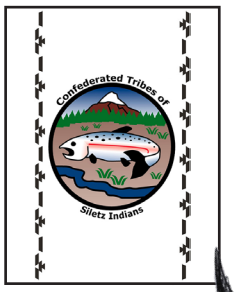
One-side of the cards with the plant and animal **descriptions** (but not the photos) and the "Siletz Tribes" logo on the other side. Several copies should be printed so each group of three to four students can have a set. For example: a class of 30, divided into groups of 3, will need 10 sets of cards.

1. Tell the students they're going to play a riddle game in which they try to guess a wetland plant or animal's identity based on its description. Break students into groups of three to four.
2. Hand out a set of the description clue cards to each group face down. Instruct students not to look at the cards before the game starts.
3. Explain that each card lists the key characteristics and descriptions of a wetland plant or animal. Based on the clues, students will try to guess the plant or animal that is being described.
4. Each group should pick one student to start as their reader. This student will read the description clues (without saying the name), one at a time and in any order, until someone in the group can guess the name of the organism. The answer is listed at the top of each card.
5. The student who comes closest to guessing the name of the organism receives points based on the number of clues that were read before he or she got the answer. Assign one student in each group to be scorekeeper and to keep track as follows: Only one clue read = five points, Only two clues read= four points, Three clues read = three points, Four clues read = two points, All five clues read = one point.

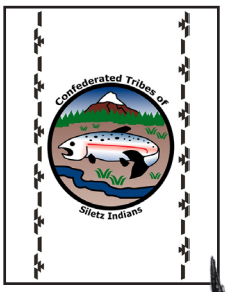
Wetlands
Lesson 2

Identifying Wetland Plants and Animals

Teacher Directions, continued



1.



2.

Cattail
Dee-Ni: Chaa-'ak-t'i
Typha latifolia

Description: 3- 8 ft (2.7 -7.3m) tall. Grows in large stands. Stems are stout, round, and spongy inside.

Leaves: 0.4 -1 in (1- 2.5 cm) wide, grayish green, alternate, flat, long and narrow (somewhat grass-like).

Flowers: Cylindrical, brown "hot dog" shape on top of tall stalk. Blooms from late June through August. Sometimes called "Corn Dog Grass" or "Swamp Sausage." The light, fluffy, cotton like seeds are carried by the wind.

Habitat: Shallow, standing or slow-moving water of marshes, lagoons, sloughs, lakes, ponds and pools, and roadside ditches.

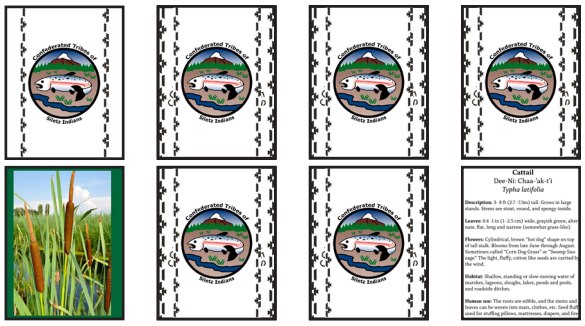
Human use: The roots are edible, and the stems and leaves can be woven into mats, clothes, etc. Seed fluff used for stuffing pillows, mattresses, diapers, and fire starting.

- **Who am I?** For this activity you will need to print two different sets of cards:

1. One set of cards: one-side with a plant or animal picture, and "Siletz Tribes" logo on the other side.
2. A second set of cards: one-side with a plant or animal description, and "Siletz Tribes" on the other side.

1. Hand out one card to each student, make sure that there is a picture card and a matching description card handed out to different students.
2. The students have to find the card that matches theirs. For example, a person with the beaver picture card has to find the person with the beaver description card. The students cannot show each other their cards, but must describe them without using the name of the animal. Students will walk around the room asking other students about their cards and comparing them until they find a match.
3. Once everyone has found their match the activity can be repeated by mixing up the cards and handing out different ones to everyone.

A:



B:

- **Memory Matching Card Game**. For this game there are two printing options:

Option A: print using the printing directions listed above for the "Who Am I?" game.
For this option students will match the picture card with its corresponding description card.

Option B: print **two** of each picture card with the "Siletz Tribes" logo on the other side. For this option the students will match duplicate pictures. Here are the directions for the matching memory game:

1. Mix cards up and lay them all face-down on a table in a grid pattern.
2. Youngest player goes first and turns two cards of their choosing over. If cards match, they take the cards and have another turn. If cards don't match put the card down in the same spot, and move to the next player. The player with the most cards at the end is the winner.
3. When all cards are matched, the player with the most sets of matching cards wins.

Wetlands
Lesson 2

Identifying Wetland Plants and Animals

IN THE FIELD!

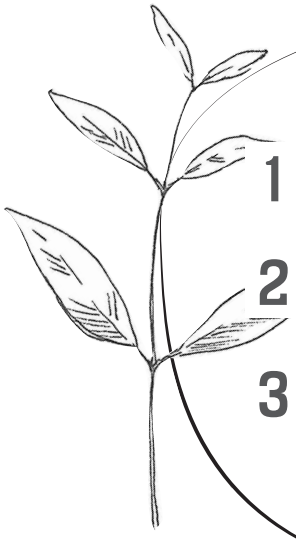
Take a set of the cards on a field trip to a wetland and use them to identify the plants and animals that the students encounter there. One activity option is to give a plant card to each student, or a small group and see if they can find that plant. Once most of the plants have been found, do a show-and-tell tour where each student or group teaches the other students about their plant and how to identify it. .

SCIENCE INQUIRY

Students can go further into this subject by learning how to use plant and animal field guides (see those listed in the "Resources" section) to identify wetland organisms. Students can add to the deck of cards by making their own wetland plant and animal cards from photos or their own drawings and information they find in books and online. Another option is to have students make their own Wetland Plant and/or Animal field guide for a specific local wetland. These could be printed and shared with the community.

Reflection

How can you tell whether a plant is a wetland plant/animal vs. a non-wetland plant/animal? Research some of the adaptations that wetland plants and animals have. What are some non-native, invasive wetland plants and animals found in your area? What are other games or activities that you could do with the plant and animal cards?



Assessment

1. Identify two animals, and two plants using only the picture cards, or by matching a picture card to a description card.
2. List the characteristics for one wetland plant and one wetland animal.
3. Describe two characteristics that are different between a wetland plant/animal and a non-wetland plant/animal.

Resources

- *Project WET Curriculum and Activity Guide.* Project WET Foundation, 1995. www.projectwet.org
- Guard, B. Jennifer., et al. *Wetland Plants of Oregon & Washington. Lone Pine Pub., 1995.*
- Russo, Candace Banners., and Erin Rose. ONeil. *A Guide to Oregon and Washington Wetland Wildlife: and Their Habitats*. Northwest Habitat Institute, 2007.
- Slattery, Britt Eckhardt. *Wow! The Wonders of Wetlands: an Educators Guide.* Environmental Concern Inc., 2003.

American Beaver

Dee-Ni: Chii-nn'telh

Castor canadensis

Length: 34 - 40 in (86cm-1m)

Weight: 24-71 lbs (10- 32kg), 44 lbs (20kg) average

Description: Largest rodent in North America. Nocturnal. Broad, wide, flat tail, which is used to slap the water as they dive to scare away predators.

Consumes: Tree bark, branches, stems, leaves, and aquatic plants.

Makes: Burrow, paths, snags, and structures that can block the flow of water (dams), and expand wetlands, thus creating more habitat.

Human use: Meat for food, pelts are prized for warm, water-resistant fur clothing.

Pacific Lamprey

Dee-Ni: Dvsh-xa~

Entosphenus tridentatus

Length: 16 - 30 in (40 - 76 cm)

Weight: up to 1.1 lbs (0.5kg)

Description: Jawless eel-like fish that have slender, elongated bodies with two dorsal fins arising far back on the body. Adults living in the sea are a bluish-black or greenish colour above and pale below, and called "Night Eel." Those that have spawned out in fresh water are brown and called "Sun Eel." They have a round, funnel-like sucking mouth with three sharp teeth. They climb up rocks using their mouths, and can get past waterfalls this way. They are anadromous, meaning they migrate from saltwater to freshwater to breed, like salmon.

Consumes: Parasitic of larger fish, including salmon.

Human use: Traditional native food that is still harvested today at places like Willamette Falls.

American Mink

Dee-Ni: Mvlh-yaa-'islh-ghelh-ne

Neovison vison

Length: 19 - 28 in (48 - 71cm)

Weight: 1-3 lbs (0.45- 1.4kg)

Description: Semiaquatic, and mostly nocturnal mammal in the weasel family. They have soft chocolate brown glossy fur, sometimes with white patches on the belly. They have a long thin body, and a furry tail. If frightened they hiss or screech and can even release a scent like a skunk. If happy they will purr.

Consumes: Small mammals including muskrats, fish, eggs, birds, frogs, and found dead animals (carrion).

Human use: Meat historically eaten when other food was scarce. Pelts are used for fur clothing,

Northern River Otter

Dee-Ni: Naa-ghaa-t'u'-ne

Lontra canadensis

Length: 50" (1.27 m)

Weight: 11-31 lbs (5-14kg)

Description: This mammal is in the weasel family. They are fast swimmers and can close their nostrils underwater. They can run 15 mph on land. Look for dark brown fur, grey throat, muscular tail and webbed toes.

Consumes: Fish, frogs, turtles, crayfish, small mammals, and birds.

Makes: Burrows in river banks.

Human use: Meat historically eaten when other food was scarce. Pelts are highly prized for warm, water-resistant fur clothing.

Tule

Dee-Ni: Ch'uu-sutlh

Scirpus lacustris

Description: 3- 8 ft (2.7 -7.3m) tall. Sometimes grows in large colonies. Grass-like. Stems are round, spongy inside, and taper from 1.18 in (3cm) at the base to 0.08 in (2mm) at the tip.

Leaves: Plant is mostly made up of stems, and has a few small leaves, which are sheath-like at the base of the stems.

Flowers: 0.31-0.59 in (8-15mm) long. Grow in clusters at the tips of the stems. Brown.

Habitat: Deep or shallow water, or in muddy or marshy ground around lakes, ponds, streams, and marshes.

Human use: Edible roots. Stems used widely for weaving mats, clothing, bags, bedding, hats, sandals, houses, and even boats.

Cattail

Dee-Ni: Chaa-'ak-t'i

Typha latifolia

Description: 3- 8 ft (2.7 -7.3m) tall. Grows in large stands. The interlocking leaves are spongy inside.

Leaves: 0.4 -1 in (1- 2.5 cm) wide, grayish green, alternate, flat, long and narrow (somewhat grass-like).

Flowers: Cylindrical, brown "hot dog" shape on top of tall stalk. Blooms from late June through August. Sometimes called "Corn Dog Grass" or "Swamp Sausage." The light, fluffy, cotton like seeds are carried by the wind.

Habitat: Shallow, standing or slow-moving water of marshes, lagoons, sloughs, lakes, ponds and pools, and roadside ditches.

Human use: The roots are edible if growing in clean spaces, and the stems and leaves can be woven into mats, clothes, etc. Seed fluff used for stuffing pillows, mattresses, diapers, and fire starting.

Willow

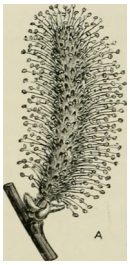
Dee-Ni: Gee-lish

Salix spp.

Description: 6- 40 ft (2 -12m) tall shrubs and trees.

Leaves: Oval to lance-shaped, broadest near tip; upper leaf surfaces are green, glossy, leaf undersides are waxy with dense, white, often rusty hairs; leaf edges occasionally have fine teeth; leaf stalks are 0.2 -0.4 in (5-10mm) long.

Flowers: In catkins on short stalks.



Habitat: Shrub swamps, moist woods and clearings, streambanks and lakeshores.

Human use: Mainly used for weaving baskets, fish nets, twine, and for building sweat lodges. Also used as a medicine similar to Aspirin.

Soft Rush

Dee-Ni: Baa-bvs

Juncus effusus

Description: 8- 40 in (20cm - 1m) tall. Grows in distinct clumps, like a bunch grass. The blades/stems of a rush are round, each pushing directly from the soil with no branching.

Leaves: Plant is mostly made up of stems, and has brown sheath-like leaves wrapped around the stems.

Flowers: Greenish to brownish cluster that looks like a continuation of the stem.

