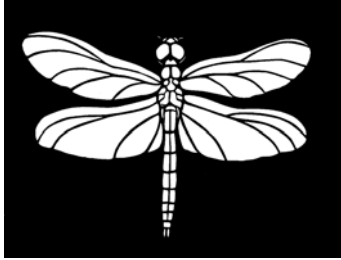


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Utah's Wonderful Wetlands

An Educator's Activity Guide

Produced by the Utah Division of Wildlife Resources
Project WILD Wetlands Education Program



Utah Division of
Wildlife Resources

Acknowledgements

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Utah Division of Wildlife Resources
1594 West North Temple
Suite 2110
Salt Lake City, Utah 84116
www.wildlife.utah.gov/wetlandsed

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Introduction to the guide

Wetlands ecosystems have been an unappreciated resource for centuries. Even the names associated with wetlands have negative connotations: mire, swamp, wastelands. Despite this negative stereotype, wetlands have begun to receive a bit of positive attention as people across the globe are beginning to realize the importance of these ecosystems.

The Utah State Office of Education recently recognized the importance of wetlands by including the study of wetlands in the 4th grade Science Core requirements. With this inclusion, the Utah Division of Wildlife Resources (UDWR) recognized a niche it could fill educating 4th grade teachers about wetlands, and encouraging them to take their students out to visit a wetland. Being a natural resources agency, the UDWR strongly feels that bringing children into a wetland is the best way for them to learn about and experience this special ecosystem. This activity guide has been produced to assist teachers in this endeavor.

Why use this guide?

The UDWR would like every 4th grade teacher in Utah to have the opportunity to use this guide. This guide offers teachers activities directly tied to the core curriculum to make it as easy as possible to teach 4th graders about wetlands. Each activity is correlated to the 4th grade science state standards, as well as other standards, such as language arts and social studies in some cases.

By using this guide you are also connected to a network of other teachers, volunteers and UDWR staff, as well as a wealth of resources from the UDWR. You may contact the following Division of Wildlife Resources personnel with any questions or concerns you may have with this curriculum and its resources:



Diana Vos, Wildlife Education Program Coordinator,
(801) 538-4719; 1594 W. North Temple, Ste. 2110, Salt Lake City,
UT 84116

Phil Douglass, Outreach Manager, Northern Region,
(801) 476-2750; 515 East 5300 South, Ogden, UT 84405

Ron Stewart, Outreach Manager, Northeast Region,
(435) 781-9453; 152 East 100 North, Suite #9, Vernal, UT 84078-2109

Scott Root, Outreach Manager, Central Region,
(801) 491-5656; 1115 North Main Street, Springville, UT 84663

Brent Stettler, Outreach Manager, Southeast Region,
(435) 636-0266; 475 Price River Drive, Suite C, Price, UT 84501-2860

Lynn Chamberlain, Outreach Manager, Southern Region,
(435) 865-6114; 1470 North Airport Road, Cedar City, UT 84720

Why Environmental Education?

Environmental education includes the study of our environment and its ecological principles, but that is just the beginning. Environmental education also considers social science, economics, politics, culture, technology, and aesthetic issues of the environment. It involves the process of dealing with environmental issues, and the associated multiple levels of feelings, values and attitudes which accompany such issues. Environmental education also stresses critical thinking and problem-solving skills needed to help students make their own decisions about issues (Disinger & Monroe, 1994).

In 1978 the Tblisi Declaration delineated 5 objectives of environmental education:

- Awareness - to help people acquire an awareness and sensitivity to the total environment.
- Knowledge - to help people gain a variety of experiences in, and acquire a set of values and feelings of concern for the environment and its associated issues and problems.
- Attitudes - to help people acquire a set of values and feelings of concern for the environment and motivation for actively participating in environmental improvement and protection.
- Skills - to help individuals acquire skills for identifying and solving environmental issues and problems.
- Participation - to provide individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental issues and problems.

But does environmental education work? Studies done on schools that focus on environmental education found that environmental education improved academic performance across the curriculum as compared with traditional educational approaches (Glenn, 2000). They have also found that "students learn more effectively within an environment-based context than within a traditional educational framework" (Lieberman and Hoody, 1998).