Habitat: Wet fields, pastures, tidal flats, shallow water at edges of ponds or lakes.

Human use: Used for weaving, sometimes mixed with cattails to weave cordage.

Yellow Pond-Lily

Dee-Ni: Lhts~ chvslh-mvn dan'

Nuphar polysepalum

Description: Leaves floating on the surface of the water are attached by long (up to 8 ft or 2.4m) stalks to fleshy roots in the mud.

Leaves: Floating leaves are large 4- 16 in (10-40cm) long) but thin, broadly oval and heart-shaped, with deep notch at base where long leaf stalks attach.

Flowers: Yellow, large up to 4 in (10cm) across bowl-shaped, on stalks that usually extend well above surface of water.

Habitat: Ponds, lakes, slow-moving streams and deep freshwater marshes.

Human use: The roots have been used medicinally to treat tuberculosis. The seeds can be roasted like popcorn eaten.

Wapato

Dee-Ni: Gus

Sagittaria latifolia

Description: 8- 35 in (20 -89cm) tall. Leaves and flower stalk grow in tufts out of roots with potato-like tubers attached.

Leaves: Arrowhead-shaped. 10 in (25cm) long and 8 in (20cm) wide; sometimes submerged, but above water later in summer.

Flowers: White, 0.4 -0.8 in(1-2cm) across, 3 petals. Grow on a 8-19 in (20-48cm) tall stalk. Blooms from middle to late August.

Habitat: Easily established in mud at edges of marshes, lakes, ponds, and sloughs.

Human use: Historic widespread use of the starchy edible tuber, which was often baked.

Bog Cranberry

Dee-Ni: Chvslh-mvn dee-chi

Vaccinium oxycoccos

Description: 2 in (5cm) tall. Small, evergreen shrub that creeps low along the ground on slender vine like stems.

Leaves: 0.1-0.4 in (3-10mm) long, alternate, evergreen, leathery, sharp pointed, with edges rolled under. Dark green on top, grey-waxy below.

Flowers: Deep pink to red growing alone or in clusters at the ends of slender stems. Fruit is a red, juicy berry.

Habitat: Bogs and wet meadows half buried in moss.

Human use: Edible berries. Berries and bark have been used medicinally for nausea and urinary tract infections.

Western Skunk Cabbage

Dee-Ni: Daa-chuu-se's

Lysichiton americanus

Description: 12- 59 in (30cm- 1.5m) tall. Flower stalks and large leaves emerge directly from ground

Leaves: Up to 5 ft (1.5m) long, and 1.6 ft (49cm) wide. Lance-shaped to oblong-oval, fleshy, thin.

Flowers: Yellow. Skunky smell. Up to 1 ft (30.5cm) long, round, corn cob looking spike covered in small flowers and surrounded by a large yellow petal-like bract. Blooms in early spring before the leaves appear.

Habitat: Swamps and marshes

Human use: The Roots were eaten as an emergency survival food, but have to be prepared in a certain way (do NOT try). Leaves can be rolled into a cone-shaped container for berry collection, or used in steam pit bakes.

Rough-Skinned Newt

Dee-Ni: Tee-li~-ch'e'

Taricha granulosa

Length: up to 8 in (20cm) from nose to tip of tail

Weight: 0.43 oz **(**12.32 g)

Description: This amphibian can be yellow or tan, but usually dark brown or black. Underside is yellow, orange or red. Dry, rough, granular skin when in terrestrial phase. Wet, smooth, slimy skin when in aquatic phase.

Consumes: Tadpoles, earthworms, slugs, snails, insects and insect larvae, and amphibian eggs.

Human use: None. They are highly toxic, and contain tetrodotoxin, which is the same toxin found in puffer fish.

Western Pond Turtle

Dee-Ni: Ts'ee-nntelh

Actinemys marmorata

Length: 4.5-8.5 in (11.4-22cm)

Weight: 1-2.4 lbs (0.45-1kg)

Description: This reptile's coloration ranges from brown to black on the the upper shell, with lighter marbling visible close up. The lower shell is black and yellow. The head and legs are dark with possible yellow markings.

Consumes: Insects, worms, tadpoles, frogs, snails, leeches, and fish. Plant foods include filamentous algae, lily pods, tule and cattail roots.

Human use: Meat and eggs for food. The shell can be made into a rattle.

Canada Goose

Dee-Ni: Haa~-chu

Branta canadensis

Length: 20-40 in (51cm-1m)

Wingspan: 50-68 in (1.25-1.7m)

Weight: Males 7-14 lbs (3-6kg) Females 5.5-12 lbs (2.5-5kg)

Description: Large waterfowl with a black head and neck, white cheeks, white under its chin, and a brown body. They are normally migratory and tend to be found on or close to fresh water, often in urban and cultivated areas.

Consumes: Grasses, aquatic plants, grain, insects, mollusks, crustaceans, and tadpoles.

Human use: Meat and eggs for food. The downy feathers can be used for stuffing pillows or mattresses. The wing feathers can be used as arrow fletching.

Pacific Chorus Frog

Dee-Ni: K'wee-lhin'-chu

Pseudacris regilla

Length: up to 2 in (5cm) long. Males are usually smaller than the females.

Description: This amphibian has a dark "mask" or eyestripe extending from the nostrils through the eye as far as the shoulder. Rounded toepad at the end of each digit. They vary in color from shades of green, tan, reddish, grey, brown or black. Individuals can even change colors over the course of several days to match their environment. Their life stages go from egg, to tadpole, to adult.

Consumes: Aquatic plants, flies, ants, centipedes, beetles, spiders, slugs, and snails.

Human use: None known.

Wood Duck

Dee-Ni: Ch'ash

Aix sponsa

Length: 20 in (51cm)

Wingspan: 28 in (71cm)

Weight: 16 oz **(**454 g)

Description: This waterfowl uses swamps, marshes, shallow lakes, and ponds as its habitat. The adult male has distinctive multicolored iridescent plumage and red eyes,with a distinctive white flare down the neck. The female, less colorful, has a white eye-ring and a whitish throat. Both adults have crested heads.

Consumes: Acorns, leaves, berries, aquatic plants, aquatic insects, beetles, and grasshoppers.

Human use: Meat and eggs for food. The feathers can be used as arrow fletching, and for decoration.

Great Blue Heron

Dee-Ni: Ch'uu-ket-ni

Ardea herodias

Length: 36-54 in (91-137cm)

Wingspan: 66-79 in (167-201cm)

Height: 45–54 in (115–138 cm)

Weight: 4-8 lbs (1.82-3.6kg)

Description: This large wading bird has gray-blue flight feathers, red-brown thighs, and a paired red-brown and black stripe up the flanks; the neck is rusty-gray, with black and white streaking down the front; the head is paler, with a nearly white face, and a pair of black or slate plumes runs from just above the eye to the back of the head. The bill is dull yellowish, and the lower legs are gray.

Consumes: Fish, amphibians, small reptiles, small mammals and birds, and aquatic plants.

Human use: Meat for food.

Red-Winged Blackbird

Dee-Ni: Lhshvn-ch'ash

Agelaius phoeniceus

Length: 8.75 in (22cm)

Wingspan: 14.5 in (37cm)

Weight: Males 2.3oz (64g), Females 1.46 oz (41.5g)

Description: The common name for this bird is taken from the mainly black adult male's distinctive red shoulder patches, which are visible when the bird is flying or displaying. At rest, the male also shows a pale yellow wingbar. The female is blackish-brown and paler below. It generally prefers wetlands, and inhabits both freshwater and saltwater marshes, particularly if cattail is present.

Consumes: Insects, spiders, snails, seeds, and berries.

Human use: Meat for food.

Raccoon

Dee-Ni: K'wvn-shan'

Procyon lotor

Length: 26-38 in (66-97cm)

Weight: 11-57 lb (5-26kg)

Description: This mammal has gray fur, a black mask around its eyes, a ringed tail, and hand-like front paws.

Consumes: Worms, slugs, insects, amphibians, small mammals, turtles, fish, seeds, fruit, and bird eggs. They are oportunistic omnivores, eating about 40% invertebrates, 33% plants, and 27% vertebrates.

Human use: Meat for food, and pelt for clothing.


Confederated Tribes of
Siletz Indians


Confederated Tribes of
Siletz Indians


Confederated Tribes of
Siletz Indians


Confederated Tribes of
Siletz Indians

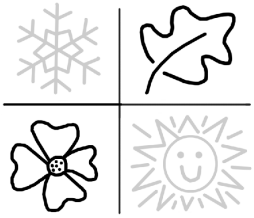
Wetlands
Lesson 3

My Pack Basket:
How Wetland Plants Are Used For Fiber

"Siletz basketry is not just an art form but also a means of making utilitarian baskets without which our people could not have survived. To see our people making and proudly wearing Ceremonial caps and work caps, carrying our children and grandchildren in our baby baskets, wearing bark capes and dresses, using traditional mats, and cooking and eating from baskets is to me preserving the very core of our collective Tribal existence." **-Bud Lane III**

Time Estimate:

1-2 Class sessions



Best Season:
spring
fall

Overview

This lesson introduces native plant fibers and their uses, with a focus on cordage, baskets, and decorative techniques. Students will gain an appreciation for basket function and design by studying traditional weaving materials and techniques. Students will then collect, prepare, and construct cordage or a simple pack basket practicing techniques and using various plant materials.

Learning Objectives

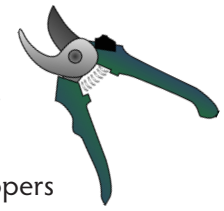
- Describe what makes some plants useful for baskets and cordage
- Recognize the history of baskets and cordage used by Siletz Tribes.
- Summarize the role of management in utilizing fiber plants
- Practice hands-on techniques using plant materials to make cordage and basketry
- Identify the decorative designs used to personalize baskets (dyes, colored plant materials, motifs) as well as the techniques that create them
- How ecosystems influence available plant fiber materials

Preparation

- Scope out locations to take the students on a plant materials gathering trip. Materials can be found in many locations: long grasses can be collected from vacant lots or roadsides; cattails, rushes, and sedges can be found in most wet areas. Challenge the students to make use of what they can find growing locally. City gathering requires creative thinking. English ivy may be readily available in urban areas. Ask permission before collecting any plants. Or, ask students to collect plant material from home to bring into class.
- WARNING: Make sure everyone can identify harmful plants (e.g. poison ivy), if they grow in your collecting area.
- Work with students to create ethical collecting guidelines for the class to use. Be sure that the students discuss such things as: responsible harvesting, cutting rather than pulling plant materials (unless it is invasive), avoiding over-collecting, and asking permission from landowners if on private land.

Materials

- plastic bags
- gloves
- dish pan
- spray bottle
- old towels
- pruners/clippers
- Twine, raffia or yarn
- project direction sheet(s)



Next Generation Science Standards

This lesson meets the following 6th Grade standards:

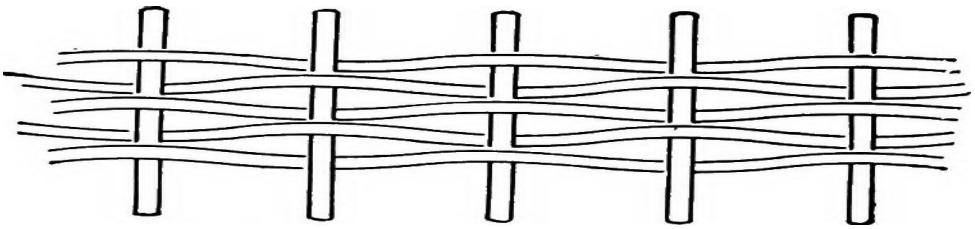
MS-ESS3-3 Changes to Earth's environments can have different impacts (negative and positive) for different living things.

MS-ETS1-1 All Human activity draws on natural resources.

MS-LS1-4 Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.

Wetlands
Lesson 3

My Pack Basket:
How Wetland Plants Are Used For Fiber



Vocabulary Words

English

fiber cell		lignin
cordage		coiling
twining	weft	warp
pack basket		tumpline
open weave		overlay

Dee-Ni

K'hee-lu.....open woven basket
See-le'.....basket bottom(s)
Xaa-ts'a.....close woven basket
Xwvn-daa-wutlh-ni~k.....basket design
Gay-yu.....baby basket
K'hee-lu.....work basket(s)
Xee-tr'at.....basket cap(s)
Gaa-si.....sieve basket
Me'-dan'.....storage basket
T'ulh.....tumpline

Background Information

For millennia, people have used plant fibers to meet the needs of daily life, from making simple twine to bind things to building entire houses. Traditionally, plant fiber has played a large role in many cultures, but with the proliferation of manmade materials like plastics, this need has diminished, as have the skills that go with it. At one time plants provided the materials for food storage containers, clothing, utensils, tools, and adornments. A woman who needed water from a stream would use a basket that was woven so tight it could hold water (Xaa-ts'a). Today, we just reach for the nearest bucket. Although modern society still depends on plants to supply fiber for paper, cloth, and lumber for building materials, much has changed in just the last couple centuries making our relationship with the plants around us very different than it once was.

What makes some plants useful as fiber plants? First, the plant must include fiber cells. These cells tend to be long, thin, and tapered on the ends. All plant cells have cell walls, making them tougher than animal cells, but fiber cells have extra thick cell walls that are reinforced with a substance called lignin. Lignin is a compound that makes fiber cell walls stronger, more waterproof, and more resistant to attack by fungi, bacteria and animals. Fiber cells are one of many plant structures that help support plants, letting them grow to reach sunlight, supporting their vascular tissue (water and sugar transporting cells), and providing them with protection from other organisms. Fiber cells are often present in the wood or bark of hardwoods, including oak *(Quercus spp.),* ash *(Fraxinus spp.),* and maple *(Acer spp.).* The stems of some plants such as flax *(Linum spp.)* and jute *(Chorcorus spp.)* also have fiber cells, which make these plants useful for fabrics like linen and weaving items like floor mats and bags. Fiber cells are also present in the leaves of many grass or grass-like plants, such as sisal *(Agave spp.),* which is used for twine and rope.

Traditionally, Siletz tribes used fiber from native plants, as well as other natural materials, to meet their needs for baskets, rope, fish traps and nets, cooking containers, water jugs, garments, plates, floor mats, and houses! Nature supplied everything they needed. Although many of these traditional plant uses have declined, people still find time to gather materials and produce objects made from plants. In our busy modern times, creating a useful beautiful object with your own hands from materials collected yourself can be very fulfilling. What are some of the things you would need to know about fiber plants, design, and construction techniques to be able to make your own containers?

Wetlands
Lesson 3

My Pack Basket:
How Wetland Plants Are Used For Fiber

Cordage

Coiling

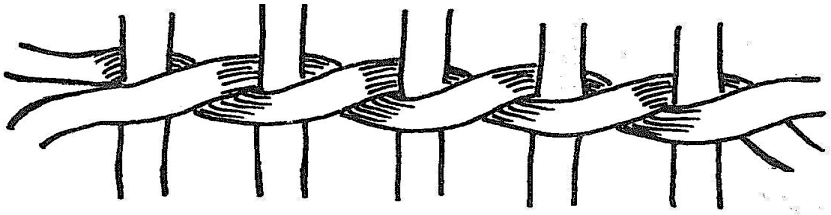
Background Information, continued

To begin, you might analyze the form and function of different container's design. One common container design is called a pack basket. Sturdy pack baskets were frequently worn on the back much like today's backpacks. Pack baskets are made for carrying heavy items such as deer and elk meat, salmon, or eels, or for when the wearer needed their hands free, such as while harvesting camas or berries. Such baskets are often cone shaped and outfitted with a tumpline (t'ulh), a strap over the forehead or shoulders, and used for hands free transporting. The cone shape fits comfortably while distributing the weight on the wearer's back. The large opening at the top allows for easy filling by tossing items over the shoulder, and the cone shape discourages thrown items from bouncing out. Tumplines (T'ulh) are a tightly woven strap made of soft pliable materials for the wearer's comfort. The baskets are often made of an open weave (K'hee-lu) to hold bulky items while contributing a minimum of weight in basket material to carry.

On the Oregon coast people use the open weave pack baskets for collecting shellfish to allow the user to rinse and drain them in one container. Tightly woven (Xaa-ts'a) pack baskets are used to harvest small seeds and berries. Tightly woven cooking baskets were used by putting water in the bottom and adding hot rocks while contantly stirring so as not to damage the valuable basket. The pack basket is just one of many designs perfectly suited for its jobs. Studying other basket types, you will find they too were designed to perform the function needed in an equally efficient manner.

Cordage is another essential tool that uses plant fiber. Cordage is made by twisting multiple fiber strands together into strong cords that can in turn be used in ropes, nets, and baskets. Many native plants are prized for making strong cordage and these vary by region. Plant fibers can be used as cordage, bundled, or in their natural form as weaving material.

There are many techniques for making baskets, with two common methods being twining and coiling. The twining method uses **two** pliable "weft" strands (usually spruce roots) that are twisted around a more rigid "warp" (usually hazel) or foundation structure. This method iss used to make some of the specialized baskets like water jugs, cooking containers, and soft hats. In the second technique, coiling, the base foundation is a spiral of materials that are sewn together with a pliable fiber thread.



Twining

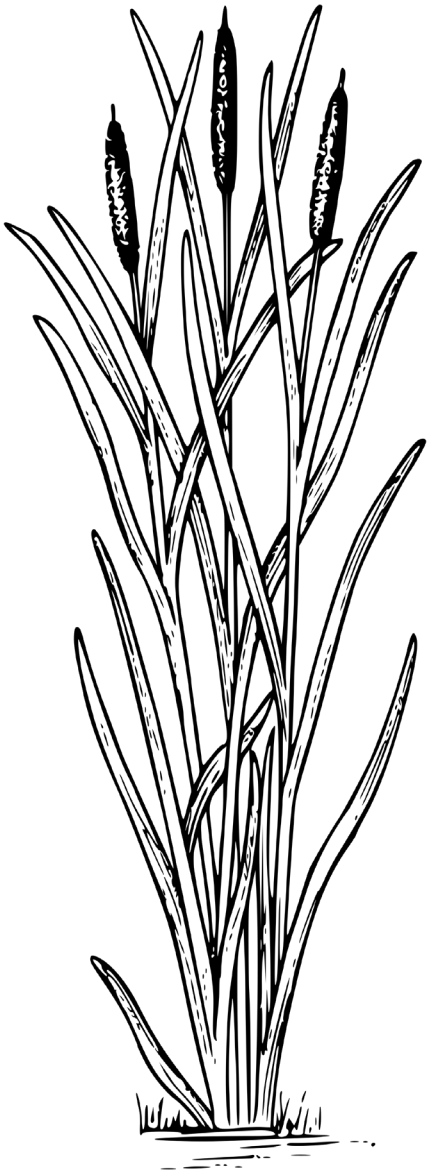
Wetlands
Lesson 3

My Pack Basket:
How Wetland Plants Are Used For Fiber

Basket Materials Gathering Times

from *The People are Dancing Again* (Wilkinson 380)

- **May** - Hazel, willow, fir sticks
- **June** - Hazel, willow, fir sticks (until mid-June)
- **July** - Fir sticks, bear grass, maidenhair fern
- **August** - Fir sticks, bear grass, maidenhair fern, hazel sticks, willow
- **September** - Bear grass, maidenhair fern, woodwardia fern
- **Year-round** - Spruce roots



Cattail
Chaa-'ak-t'i
Typha latifolia

Background Information, continued

Baskets can be constructed of many different native plant materials, but some species stand out for their superior fiber or weaving attributes. Shoots of hazel and willow, spruce roots, the inner bark of cedar, and the stems and leaves of rushes, cattails, and tules are all prized materials. Historically, cattails, tules, and rushes were be woven into mats with many uses (e.g.. clothing, sleeping, house siding, and even canoes!). Traditionally, baskets were used in all aspects of life; some were plain and quickly made for immediate use. Other baskets show painstaking attention to detail and were intricately decorated. Some baskets show geometric patterns that are woven in or overlaid in contrasting colors. Plant materials supply the colors for these designs. For example reds were made with a dye from the inner bark of alder, and yellow from the root of oregon grape. Highly decorated baskets are cherished, culturally important, used in ceremonies, and passed down from generation to generation. "The most prized of all [Siletz] baskets are the basket caps used by female dancers in Nee Dosh or by women and men on other impoortand occasions. Small and delicate, these hightly decorative caps, tightly and finely woven, were created by experienced weavers. Making a high-quality basket cap -- a piece that rises to the level of fine art -- takes 50 to 100 hours" (Wilkinson 379)

Traditionally, fire was used by the Siletz tribes as a management technique to promote long, straight plant re-growth for harvest. This traditional management method has become more difficult to use with changing times although it is still employed in natural areas around the state.

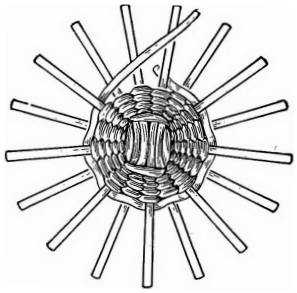
Gathering native plant materials requires ethical collecting practices to ensure access for future generations as well as to protect significant natural ecosystems and species. Ethical collecting includes preventing over-collection to minimize population damage. When gathering plant material, one should minimize damage to the parent plant by cutting and removing only a small section of plant, not disturbing the roots, and never taking whole plants. Collect only from large plant populations and allow plants to reproduce between collections. Using thoughtful practices can allow you to harvest plants fibers without hurting plant populations. Think also about actions you can take to protect or enhance native plant populations for the future. Imagine the connection you would have to your environment if you used plants to supply all your needs, from containers to clothes!

Wetlands
Lesson 3

My Pack Basket:
How Wetland Plants Are Used For Fiber

Directions

1. Ask the students to think of all the containers that they come into contact with daily; food storage, cooking, eating, backpacks, purses, boxes, water bottles, and egg cartons. We are surrounded by containers of all uses, shapes, and sizes. Have them make a list of 10 containers that they commonly use daily. Tell them to take 5 from their list and brainstorm ways that they could construct an adequate replacement container using materials found in nature. Ask the students to share their ideas with the class.
2. **Class discussion:** How often did baskets come up as a container in the brainstorming session? What are the pros and cons of using traditional vs. present day container materials? Be sure to address such things as: individual vs. mass production, knowledge of materials, cost, time, and skills. Don't forget to include issues concerning sustainability and environmental integrity.
3. Challenge the students to learn some of the traditional art of using native plants to make utilitarian and decorative objects. Have them choose one of the projects from this lesson: "Make a Simple Pack Basket," or "Making Fiber Cordage." Make copies of those project direction pages to distribute to the class.
4. Use materials gathered beforehand, or go on a gathering walk to collect materials needed for their projects (cordage and/or baskets). Have them work with a partner or in a small team. Each team will need pruners/clippers, a plastic bag, and gloves.
5. Traditionally, most fiber materials are collected when they are green and are dried before use. This helps to keep the basket weaving tight, because green materials will shrink as they dry and may disrupt the weave. This might not be an important factor in a large gathering basket, but it is critical in baskets used to hold water. We will be using green, un-dried materials for this project because of time limitations, and because green materials are easier to work with.
6. Review responsible gathering guidelines and how to identify plants to be avoided (i.e. stinging nettle, poison ivy, and poison oak). Collect in an area where you have permission (if on private land), and take precautions to avoid damaging the plants; cut rather than pull out or tear the materials, don't over collect or gather more than is needed. Give the students gloves to protect their hands while collecting.
7. Upon returning to the classroom, have students organize their collected materials. Separate similar materials into piles so that all of the grasses are in one pile, the willow in another, and so on. Prepare the materials by removing leaves, cutting off seed heads, etc. Store the materials in a folded damp towel to keep them moist and pliable until students are ready to use them.
8. If working with dried materials, soak them in water for several hours to make them more flexible before working with them.
9. Consult the project sheets at the end of this lesson for directions to make the specific projects.



Taking it Further

- Gain additional appreciation for the beautiful baskets created with native plants by Siletz people, past and present. View online collections listed in the resources section, or ask the Siletz Cultural Resource Program about a class presentation on basketry. When observing the collections, analyze the basket for their form and function, as well as decorative patterns and techniques. Challenge yourself to identify the weaving technique employed, and speculate as to the intended use, before reading any caption information.
- Research other historical and modern uses of plant fibers. What other cultures of the past depended on plant fibers for everyday items? What items do you use regularly that include plant fibers?

Wetlands

Lesson 3

My Pack Basket:
How Wetland Plants Are Used For Fiber

IN THE FIELD!