Environment as an Integrating Context for learning (EIC) is an effective way of teaching children using environmental education. EIC uses the local surroundings around a school as a focus point for students to construct their own learning. This can include their immediate local surroundings, such as the school grounds, or off-site areas, including a local wetland! Using a local environment to help students learn allows them to complete projects that are more relevant to their lives than something that occurs hundreds or thousands of miles away. This can improve their academic achievement, and make them want to learn more. The benefits of using this EIC approach have been documented after studying 66 schools that implemented this model.

Learning Styles

As you have probably observed in your classroom, not all students learn in the same manner. Some are probably interested in your lectures, while others enjoy doing experiments in the classroom. This is indicative of the different learning styles everyone possesses. The 3 basic learning styles are visual, auditory, and kinesthetic. About 65% of the population are visual learners who learn best by reading, looking and watching. Thirty percent of the population learn best by listening and discussion of ideas. Five percent of the population are kinesthetic learners who need to touch and do things to learn. Activities in environmental education are often hands-on, experiential activities that integrate all 3 of these learning styles.

Teaching in untraditional ways and solving real-life problems is integral to environmental education. In 1983, Howard Gardner, a professor of education at Harvard University, developed his theory of Multiple Intelligences. Gardner's definition of intelligence includes 3 factors:

- ❑ Ability to solve real-life problems
- ❑ Ability to find and create solutions to problems
- ❑ Ability to offer a product or service that is valued in a culture.

With this definition of intelligence, Gardner concluded that measuring a person's intelligence on one level, such as IQ, is inappropriate, because there are multiple intelligences people may possess. Gardner's 9 intelligences include:

Verbal-Linguistic Intelligence — well-developed verbal skills and sensitivity to the sounds, meanings and rhythms of words.

Mathematical-Logical Intelligence — ability to think conceptually and abstractly, and capacity to discern logical or numerical patterns.

Musical Intelligence — ability to produce and appreciate rhythm, pitch and timber.

Visual-Spatial Intelligence — capacity to think in images and pictures, to visualize accurately and abstractly.

Bodily-Kinesthetic Intelligence — ability to control one's body movements and to handle objects skillfully.

Interpersonal Intelligence — capacity to detect and respond appropriately to the moods, motivations and desires of others.

Intrapersonal Intelligence — capacity to be self-aware and in tune with inner feelings, values, beliefs and thinking processes.

Naturalist Intelligence — ability to recognize and categorize plants, animals and other objects in nature.

Existential Intelligence — sensitivity and capacity to tackle deep questions about human existence, such as the meaning of life, why do we die, and how did we get here.

Gardner theorizes that each person possesses a certain amount of each type of intelligence and therefore each person learns differently and has different strengths. Environmental education can make it relatively easy and fun to teach your students while stimulating their multiple intelligences. When students are able to use their strongest intelligences to learn, they are more apt to enjoy learning, and thus learn more easily.

Organization of Activities

The activities in this guide are all organized in the following manner:

- Summary* - A one or two sentence summary of the activity.
- Objectives* - What your students should learn by the end of the activity.
- Materials* - What you will need in order to complete the activity. Some materials you will already have in your classroom, such as art materials, and some are provided in this guide. Others you will have to spend a little time making.
- Background* - Additional information to help you understand what the activity is about, and how it is important. In some cases it is also background information you may wish to share with your students.
- Time Involved* - Amount of time the entire activity should take. This will vary by classroom and the amount of time you want to spend on extensions, etc.
- Utah Core* - The most up-to-date (as of August 2003) Utah Core standards and objectives met by this activity. Most will be science core standards, unless otherwise noted.
- Preparation* - Things you need to do before the activity to prepare for it, other than reading background material.
- Literature Connections* - Appropriate children's literature that can be used in conjunction with the activity.
- Activity* - What you will be doing with the students.
- Extension* - Additional activities to do with your students if they enjoyed the activity and would like to take it a step further, to learn and do more. In some cases, various Project WILD activities are listed as extensions. To learn about Project WILD and find out how to get the associated materials in Utah contact: Diana Vos, Coordinator Project WILD, Utah Division of Wildlife Resources at (801) 538-4719 or e-mail dianavos@utah.gov.
- Assessment* - Suggestions on how to determine what your students have learned from the activity. These are directly related to the objectives of the activity.
- Helpful Websites* - One or more websites that may help either the teacher or the students complete the activity.