- Take a field trip to a museum with basket collections, or contact the cultural resources department of your tribe to inquire about viewing their collections. Take your field journal and sketch your favorite piece, including information on the materials used. Cross-reference the plant materials in a local field guide, and include other plant history and ethnobotany in your journal entry.
- Examine baskets that you have at home or in stores. Look closely at the weaving. Mass produced baskets tend to be woven using a different technique than the traditional methods you learned in this lesson. Can you identify how they are different?

SCIENCE INQUIRY

Fiber plant materials are valued for many attributes, including strength, durability, availability, and beauty. Fiber was used for cordage to make rope, snares, fishing line, and nets, where strength was critical. Design a way to test the strength of cordage materials. Make cordage from several different fiber sources and compare their strength. Write up a simple analysis of your trials. Explain how you controlled for different variables in your testing. Consider testing for other qualities such as strength when wet, durability, and ease of use.

Reflection

Cultures throughout time have used their skills to decorate their homes and belongings. How would you decorate a basket to express what is important to you? Design a basket that you would call beautiful. Share it either through making it, drawing it, or writing a detailed description. If you feel artistically challenged by this activity, try using small-square graph paper and color in the squares to make your display your pattern. Geometric patterns lend themselves well to this technique.

Assessment

1. Describe what makes some plant materials more useful as fiber plants.
2. List two native plant materials that are valued for their fiber.
3. Define cordage, explain how it is constructed, and list some of its uses.
4. Name several traditional uses for basketry.

Resources

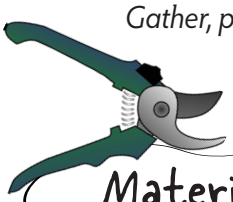
- Wilkinson, Charles. *The People are Dancing Again.* University of Washington Press, Seattle, WA. 2010.
- The Language of Native American Baskets from the weavers view. http://www.nmai.si.edu/exhibitions/baskets/subpage.cfm?subpage=intro
- Confederated Tribes of Siletz Indians Webite has some photos of Siletz baskets http://www.ctsi.nsn.us/chinook-indian-tribe-siletz-heritage/salishan-nehalem-warm-springs-siletz-photos/gallery-i#content
- Portland Art Museum's collection of Siletz baskets is visible on their website: http://portlandartmuseum.us/mwebcgi/mweb.exe?request=record;id=14074;type=701

Wetlands
Lesson 3

My Pack Basket:
How Wetland Plants Are Used For Fiber

MAKE A SIMPLE PACK BASKET

Gather, prepare plant materials, and make a simple cone-shaped pack basket using the twining technique.



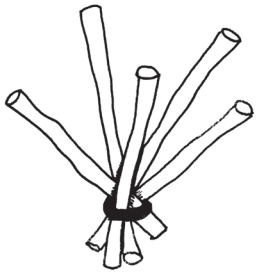
Materials Needed

- plant fibers for weaving (raffia, twine, natural cordage, cattail, tule, rush, etc)
- thin, flexible, straight, unbranched willow or hazel twigs 5 or 7 per student (always an odd number)
- rubber bands
- pruners
- optional: colored raffia, yarns or

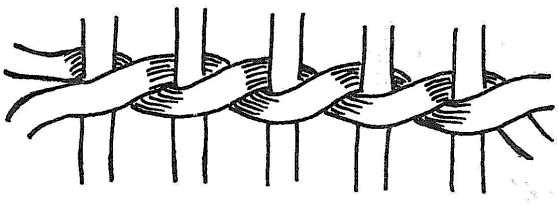
Directions

1. Make a rigid form for your basket out of straight, supple twigs of uniform size. Use a minimum of 5 twigs (always an odd number), approximately the diameter of a pencil and 10-12 inches in length. Using additional sticks or longer sticks will make a larger basket. Bundle the twigs together with a rubber band approximately 1 ½ inches up from the bottom.

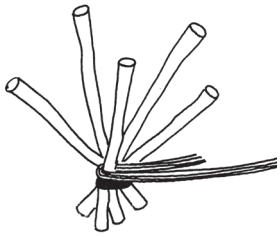
2. Fan out the longer end of the twigs to make a cone-shaped form for your weaving.



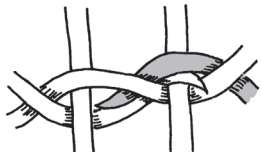
3. Prepare your plant weaving materials. If you are using green, supple materials, little preparation is necessary. The drawback is these materials will shrink as they dry and can leave your weaving loose. If you have collected dry materials, presoak them before using to make them flexible and less prone to breaking. Wrap the fibers in a warm wet towel, and leave for 30 – 60 minutes before using. Raffia must also be presoaked.



4. Prepare your weaving strands. In the twining technique, you will use **two strands** of the material, each one passing on either side of the twig form and then twisting between the sticks, alternating as you work around the basket.



5. Start by taking an 18-24 inch strand of fiber and folding it loosely about one third from one end. This will stagger the ends, making it easier to add new weaving material smoothly. Place the fold around one of the twigs at the bottom of the basket form (near the rubber band) and start. Don't forget to make the twining weave, the double strands need to cross between each twig.
6. Continue weaving the two strands around the twig form, twisting each fiber to alternate back to front at each twig.
7. When you start to run out of weaving material, add a new strand by laying the new strand overlapping the old one 3-4 inches. This technique is called splicing. Then continue weaving as before.

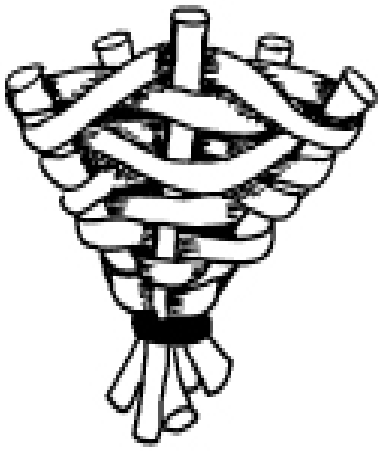


8. **After each course around your twig form, be sure to push the weaving materials down to fill in empty spaces.**
9. **Hints:** To keep the cone shape basket form, start weaving with thinner materials (e.g. grasses). As you work up the cone, use weaving material of thicker diameter or double-up the fiber strands. Additionally, if you are right-handed, hold your left hand (switch if you are left-handed) in a fist in the center of your basket to maintain the spread shape as you weave. This will keep your basket spread and keep you from pulling in the twigs in by weaving too tightly. If you work with a partner, they can help hold it open for you

My Pack Basket:
How Wetland Plants Are Used For Fiber

MAKE A SIMPLE PACK BASKET, continued

10. To finish the edge of your basket, make a loop knot around the last twig and tuck the ends into the weaving below. An experienced weaver can finish their basket so you cannot even find the ends of the strand. Don't expect this for your first attempts. You have just finished a very simple twining weave basket. Don't expect your first weaving attempts to be uniform or tight. If you find this interesting, try a more detailed how-to book or take a basketry class.



Add a Design (for ambitious basket weavers)

11. Design by texture: Use different textured fibers or weaving materials. Experiment with leaving the leaves or seed heads on your plant fibers or using different diameter strands for twining.
12. Design by color: Traditionally designs were created from naturally colored fiber or dyed materials (e.g. red from the inner bark of alder, yellow from the inner bark of Oregon grape). You can add color with yarn or raffia fiber worked into your design.

References

- Tutorials on gathering, preparing, and basketry techniques: www.basketmakers.com/topics/tips/tipsmenu.htm
- Wilkinson, Charles. *The People are Dancing Again.* University of Washington Press, Seattle, WA. 2010.
- Portland Art Museum's collection of Siletz baskets is visible on their website:

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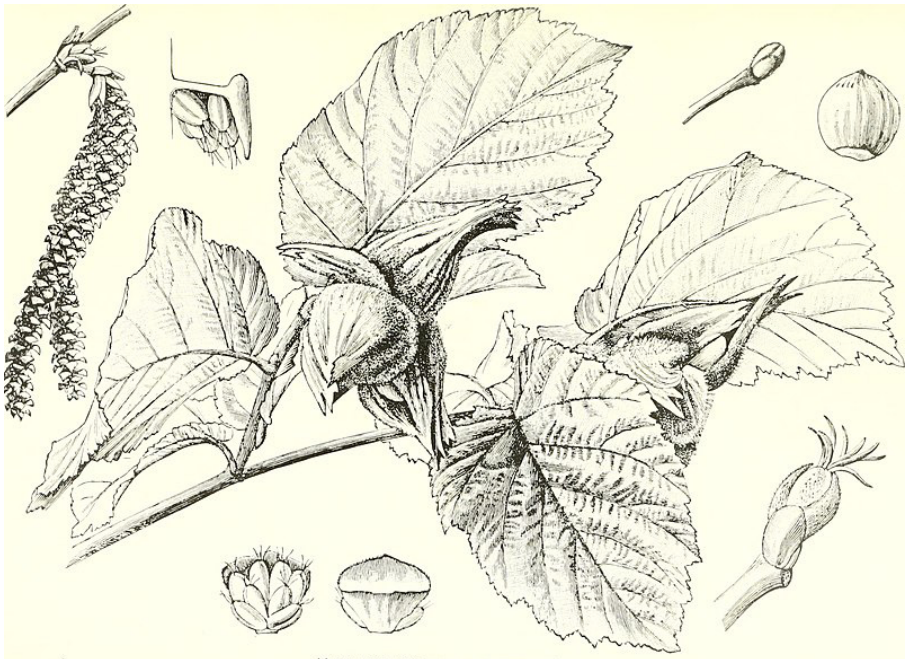


Beaked Hazelnut
K'vn
Corylus cornuta

Wetlands
Lesson 3

My Pack Basket:
How Wetland Plants Are Used For Fiber

MAKING FIBER CORDAGE

Directions:

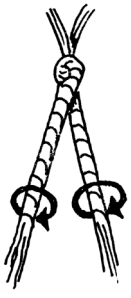
Materials Needed

- one-foot section of two-ply twisted natural twine (jute, sisal, or hemp)
- plant fibers—cattail is one of the easiest to identify and find, Stinging Nettle, Rush and Tule can also be used.

1. Get a feel for cordage by investigating a piece of readymade twine. Observe the twisting pattern. Unravel it slowly and note how the cord twists as you pull it apart. Look for the direction of the twist. If you stop pulling the twine and give it slack, it will most likely re-twist slightly. The twisting motion is what holds the twine together and makes it strong. Most twine is made by machines. Your early cordage attempts will not be as uniform, but with practice your skills will improve.

2. Prepare your plant fibers. Remove extra leaves, seed heads, or outer bark. Plant fibers will need to be free from chafe and pithy interior materials. Roll or rub the fiber by hand, or lightly pound it with a rock to divide the fibers. Divide larger leaves such as cattails by standing on the leaf tip and pulling the ends apart, making several smaller strands out of one leaf. Prepare fibers of uniform size to produce a higher quality product. Green fibers can be used soon after collecting but may shrink when dried. If working with dry fibers, wrap them in a damp towel to make them pliable. For dry cattails, soak them about 15 minutes before working; other types of fibers may need longer soaking times.

3. Take 2 strands of different lengths and tie them together with a knot in one end. This makes it easier to add new materials as you add to your cord.



4. Have a partner hold the knot or clip it to a stationary object to hold while you are twisting. Take a fiber strand in each hand about 6" from the knot. Twist both strands tightly to the right.

5. Once you have the two strands twisted, pass your right hand over your left and switch the bundles in your hands. This will produce the double twist.

6. Continue twisting the individual strands to the right for another 6" and cross your hands again, right over left and switch bundles. Continue in this pattern to make your cord as long as needed. Make sure you are always twisting and crossing your hands in the same direction.

7. When you come to the last 3-4 inches of your fiber strand, you will need to splice in a new fiber piece to continue. Overlap the thinnest end of the new fiber with the old, and just twist the two together as you work.

8. You may end up with some fiber "hairs" sticking out but these can be trimmed off when you are completed. If you staggered the ends of your initial fiber these spliced joints will come at different spots on your cord.

9. When your cord reaches your desired length, end by tying an overhand knot including both ends.

10. Use your cordage to tie things together, make a handle for a basket, or add beads and turn it into a friendship bracelet.

Resources:

- Wilkinson, Charles. *The People are Dancing Again.* University of Washington Press, Seattle, WA. 2010.
- Native American Cordage: http://www.nativetech.org/cordage/ by Tara Prindle, 1994. The website of Native American Technology & Art.
- Cordage and other basketry directions: http://basketmakers.com/topics/tutorials/cordagea.htm

Wetlands
Lesson 4

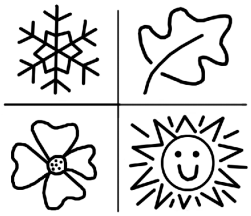
Ecosystem Services of Wetlands

"I pray that this message will go to all people, to be able to teach their children and their children's children, not to make a garbage dump out of rivers and streams. We need to start cleaning it up. Those swimmers in the water, they have the right to live just the same as anything else."

—Agnes Baker Pilgrim, Siletz Tribal Elder

Time Estimate:

1 hour



Best Season:

Any- Indoor classroom with a sink

Overview

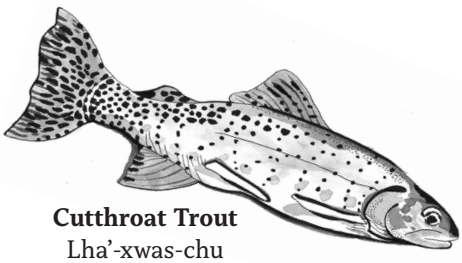
Students learn about the ways that wetlands filter water and reduce the risk of flooding by doing a science experiment using common kitchen items and natural materials.

Preparation

- Depending on the amount of materials available to you and the number of students, you can either do the experiment as a class, or in several small groups. Decide this beforehand because it will determine the amount of materials you need.

Learning Objectives

- Perform an experiment to find which natural materials are more effective at preventing flooding.
- Use an experiment to demonstrate how freshwater wetland soils and plants can filter water.



Cutthroat Trout
Lha'-xwas-chu
Oncorhynchus clarkii

Materials

Each experiment will need:

- Kitchen sieve, strainer, or colander
- Cheesecloth, burlap, or any other loosely woven fabric
- 2 large clear glass or plastic bowls that can hold 2 liters of water
- Scale- a digital scale that can weigh in grams is preferred
- 4 cups of Sphagnum or Peat Moss (can be found in the gardening department of most department stores)
- Sod (Can be dug up with a shovel from a field or lawn)
- Sand
- Gravel
- 2 liter plastic bottle full of dirty, turbid water (Make by mixing 1/2 cup sand, dirt, leaves, etc.) Have enough mix to fill each bottle four times.
- 1 data collection sheet for each student
- 1 instruction sheet for each group
- Stopwatch & timer

Vocabulary

English	Dee-Ni
Turbidity	Sand: Lhtr'vsh
Sphagnum Moss	Moss: Mvs-na
Hydrology	Gravel: Naa~-k'vt
Aquifer	Cloth: Lhchvms
Evapotranspiration	Dirt: 'Ee
Recharge	Flooding: Taa-naa~-ya

Next Generation Science Standards

This lesson meets the following 6th Grade standards:

MS-LS1-1 Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation.

MS-ESS2-6 Develop and use a model to describe phenomena.

MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by the force of gravity.

Wetlands
Lesson 4

Ecosystem Services of Wetlands

Background Information

Hydrology is the scientific study of the movement, distribution, and quality of water in relation to the land. Hydrologists have determined that wetlands store water, control floods, recharge and discharge groundwater. Wetlands provide a myriad of services to their entire ecosystem and its inhabitants, including humans. Wetland ecosystems provide a very high amount of ecosystem services in comparison to other ecosystems. Here are the main ecosystem services that wetlands provide:

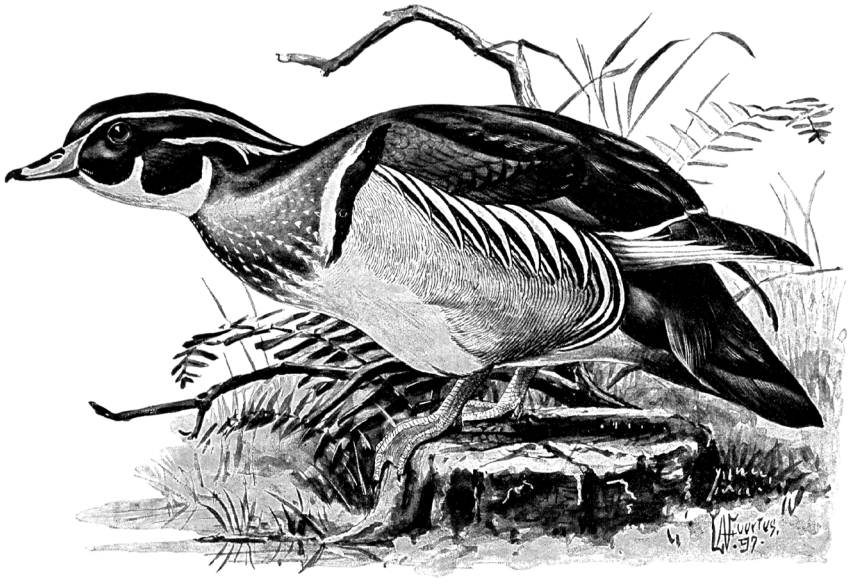
- Wetlands contribute to good water quality by filtering out and trapping pollutants and sediments. They absorb heavy metal pollutants like lead, cadmium, and copper. They also reduce biological pollutants in sewage and stormwater runoff. All of these function to lower the **turbidity** of water. **Turbidity** is the measure of cloudiness of water due to the presence of suspended particulates. The lower the **turbidity**, the higher the water quality.

- Plants in wetlands act as filters or nets to trap pollutants and sediment from the air and ground, cleaning tributary flows before they reach **aquifers** and rivers. These plants, especially **sphagnum and peat moss**, also act as important carbon sinks, which is a factor in combating climate change. Wetland plants also contribute greatly to the water cycle through **evapotranspiration** (evaporation + water loss by transpiring plants).

- By retaining and absorbing water into the ground, wetlands act as natural flood prevention systems. Wetlands function as a natural sponge by slowing down water before it flows into rivers, which reduce flooding from storms and acts as a reserve during droughts. This water absorption also results in a gradual release of water that refills, or **recharges aquifers** (ground water).

- Wetlands provide one of the most productive and diverse habitats in the world, supporting a wide range of plant and animal biodiversity. Wetlands are the major habitat for most of the world's water birds and are a key habitat for migratory bird species. Almost all of the world's water birds use wetlands as feeding and breeding grounds.

- Wetlands provide great opportunities for recreational activities including hiking, fishing, bird watching, and photography.



Wood Duck
Ch'ash
Aix sponsa

Wetlands
Lesson 4

Ecosystem Services of Wetlands

Teacher Directions

1. Begin this lesson with a short discussion. Ask the students: What are some benefits of wetlands? How do you think wetlands effect flooding? How do you think wetlands effect water quality?
2. Tell the students that today they get to be scientists and are going to do a science experiment to research these questions using data they will be collecting. Hand out a data sheet to each student.
3. Depending on the amount of materials available to you and the number of students, you can either do the experiment as a class, or in several small groups.
4. If done as a class, put all the materials in view of the students on a table at the front of the classroom. You can perform the procedures yourself, or ask for student helpers. All of the students not helping with the procedures should be collecting data on their data collection sheets. See the Experiment Procedures page for further directions.
5. If you are doing the experiment in small groups, divide the class up into groups of 3-5, depending on the amount of materials at hand. Distribute the materials to each group in addition to one Experiment Procedures sheet for each group, and one data collection sheet for each student. Once the students are all set up, you can rove from group to group to assist and answer questions.
6. Analyze and discuss the results of the experiment with the class. If the experiment was done in small groups, compare the data for differences and similarities. Write the results on the white board, or create a spreadsheet and bar graph to display with a projector for the whole class to see. Here are some questions to guide the discussion:
    - Which materials held water best?
    - Which materials filtered the water the best (i.e. resulted in the lowest water turbidity)?
    - Which materials would most likely be found in a wetland?
    - How do wetlands help to prevent flooding and filter water?
    - What would happen if there were no wetlands to filter water?
    - Why do you think having wetlands along a river helps to keep that river flowing in the summer?

Salmon
Lhuk
Oncorhynchus sp.

Wetlands
Lesson 4

Ecosystem Services of Wetlands

IN THE FIELD!

Bring a water quality testing kit on a field trip to a local wetland and test the water's turbidity, temperature, pH, flow, and dissolved oxygen. Water quality can also be tested by doing a survey of the aquatic macroinvertebrates present, since some of them are very sensitive to pollution. Contact your local OSU Extension office for kits of materials for conducting these field experiments.

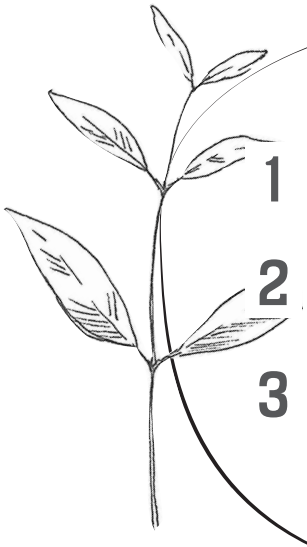
SCIENCE INQUIRY

Find a map of the closest freshwater wetland using the online National Wetland Inventory (NWI) https://www.fws.gov/wetlands/data/mapper.html

Identify possible nearby sources of potential pollution or contamination: agricultural, urban, industrial, silvicultural (tree farming). Where might pesticides and herbicides be sprayed nearby? How do wetlands function as a water filter? Are there any threats to local wetlands from development, sediments from logging or other sources?

Reflection

How do wetland plants help filter pollutants from the water? Why are wetlands crucial for preventing flooding? What kind of wetland do you think would be best at filtering water or preventing flooding: bog, swamp, marsh, or fen?



Assessment

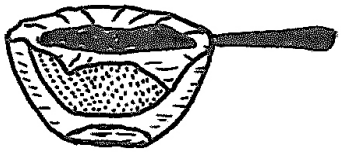
1. Which natural material soaked up the most water in the experiment? Why?
2. Which material filtered water the best? Why?
3. What other natural materials would be good at absorbing and filtering water? Why?

Resources

- Slattery, Britt Eckhardt. *Wow! The Wonders of Wetlands: an Educators Guide.* Environmental Concern Inc., 2003.
- Discover Wetlands. 1995. WA Dept. of Ecology. https://fortress.wa.gov/ecy/publications/documents/8816a.pdf
- *Project WET Curriculum and Activity Guide.* 1995. Project WET, 301 N. Willson Ave. Bozeman, MT 59715. projectwet.org
- Lesson 2: Nature's Water Filter. 2016 SEA NOAA Pacific Services Center. https://coast.noaa.gov/data/SEAMedia/Lessons/G5U2L2%20Natures%20Water%20Filter.pdf

Wetlands
Lesson 4

Ecosystem Services of Wetlands



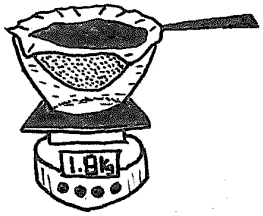
–Experiment Materials–

- Kitchen sieve, strainer or colander
- Cheesecloth, burlap, or any other loosely woven fabric
- 2 large clear glass or plastic bowls that can hold 2 liters of water
- Scale- a digital scale
- 4 cups of Sphagnum or Peat Moss
- Sod
- Sand
- Gravel
- 2 liter plastic bottle full of turbid water (mix with 1/2 cup sand, dirt, leaves, etc) Have enough materials to fill each bottle four times.
- 1 data collection sheet for each student
- 1 instruction sheet for each group
- Timer or clock

–Experiment Procedures–

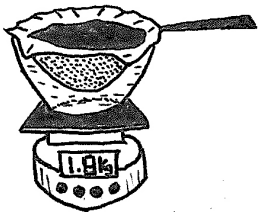
1. Place the cheesecloth (or muslin, burlap, etc.) inside of the kitchen strainer so that it lines the entire inside of the strainer and can be folded over the edge. The strainer and cloth represent layers of soil that filter and slowly release water from wetlands.
2. Set the strainer and cloth inside of a large clear glass bowl to make a "Wetland Tester." The bowl represents an **aquifer** (underground water deposit), and the glass will allow you to see and measure the **turbidity** (cloudiness) of the water once it has passed through the various materials.

3. Weigh out your sample of sphagnum moss, and write this as weight "A" on your data sheet. It is important to start with the Sphagnum Moss since it is the lightest, and go through the order of sod, sand, and gravel after that. When weighing each material make sure each sample weighs about the same amount.