Pre/post test

1. What three main ecosystems can be found in Utah? Give one unique characteristic of each.
2. Name two kinds of wetlands that can be found in Utah.
3. Explain one way that scientists classify things. You may show an example if you like.
4. Give three characteristics of wetland soil. What does it look like? What does it feel like?
5. Give one adaptation wetland plants may have that allow them to live in a wetland.
6. Name three animals or plants commonly found in Utah wetlands.
7. How do birds find their way when migrating? Give at least two ways.
8. Name one bird that migrates through Utah.

9. What are some ways that organisms interact with each other in a wetland?

10. What are two functions that wetlands provide - things wetlands do?

11. What are three clues that animals might leave behind in an area they have been?

12. What are the four main components of a habitat?

13. What can macroinvertebrates tell us about the water they live in?

14. Do you think that wetlands are important? Why or why not?

Assessing Student Learning

There are many different methods to assessing student learning. Simply giving students a written test may be inadequate in determining their knowledge and/or skills gained. The following is a list of different methods of assessing your students on a variety of levels. (From *Project WILD Aquatic Activity Guide*, Council for Environmental Education, 2002. Evaluating and Assessing Student Learning, p.238-239).

Educator-Generated Tests

These tests are created by the person instructing the students. They can be multiple-choice, fill-in-the-blank, true/false or essay type tests. Project WILD recommends that this type of evaluation be used on a regular basis for on-going evaluation rather than as a cumulative tool.

Portfolios

A portfolio is a collection of a class or project work chosen to specifically address a student's progress. Portfolios usually include examples of student work, reflections, self-evaluations and goal-setting items. The purpose of a portfolio is to document what has been taught and the national standards that have been met. It also allows subject area assessments to be integrated and student growth to be charted.

Performance Tasks

A performance task is an assessment tool that is generally chosen by the student and demonstrates their understanding of concepts and processes as they apply to everyday life. The task is usually meant for a larger audience rather than for the educator alone. It is carefully planned and evaluated with detailed scoring. Performance tasks can range from solving a real life problem to preparing a speech or project, demonstrating a specific skill or writing a paper or report.

Journals and Learning Logs

Journals and logs are tools for students to use to record their own learning in a less formal manner. Journals are usually a subjective account of a student's perspective on what they have learned. Logs are more detailed and give a direct account that follows a given format.

Visual Vocabulary

An alternative method of assessment for the expression of learned concepts is through pantomime and creative movement. Students review vocabulary they have researched and then select specific terms to portray that demonstrate their understanding of the activity's concepts.

Observation Checklists

Educators may use observation checklists to monitor whether a student has mastered a specific skill. This type of checklist is a useful tool to address specific skills.

Graphic Organizers

Web diagrams, charts, and other forms of graphics can be generated by a student to demonstrate what they have learned and how it has been organized into their thought process.

Interviews and Conferences

Educators can assess learning by interviewing or conferencing with students using a systematic approach. When discussing a topic, students can clarify their thinking and educators can gather information on how a student is processing what they have learned.

Rubrics

Rubrics are used for any of the assessment strategies outlined above. Rubrics are a way of scoring students in a detailed manner. Rubrics are usually judged by a set of criteria that will evaluate all aspects of the student learning, breaking the tasks down into smaller attainable pieces. The use of rubrics allows students and educators to know specifically what is expected and how each student has measured up to those expectations. Rubrics can be used in self-evaluation, by peers or by an educator. Sometimes a single rubric is used in all three ways to provide a more accurate evaluation.

Background Information on Wetlands



Cottonwood tree

What makes a wetland a wetland?

When you hear the word *wetland*, what comes to mind? Maybe you imagine a pond where you caught slimy frogs as a child. Or maybe you picture the great expanse of the Great Salt Lake and the ducks, geese and shorebirds associated with its edges. Perhaps you think of yourself with a child, fishing from the bank of a river. All of these places are wetlands, and as such are incredibly valuable to Utah.

So, what is a wetland anyway? Taking the word apart - *land* that is *wet* tells us a little to start with. But, nature is not as simple as that. To be classified as a wetland, an area must have the correct combination of soils, plants and presence of water.