4. Place the sphagnum moss sample into the wetland tester and weigh all of them together on your scale. Write this weight on your data sheet as weight "B."
5. Take the 2 liter bottle of water and make it cloudy (turbid) by adding 1/2 cup sand, dirt and/or leaves. Put the cap on the bottle and shake it up to mix in the materials that you added.
6. Slowly pour the water from the bottle onto the sphagnum moss inside of the wetland tester until the bottle is empty or the bowl is full, whichever comes first. Use a timer or clock and let the wetland tester and moss sit in the water for two minutes.
7. Lift the strainer out of, and above the bowl and allow it to drain until there is only a slow dripping. Do not squeeze any water out of the moss or stainer.

8. In the turbidity column "C" of your data sheet describe in detail how cloudy (turbid) or clear the water in the bowl is. Descriptive words you can use: totally clear, pretty clear, slight color to the water, somewhat turbid, light brown, muddy, bits of stuff floating, etc. If you have a turbidity meter, you can use that to be more accurate.
9. Once the strainer has reached the slow drip stage, pour the water into a sink or outside.



10. Weigh the wetland tester and moss again. Record this as weight "D" on your data sheet.
11. Rinse off the strainer and cloth, and then put them back into the bowl.
12. Find out how much water each material held by subtracting the dry weight "B" from the wet weight "C." Write down the weight of the water in column "E." Soaked sample weight - dry sample weight = weight of water
13. Repeat steps 3-11 for each of the other materials: sand, sod, and gravel.

14. Organize and display your results with a bar graph, comparing dry weight with wet weight, and turbidity for each material.
15. Discuss the results of your experiment with your class.

Wetlands
Lesson 4

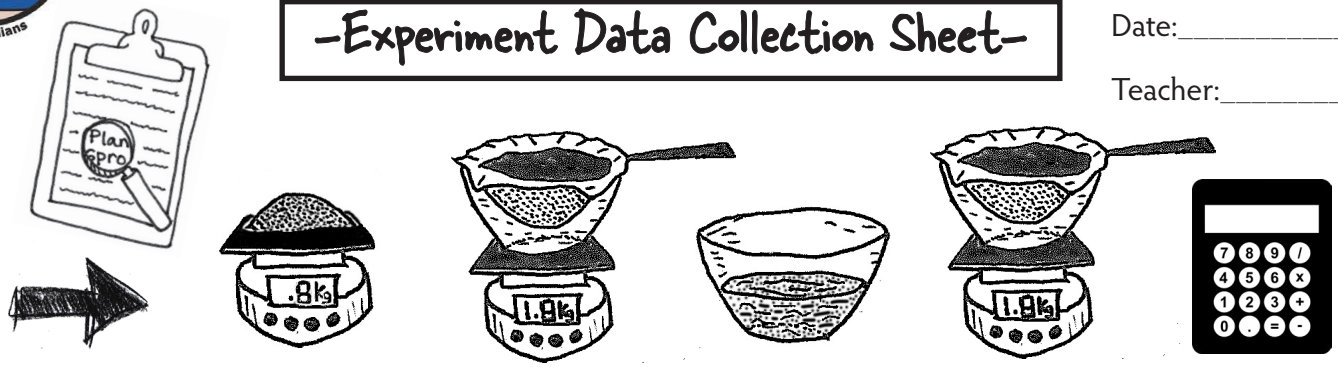
Ecosystem Services of Wetlands

Name:_____

Date:_____

Teacher:_____

-Experiment Data Collection Sheet-



Material	A. Weight of Dry Material (These should be the same)	B. Weight of Material and Wetland Tester (dry)	C. Describe the Turbidity of water in the bowl	D. Weight of Material and Wetland Tester (wet) *	E. Weight of Water Absorbed by Material (D-B)
1. Sphagnum or Peat Moss					
2. Sod					
3. Sand					
4. Gravel					

*Keep the Wetland Tester and Material in the bowl of water for 2 minutes.

- Which of these materials would most likely be found in a wetland?_____
- Which material absorbed the most water? (highest number in column E):_____
- Based on your data in column E, do wetlands increase or decrease flooding?_____
- Which material filtered the water best? (clearest water in column C):_____
- Based on your turbidity data, do wetlands filter or contaminate water?_____

Use the data you collected above to make a vertical bar graph on the following page.

Wetlands
Lesson 4

Ecosystem Services of Wetlands

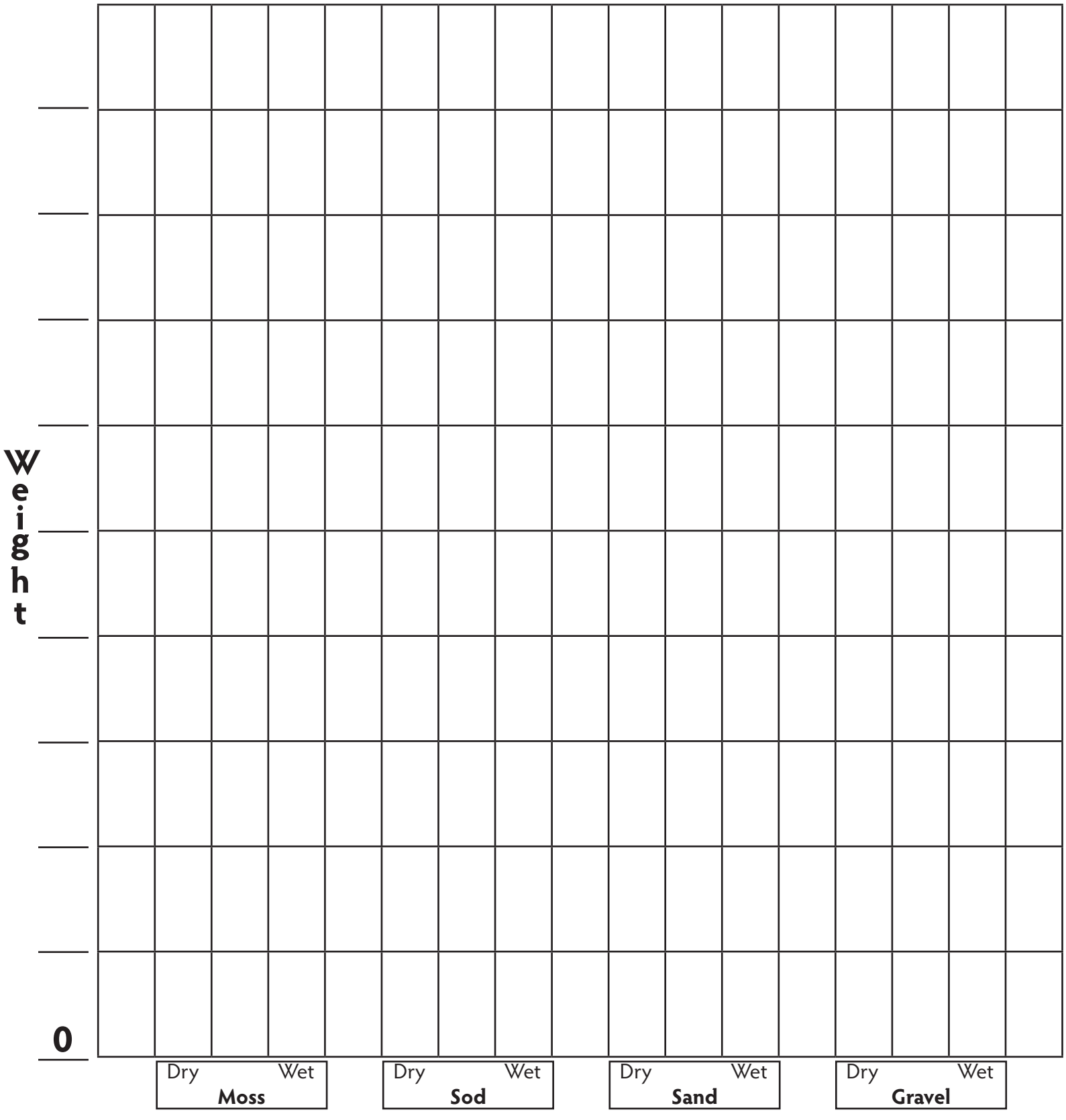
-Experiment Data Vertical Bar Graph-

Name:_____

Date:_____

Teacher:_____

Use the data from your Experiment Data Sheet to shade in the weight for each material, dry and wet. Add numbers to the horizontal lines depending on the weight measurement used. Make an "X" next to the measurement used: Ounces_____ Kilograms_____ Grams_____



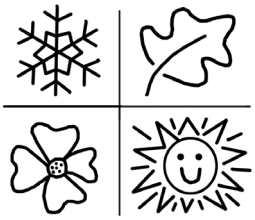
Material- Dry vs. Wet

Wetlands
Lesson 5

Designing a Wetland Restoration Plan

"We're being a voice for the voiceless. Mother Earth is calling us back. We're covering her face with concrete. We're polluting her waters with garbage. Enough is enough. When the trees and water are gone, how can the world banks manufacture money?"
-Agnes Baker Pilgrim, Siletz Tribal Elder

Time Estimate:
60-90 minutes



Best Season:
Any- indoor classroom

Overview

This lesson introduces the basics of wetland restoration through exploring restoration concepts, terminology, and methods. Learn about common restoration tools and weigh the trade-offs land managers juggle when planning a restoration project. You will work as part of a team using design principles to plan, budget, and market a restoration plan to the Siletz Tribal Council.

Learning Objectives

- Define habitat restoration terminology.
- List several restoration tools.
- Apply design skills to create a habitat restoration plan.
- Practice persuasive writing skills by submitting a written habitat restoration proposal.

Materials

- budget worksheet
- site map
- tracing paper for overlays
- colored pencils
- Internet connection and screen to play videos.

Preparation

- Introduce wetland & wapato restoration with these videos about the Yakama Nation's wetland restoration projects: "Restored Wetland Brings Wapato Back to Yakama Nation" https://youtu.be/GEF6BNNExHg and "Return of the Wapato" https://youtu.be/J2LiaKkas4w
- After the videos have a class discussion: brainstorm what it means to restore a native wetland ecosystem, and have the class formulate a definition of "restoration". Discussion questions: What are some causes of wetlands degradation and/or loss? Why is wetland restoration important? What part do humans play in restoration? Can restoration happen naturally? How and when? When is restoration complete? Define these words with the students: reclamation, mitigation, reintroduction, conservation, degrade, disturbance, native, non-native, and invasive species.

Vocabulary

English
- Restoration
- Disturbance
- Reference Ecosystem
- Reintroduction
- Rehabilitate
- Reclamation

Dee-Ni
- Habitat: St'lh-xat-dvn
- Controlled burn: Xaktlh-nvt
- Species: Dan'-dee-ne
- Weed(s): Xvm-srvn'
- Tool(s): Yvlh-naa-dvtlh-nvsh
- Seed(s) : See-'e'

This lesson meets the following Next Generation Science standards for 6th Grade:

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Math 6.NS Compute fluently with multi-digit numbers and find common factors and multiples.

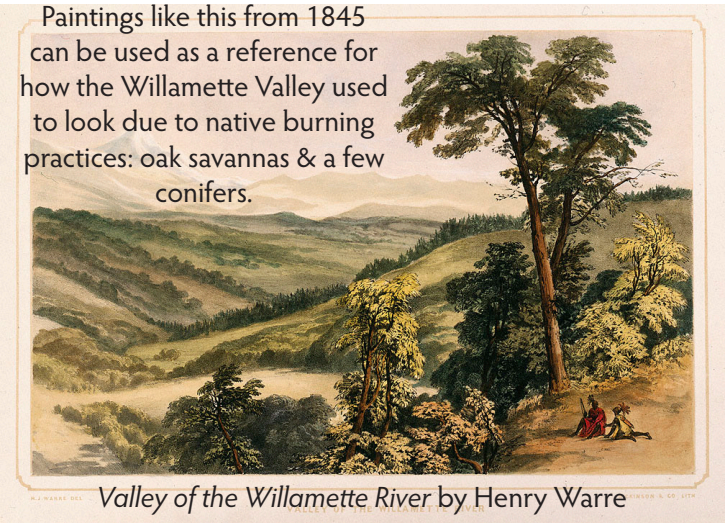
MS-ETS1-1 Define the criteria and constraints of a design problem with to ensure a successful solution, taking into account scientific principles and potential impacts on people and the natural environment.