First, lets talk about **soils**. Not all soils are created equally. The four main types of soil are clay, sand, silt and organic. Clay, sand and silt soils are mineral soils. Organic soil forms when plant decomposition is slowed down and dark, mucky soil forms. Wetland soil can include any combination of these soils, but it must be *hydric*, saturated with water, for at least part of the growing season - saturated long enough that there is little oxygen left in the soil. When this happens, the soil is *anaerobic* (without oxygen). Soil that is hydric usually smells like rotten eggs from the anaerobic bacteria which thrive in it, creating hydrogen sulfide. It will also often look dark and slimy. (Activity - *Do you Dig Wetland Soil?*).

Little oxygen left in the soil and water greatly affects the organisms living in a wetland - especially the **plants**. It takes a very special plant to be able to live in a wetland. We all know that plants need water, but have you ever over-watered a house plant? If you have, you know that different plants require different amounts of water. Plants found in wetlands are called *hydrophytes*. These plants have special adaptations that allow them to live in a water-saturated environment where oxygen is hard to obtain (see later section for more details on hydrophytic plant adaptations).

But, of course we would not have a wetland without water! Water in a wetland comes from many places including rain, groundwater, surface water runoff or flood waters. Water does not need to be above the surface of the ground all the time in a wetland - just part of the year. Usually, though, there is water just below the ground so that when it rains the ground becomes saturated quickly. The kind of wetland that develops depends upon when water is present and the length of time it is present - its *hydroperiod*.

Wetlands are ecosystems identified by the presence of water at some point during the year, which creates a unique environment with hydric soils and specially adapted plants and animals.

Kinds of Wetlands

Wetlands are found on every continent on the earth except Antarctica. Scientists estimate that wetlands cover between 4-6% of the earth's surface. Although wetlands are considered to be extremely important ecosystems in the world, not many scientists agree on how they should be classified, or what they should be called. If you live in North America, you may have heard of any number of the following names for wetlands:

- Bog
- Bottomland
- Fen
- *Lake
- Mangrove
- Marsh
- *Mud flat/Salt flat
- Peatland
- *Playa
- *Plunge Pool
- *Pond
- *Pothole
- *Riverine/Riparian
- Salt Marsh
- Sedge Meadow
- Slough
- *Subalpine/Montane
- Swamp
- Tidal Freshwater Marsh
- Vernal Pool
- *Wet Lake Margin
- *Wet Meadow
- Wet Prairie

Wetlands that are marked with an asterisk (*) are wetlands found in Utah.
(Activity - *Where are the Wetlands?*)

However, if you live in Great Britain or the rest of Europe or Australia, there are many more names for wetlands - even those wetlands that look and function the same as the North American wetlands!

Scientists first began to recognize the extreme importance of wetlands in the 1970s. Eventually this recognition led to a general classification system for wetlands being created by Cowardin et al. in 1979 in a report entitled *Classification of Wetlands and Deepwater Habitats of the United States*. Although this document includes what are probably the most widely accepted definitions of different types of wetlands, it is not universally accepted. Cowardin et al. classified wetlands according to the hydric soils, hydrophytic plants and hydroperiod (how often water is present) for each wetland. Other scientists classify wetlands according to the hydrogeomorphology of the wetland, such as whether it is a slope or depressional wetland. There are also general classifications, such as calling a wetland *lacustrine* (lake-like) or *palustrine* (pond-like). Therefore, although scientists may be able to agree upon classifying forests, for example, agreeing on wetland classification, and even whether or not a wetland is present, presents a challenge. For the purposes of this activity guide, we will use the Cowardin et al. classification system. Using this system to define Utah's wetlands, the following pages contain a list of wetlands found in Utah and their definitions.

Mud flats/Salt flats: These wetlands usually have little or no standing water, and have almost no vegetation. They also may have an outlet to another water body. The environment, especially in the salt flats, poses a huge challenge to any plants trying to adapt to these conditions. Most of the mud flats in Utah are located around the Great Salt Lake.



Playas: Playas have little to no vegetation and no outlets to other water bodies. A playa is a depression in the earth that fills with water in the spring rainy season, then slowly dries up, often leaving behind a salt flat. A playa always has both wet and dry seasons. Salt grass is the most common vegetation found in a playa. Playas can be found around the Great Salt Lake, as well as throughout the southern and western parts of Utah.