Painted Turtle
Ts'ee-nntelh
Chrysemys picta

Wetlands
Lesson 5

Designing a Wetland Restoration Plan

Background Information



Valley of the Willamette River by Henry Warre

Wetland Degradation and Loss facts:

53 percent of the wetlands in the United States have been lost since the 1700s. The United States loses about 60,000 acres of wetlands each year. In Oregon, 38 percent of wetlands have been lost (Dahl, 1990). Losses for particular rare wetland types such as wet prairie or peatland in the Willamette Valley range from 99.5 to 98 percent, respectively. Many wetlands are lost through urbanization and direct fill for development. Unfortunately, this removes wetlands from locations where the functions they provide might have the most value for humans, fish and wildlife.

Invasive species, such as reed canarygrass, purple loosestrife, and Japanese knotweed, invade and degrade wetlands. They do this by displacing native plants, reducing plant community diversity, reducing sources of food for wildlife, and altering water flow and storage function. Invasive, non-native carp, and bull frogs can impact wetlands by consuming important native plants and fish.

Habitat restoration goes beyond protecting or preserving land and natural resources. Through the use of a wide variety of techniques and tools, restoration ecologists are learning to return degraded land to a condition that resembles its pre-disturbance state in both community structure and function. If available, a **reference site** is used as a model for restoring another ecosystem. The reference site has more intact ecological processes, higher functionality, more complex structure, and greater diversity than the system to be restored.

The Society for Ecological Restoration (SER) International defines **habitat restoration** as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed"(SER 2004). Many aspects of restoration are debated amongst scientists and on-the-ground practitioners in the habitat restoration community. Therefore, when planning restoration treatments, project managers must first know and understand what the "desired condition" is that they are trying to achieve. Can we really restore an ecosystem to a state that existed hundreds of years ago and do we even have the necessary data to do so? Since ecosystems are constantly changing through the process of succession, what stage of succession should a restoration project strive to reach?

Should ecological conditions in Oregon be restored to mirror exactly what they looked like before Euro-American settlement, and is that even possible? What financial limitations or constraints need to be considered or how big does the project need to be to make an impact? These are some of the questions that land managers and restoration practitioners face and must address while planning a restoration project.

The charts on pages 46 & 47 include some restoration tools land managers use to accomplish restoration objectives. This is not an all-inclusive list, but it covers many commonly used restoration tools. Use the information in the chart to hel guide your own decisions as you work through your restoration plan.


Work crew getting ready to plant native plants at a restoration site on the Siletz reservation.

Designing a Wetland Restoration Plan

Background Information, continued

Agnes Baker-Pilgrim, Siletz Elder, lights a prescribed burn of Camas Prairie with a drip torch.

Siletz Land Stewardship & Restoration Practices

Siletz tribes historically used fire as a tool to aid plant cultivation and gathering, and in hunting. Tribes traditionally used fire: in hunting drives to concentrate deer, making them easier to hunt; to clear underbrush from around oak and hazel trees in order to increase nut production; to stimulate berry and root production, especially in the once extensive camas prairies; to gather insects, particularly grasshoppers; and to prune willow and hazel trees for basketry materials. These controlled burns also promote deer and elk habitat, and reduce the amount of conifers, thus maintaining oak savanna ecosystems. The fires were started in the late summer, and early fall before the first rains came to put them out (Boyd, 1999).

The Confederated Tribes of Siletz Indians (CTSI) still practice controlled burning as a restoration tool to increase food and fiber plant production. CTSI has worked with several different non-profit organizations and government agencies to perform controlled burns on various sites in Western Oregon. One example of this is the Camas Prairie Restoration Project, a collaboration with CTSI and the Confederated Tribes of Grand Ronde, BLM, Oregon State University, Lane Community College, Youth Conservation Corps, Linn County Sheriffs' Correction Crews and the USFS Sweet Home Ranger District. This project focused on restoring a 14 acre parcel of fallow ranch land back to a native wetland prairie. The project began with the re-introduction of fire. Tribal fire crews cut down encroaching ash trees and later burned the site. Then Lane Community College students, tribal members, and volunteers collected tens of thousands of camas seeds in order to reseed after prescribed fires. Some of the seed was planted at a private nursery to be grown out and replanted at Camas Prairie.

Camas Prairie has been burned every two years and seeds have been collected yearly with remarkable success. Since the restoration project began, camas plants have almost tripled in number and invasive plants have decreased by half. Other native species have been reintroduced to the site such as native tufted hairgrass, meadow barley, western red cedar trees, and hazelnut.

In 2016 CTSI, with a grant from the Oregon Watershed Enhancement Board, acquired a 125-acre parcel of Siletz ancestral territory called Fivemile Creek. Restoration plans for the site focus on creating and protecting coho salmon habitat and include removing two dikes, adding large woody debris to the wetlands, and restoring traditional native food & fiber plants.

CTSI is also working with the Wetlands Conservancy to preserve cultural customs specific to wetlands by conserving and restoring wetlands of the Siletz and Yaquina Basins. These cultural customs include harvesting basketry materials and traditional food plants (like camas) found in wetlands. Combining traditional cultural knowledge with modern conservation & restoration planning is a new and innovative approach.

The mouth of Fivemile Creek upstream of where it flows into Tahkenitch Lake, Siletz ancestral wetlands.

Wetlands
Lesson 5

Designing a Wetland Restoration Plan

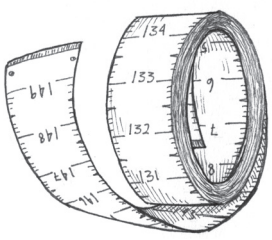
Student Directions

Watch these YouTube videos: https://youtu.be/GEF6BNNExHg **"Restored Wetland Brings Wapato Back to Yakama Nation,"** and https://youtu.be/J2LiaKkas4w **"Return of the Wapato."**

Discuss the videos with your class. This activity will teach you how to restore a nearby wetland on Siletz Tribal land to increase native food and weaving plants like wapato, cattail, soft rush, and willow and to improve wildlife habitat.

Practice Restoration Scenario: A local landowner recently donated a ten acre rural property to the Confederated Tribes of Siletz Indians. The Siletz Natural Resources Department wants the land restored back to a wetland to enhance habitat for native food, weaving plants, and wildlife. The previous owner drained the wetland for farming, and it is currently a mixture of non-native grasses and invasive weeds. The site was historically a wetland that was used by Siletz tribes for harvesting wapato, cattail, willow, and soft rush. The topography is a combination of upland and lowland that is bisected by a standing or slow moving water course during the wet season.

1. Work in teams of 2-4 students to create a restoration plan. The restoration goal for this scenario is to restore the land back to a wetland to enhance habitat for native food, weaving plants, and wildlife. Imagine that your plan will be submitted to the The Siletz Natural Resources Department as a bid proposal to do the actual restoration work. The plan needs to cover the first year of work including site preparations, restoring natural vegetation, and monitoring. You need to balance the restoration goals, current conditions at the site, environmental concerns you identify, and the costs of your project. Use the information in the **Examples of commonly used restoration tools** chart on pages 46 & 47 to help guide your decisions, and then fill in the **Wetland Restoration Plan** worksheet with the tools you want to use. There is no single right answer or approach to this project.
2. Make a project budget using the **Wetland Restoration Plan** worksheet and the **Wetland Restoration Plan Budget** worksheet. Keep in mind the individual rate sheet units and the size of your site. Remember that the costs are generally per acre and you are working at a ten acre site. Give an itemized cost for each restoration tool used and calculate the grand total cost for the entire project.
3. Use the example site map to help **design your own unique site map** to accompany your restoration plan. The map must have a compass rose, and a key with symbols to identify topography, current plants, water, neighboring housing, and labels or symbols for where you will use your proposed restoration tools (mowing, burning, planting, herbicides, etc.) Refer to the list of **Western Oregon Native Plants and Their Uses** to decide what plants to add to the site. Make a symbol for each plant species, and draw those symbols on the map where they will be planted.
4. Present your restoration plan and map to the rest of the class, who will pretend to be the Natural Resources Department. Each presentation will be voted on and given feedback. The plan that best meets the restoration goal will be considered the winning bid.



Wetlands
Lesson 5

Designing a Wetland Restoration Plan

Examples of commonly used restoration tools

Restoration Tool	Explanation	Benefit	Challenges
Part 1: Planning—Long term success of restoration			
Conduct baseline inventory	Describe current conditions, create list of plant and wildlife species present, note dominant species & rare species	Needed for long term comparison	Can be costly when inventorying a large site
Pick a model or reference ecosystem (What is the desired future condition?)	Study a nearby habitat to act as a model of what the restoration is attempting to achieve	Planning tool for species composition	Possibly no similar sites nearby to use as reference
Use historical data	Search original land surveyor records or explorer's journals to learn about the site's historical conditions	Information can give an overview of the major species present prior to development changes	Records may be difficult to locate, hard to read, incomplete
Create master plan	Write a plan to guide each step of the restoration	A document that all parties can use to guide activities	Plan needs to be kept current with modifications, timetable and monitoring data
Part 2: Restore historical topography and hydrology			
Earthmoving	Large machinery to restore historic topography	Restore natural hydrology	Disturbs soils, may interfere with native plants and wildlife
Drain tile removal	Remove drain tile, ditches, and culverts	Restore natural hydrology; most common at wet sites	May affect neighboring property & local flooding
Dam or water diversion removal	Take out earthen dams and swales that restrain or channel water	Restore natural hydrology	May affect neighboring property & local flooding
Part 3: Site Prep—Control unwanted vegetation (encroaching trees/shrubs, invasive species, other unwanted plants), open areas for planting, reduce competition for seedlings and transplants			
Hand pulling, digging, or cutting	Manually pull, dig, or cut out individual plants.	Good control for small infestations, generally low impact	Labor intensive, may disturb the soil
Herbicide	Chemical control through spot spraying (individual plants) or broadcast spraying (large infestations)	Good for large areas, fast, relatively inexpensive	Leaves chemical residues in soil and water, timing is crucial for application, need chemical applicators license, spray can drift off property, not suitable near water, can have negative effect on pollinators and wildlife
Mowing	Cutting vegetation close to ground level	Prevents plants from producing seed, good control of annuals	Weather or terrain may not be suitable, correct timing essential, repeat mowing will be necessary
Prescribed burning	Low intensity, controlled burn of ground level vegetation	Mimics historic disturbance regime, encourages growth of grasses and flowering plants, discourages shrubs and trees	High cost, permits required, specialized equipment and trained staff needed, weather can be an issue
Part 4: Restore Natural Vegetation—Seeding			
Local seed collection	Hand collect seed from plants at your site or nearby areas	Seed source is well adapted for your site	Labor intensive; plant I.D. and seed collection knowledge needed.

Designing a Wetland Restoration Plan

Examples of commonly used restoration tools (continued)

Restoration Tool	Explanation	Benefit	Challenges
Part 4: Restore Natural Vegetation—Seeding (continued)			
Regional seed collected	Purchase seed grown for regional restoration projects	Genetics similar to the plants native to the region	Locating the needed seed may be difficult or impossible
Plant propagation	Start and grow plants from seed, then transplant to restoration site	Gives more control over seed source and quality of material, plants available when needed	May require greenhouse, specialized seed starting knowledge, time to care for plants
Plant relocations	Move plants from local areas slated for development	Saves plants that might otherwise be destroyed; ensures local plants are used	May be labor intensive, and can only occur at certain times of year
Transplant plugs	Purchase small plants in small rocket-shaped pots	Relatively inexpensive, good availability, efficient to plant	More expensive than seeding, plants are small
Transplant bareroot plants	Purchase started plants for planting when dormant	Relatively inexpensive, easy to plant	Need to be planted when dormant, weather & accessibility issues
Transplant potted plant materials	Purchase well-rooted plants in pots of larger sizes	Established plants	Relatively expensive, will probably need watering for first year
Natural re-establishment of native plants and wildlife	Allow native plants and animals to recolonize on their own. Often native animals return after native plants and food sources have been reestablished.	Inexpensive, uses local seed source, Useful at sites with a minimum of destruction to be repaired.	Slow, leaves areas open for establishment of invasive plants
Part 5: Monitoring—Evaluation			
Mapping	Create a data library. Maintain map of site plantings, locate invasive problems, can use GPS	Guides restoration, essential in communicating with partners	Need to keep updated with changes over timetime
Photo points	Photos taken from permanently marked fixed points (e.g., a fence post) regularly for long term monitoring	Time saving, general view of restoration, easy to duplicate, inexpensive, gives good overview of changes to site	Gives only a general overview, no specific numerical data, limited use when following specific plant populations
On the ground data collection	Counting (sampling, percent cover, complete counts)	Can give more detailed information, good for tracking specific plant populations	Labor intensive, costly
Part 6: Long Term Maintenance—Simulating natural disturbance cycle and controlling problem species			
Prescribed burning	Low intensity, controlled burn of ground level vegetation, used in grassland and prairie restoration	Mimics historical disturbance regime, encourages growth of grasses and flowering plants, discourages shrubs and trees	Expensive, permits required, specialized equipment and trained staff needed, can only occur under correct weather conditions
Mowing	Uses large machinery to limit height of vegetation or prevent invasive plants from setting seed.	Replace disturbance regimen to control unwanted vegetation.	Equipment can spread weed seeds from other sites, cut material may accumulate over time and require removal
Livestock grazing	Run cattle, sheep, goats, or other livestock for part of the year, used in prairie restoration	Can control height of vegetation, browsers (goats) can target brush or grazers (cows, sheep) can target grasses	Animals may feed indiscriminately on all plant material, overgrazing can be harmful, trampling of sensitive species, uncontrolled access to water can denude stream banks, may spread exotic and invasive species

Designing a Wetland Restoration Plan

Wetland Restoration Plan Worksheet

Team Member Names:_____

Site Name:_____

Date:_____

Site Size: 10 acres

Restoration Goal: Restore the land back to a wetland to enhance habitat for wildlife, and native food and fiber plants.