Ponds: Ponds, also known as depressional wetlands, are always covered with shallow water. Ponds are very important to wildlife, including migrating birds and many other species. Most wetlands found at lower elevations in Utah are ponds.



Lakes and Reservoirs: Lakes and reservoirs are similar to ponds, but have much deeper water. Because of this deeper water, they are sometimes not considered wetlands, but are more of a deep-water habitat. As stated previously, defining wetlands is not always straightforward.

Potholes: Potholes occur in solid rock. These small basins have been ground out of the rock by stones swirling in the water. The water in them is freshwater from precipitation or surface runoff. They do not have water all of the time, usually only during the spring or during the rainy season. There is often no vegetation, but you might find fairy shrimp in the water. They have no outlet and dry out through evaporation. These wetlands are also called tanks or tinajas. They are found in the Colorado Plateau.

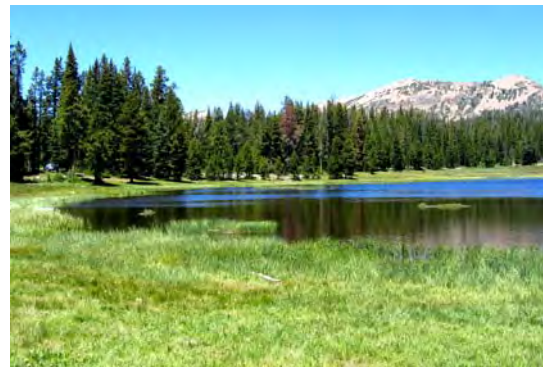


Riverine/Riparian: These types of wetlands are found along rivers and streams. They usually have moving water and often connect two larger bodies of water. Riparian areas are considered some of the most productive areas for plants and animals, especially in Utah where there is little precipitation. Riparian areas often seem to be a ribbon of green in a sea of brown, unvegetated areas. However, not all riparian areas are considered wetlands. Cutthroat trout are often found in riverine wetlands in Utah.



Wet Meadows: Wet meadows may not always have water that is obvious, because they often have lots of vegetation associated with them. In fact, sometimes the vegetation is so thick that the wet meadow may look dry, but if you dig just beneath the surface of the ground you will find water. They are often found near riverine systems at middle or high elevations throughout the state. Wet meadows are important to a diverse group of wildlife including raptors, songbirds, moose, mule deer, elk and red fox.

Wet Lake Margins: Wet lake margins are most often found at low elevations, but can be found at any elevation. They usually dry up during a drought period. They will have some vegetation cover, especially cattails, but not as much vegetation as a Wet Meadow.



Subalpine/Montane Wetlands: These wetlands can include several different types, including marshes, ponds, fens and glacial lakes. The common characteristic linking them together is that they are found at high elevations. They are also only covered with water now and then, and will have some vegetation, such as marsh marigold, associated with them. Moose are commonly found in montane wetlands.

Plunge Pools: Plunge Pools occur below waterfalls. They may have groundwater seeping into them through the rock faces. They are also called hanging gardens, and often have perennial water. Hanging gardens have many rare plants that only grow in these locations, such as Alcove death camas, Alcove bog orchid and cave primrose. They have outlets to other water bodies via stream channels. These wetlands are found in the Colorado Plateau.



People and Wetlands



People in recent history have not always valued wetlands for the great bounty they provide. In the past wetlands had often been viewed by European settlers as quagmires with no value to humans. However, this was not necessarily true for Native Americans who inhabited wetland areas long before modern societies did. This is especially true in Utah, where water is extremely difficult to find. Picture yourself living hundreds or even thousands of years ago along wetlands near either the Great Salt Lake or a river in southern Utah, or wherever you live right now. What would you eat? In what kind of shelter would you live?

The presence of water and wetlands greatly affected the lifestyles of native people in Utah. People living in an area such as around the confluence of the Weber and Ogden Rivers and the Great Salt Lake were often more sedentary than those that lived in the more desert areas of the state. This is because wetlands offered so much to these people—plenty of water, fertile land, and plants and animals for food, that they did not want or need to leave to sustain themselves. This was true of the Fremont Indians that lived around 400 A.D. Many times they would not even need to cultivate crops because the wetlands provided their every need. Native people used everything at their disposal to survive. They hunted rabbits, skunks, porcupines, coyotes, bobcats, waterfowl, deer, elk, antelope and bison for food and bones of these animals were used to make tools. They even had group hunts of crickets and grasshoppers, where they drove thousands of the insects into ditches, then set the ditches on fire. The roasted insects were then gathered and either eaten whole or ground into meal.