Directions: Use the **Examples of commonly used restoration tools** charts on pages 46 & 47 to decide what tools your group wants to use on its restoration site. For each of the six parts, write which tool or tools you want to use in the blank space provided. When you are done deciding on what tools to use, fill out the **Wetlands Restoration Plan Budget** worksheet to find out what the cost will be. You may then make changes to both worksheets if you would like to change the total cost of your project. Use the Plan Proposal section of this worksheet, or another sheet of paper to write out your oral presentation to present your restoration plan and map to the rest of the class.

-Restoration Tools-

Part 1: Planning- Long term success of restoration_____

Part 2: Restore historical topography and hydrology_____

Part 3: Site Prep- Control unwanted vegetation_____

Part 4: Seeding- Restore natural vegetation_____

Part 5: Monitoring - Evaluation_____

Part 6: Long term maintenance_____

Plan Proposal:

Designing a Wetland Restoration Plan

Wetlands Restoration Plan Budget

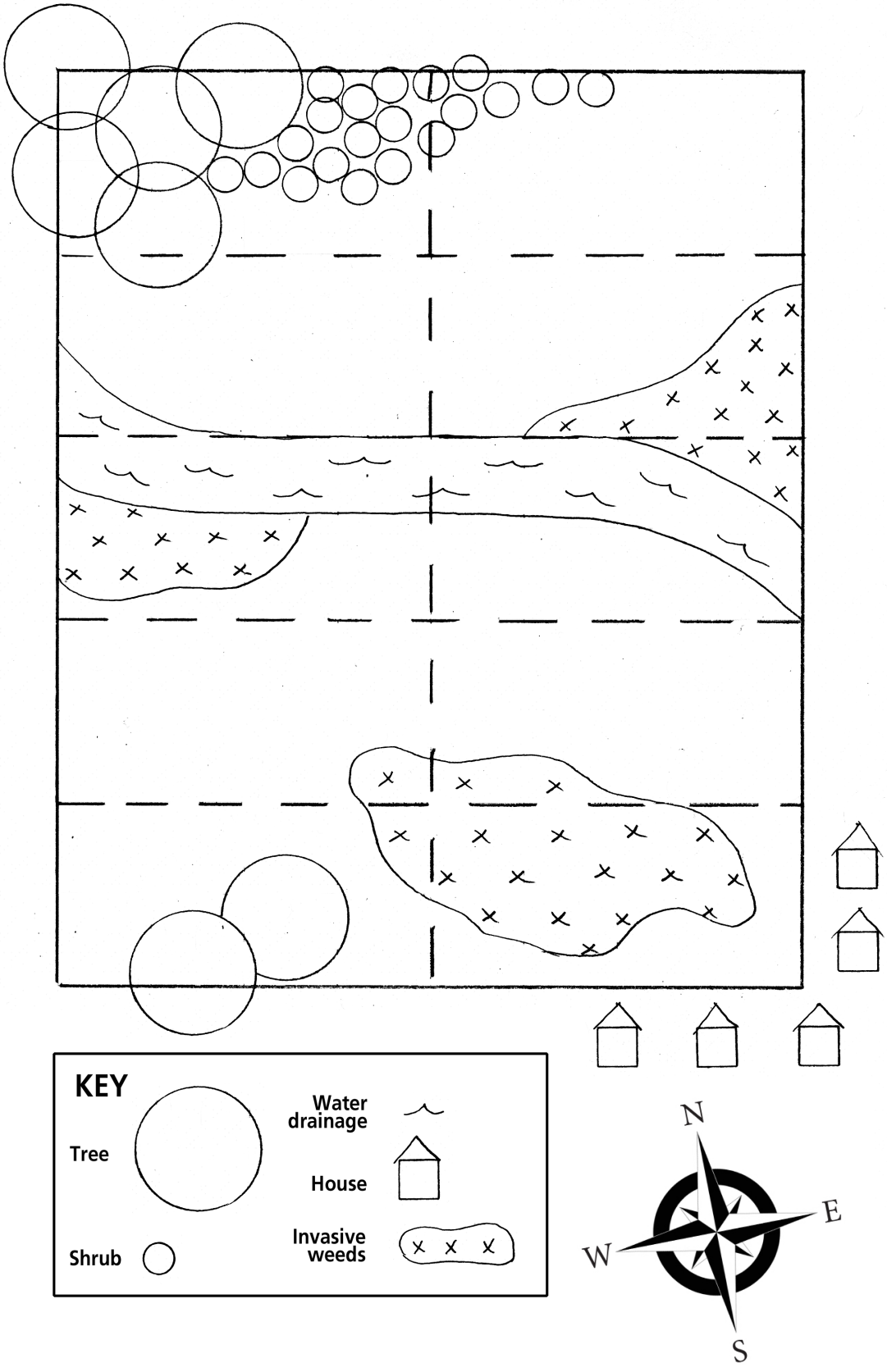
Team Member Names:_____**Date:**_____

Site Name:_____**Site Size:** 10 acres

Possible Restoration Tool or Activity	Cost/Unit	# Needed / Area to Implement	Total Cost
Prescribed burn	$400 per acre		
Brush clearing (mechanical)	$91 per acre		
Spot spray herbicides	$61 per acre		
Broadcast spray herbicides- need to be aware of drift issuses close to water and housing.	$55 per acre		
Hand pulling	$100 per acre		
Tractor work (seeding, mowing)	$75 per acre		
Plug planting (100 plugs per hour)	$50 per hour		
Grass seed (rate of 5lbs/acre)	$25 per lb.		
Wildflower seed (forbs) (rate of 3-5lbs/acre)	$1,000 per lb.		
Grass & grass-like plug (1210/acre at 6 ft. spacing)	$0.45 per plug		
Wildflower plug (forbs) (1210/acre at 6 ft. spacing)	$1.40 per plug		
Monitoring- 1 hr for photo point, 8hrs for sampling, 24 hrs for complete count.	$75 per hour		
		TOTAL:	

Designing a Wetland Restoration Plan

Example Map – 10 acre site



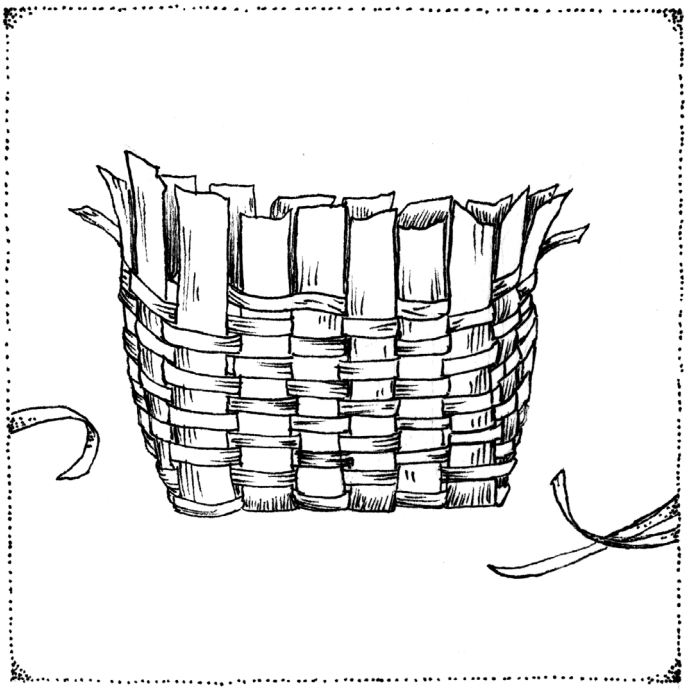
Designing a Wetland Restoration Plan

Western Oregon Native Plants and Their Uses

Food plants:

- berries—black, black-cap, blue, currant , elder, huckle, salal, salmon, strawberry, thimble, manzanita, three-leaf sumac, gooseberry
- camas bulbs
- crabapple
- black and white acorns
- chokecherries
- hazelnuts
- yampah root
- miner's lettuce leaves
- ponderosa pinenuts
- tarweed seed
- wild celery seeds
- wild parsley roots
- wild sunflower seed
- skunk cabbage roots—a famine food
- cow parsnip young shoots
- Sego lily bulbs
- other edible roots: bracken fern, cattail, chocolate lily, Pacific silverweed, lupine, springbrook clover, wapato

Common fiber plants used for cordage and basketry:



- bear grass
- cattail
- hazel shoots
- maidenhair fern
- purple-tinged grasses
- red cedar bark
- reeds
- rushes
- sea grass
- spruce root
- tule
- willow
- juncus aka common rush
- nettle fiber
- slough sedge

Common dye plants:

- Oregon grape roots/inner bark—yellow
- red alder—orange-red from inner bark

Wetlands
Lesson 5

Designing a Wetland Restoration Plan

IN THE FIELD!

Take a field trip to view a restoration project in progress. Ask the managers of the restoration project to talk to the class about what they are doing at the site, including their restoration goals, how the site was selected, what historical data they used, the steps of the project, and where they are in the restoration process. If available, visit restoration sites in various stages of completion (beginning, middle and finished). Make observations in your field journal at each of the sites. Compare the sites: how do they differ, not only in ecosystem type but progress toward their desired future conditions? Make a video about the restoration project similar to the videos from the Yakama Nation projects.

SCIENCE INQUIRY

Monitoring data can be collected to assess restoration site conditions before, during and after a restoration project. This allows land managers to learn what restoration techniques are most effective. They can then use the information to improve future restoration work. Ask if you may become involved in any monitoring that goes along with the restoration site. Talk to the agencies involved to find out what methods they use and what they hope to learn.

Many natural areas have been historically maintained by fire at some frequency. Today, using prescribed fire can frequently come into conflict with present-day policies. Air quality regulations, public perceptions, and safety concerns can all make using prescribed fire a challenge. Brainstorm alternative methods for maintaining a restoration site. How would you test your methods?

Reflection

This activity has touched on some of the philosophical difficulties associated with habitat restorations. Use what you know to evaluate the ways environmental ethics, public opinion, scientific work, and/or government policy impact your environment and society. Explore your own personal views on one of these topics.

Assessment

1. List the components of a successful restoration plan.
2. List and explain two tools used in each: planning, site prep, restoring vegetation, and monitoring in restoration projects.
3. Work as part of a team to complete a restoration project proposal. What did you learn?

Resources

- Dahl, T.E. 1990. Wetland losses in the United States, 1780s to 1980s. U.S. Fish and Wildlife Service Report to Congress, Washington, D.C.
- Society for Ecological Restoration International Policy and Science Working Group (2004). *The SER International Primer on Ecological Restoration.* Society for Ecological Restoration, Tucson, AZ.
- Anderson, Kat. *Tending the Wild: Native American knowledge and the management of California's natural resources.* Berkeley: University of California Press, 2013.
- Boyd, Robert, ed. *Indians, Fire, and the Land in the Pacific Northwest.* Corvallis: Oregon State University Press, 1999.