If you were a native person long ago, you would have probably eaten many things you wouldn't think of eating today. Cattail plants, that you probably don't even give a second thought to, would be your best friends. It has been estimated that one acre of marsh can yield up to 5,500 pounds of edible flour from cattail roots and tubers! And, believe it or not, nutritionally, this cattail flour is equal to wheat flour or rice. You could use cattail pollen to make flour for cakes that could be baked and then stored for long periods of time. You would use the roots of the cattails to help flavor your foods too even though they were hard to get sometimes. Pollen needs to be shaken from the plants when it is yellow and fresh—usually in spring. To eat the roots, it needed to be pounded or ground until the starch was separated from the fibers. These fibers would be made into cordage that would be used to make fish nets or animal snares. You could use the fluff, or down of the cattail seed head (the brown hot dog-looking things) to soften a pillow or bed. It can also be used in the diapers of babies! The leaves would be used to make baskets, and the stalks would be woven into sleeping mats for beds. You would also collect lots of other plants and seeds, including iodine bush (found on salt flats). The seeds would often be ground down to be eaten and stored overwinter. Waterfowl would also be abundant in wetlands. They would most easily be caught while they are molting and unable to fly.

If you want to learn more about how Native Americans used cattails, visit the website: www.nativetech.org/cattail/index. Here you will learn about how to make cattail mats and cattail toys, and discover other ways to use cattails, including using pollen as a hair conditioner! Native Americans also used many other wetland plants. The round stalks of bulrush sedge were used for mat construction, and the leaves were used for making twine. Carex sedge leaves, tussock sedge leaves and milkweed were also used for making a thin twine. The inner fibers of dogbane, also called Indian hemp, were used to make rope and cordage for fishing lines, woven nets, finger woven bags and thread. However, it is toxic to eat, providing a good example of how Native Americans understood what was safe to eat and what was not. Most likely, they first discovered this through trial and error, and then the knowledge was passed down through generations. (Activities: *How Did They Live?*, and *Cattail Ducks*)

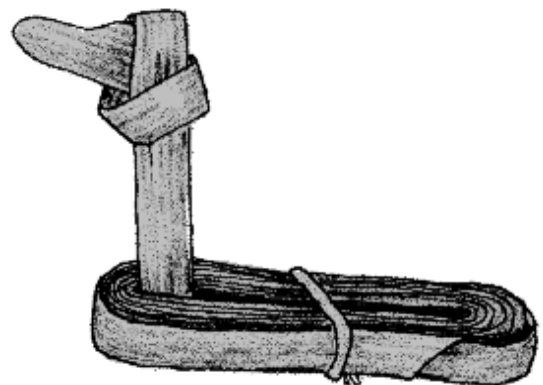


Image of cattail duck from www.nativetech.org

Wetland Functions

What do we mean by *wetland functions*? Often when people talk about ecosystem functions, they are referring to goods and services that an ecosystem provides for humans. By using this definition, it is easier to quantify the worth of an ecosystem in monetary terms. An example of a human-centered value is that wetlands help provide flood control by absorbing floodwaters before they can do damage to people's homes and businesses. At one site in Illinois along the Kankakee River, scientists estimated the value of this service to be approximately \$691,000. This would be the cost if they filled in the wetlands and had to create an alternate way of protecting homes and businesses from floodwaters.

But considering functions from only a human perspective leaves out a lot. Wetlands and other ecosystems are valuable also because they provide services to the environment at large, which indirectly benefits humans too. The following wetland functions should be viewed as both functions for humans, as well as for other living things. (Activity - *Wetland Metaphors*)

Flood mitigation: Wetlands slow storm water runoff, retain these storm waters and release them slowly back into the environment. Wetlands are also essential in coastal areas. Salt marshes provide a buffer between the storm (such as a hurricane) and the communities that live behind those salt marshes.

Groundwater recharge: Water found underground (groundwater) can be depleted rapidly when used by people. Some wetlands help to return water back to the groundwater by seeping underground. However, many wetlands have an impermeable soil layer underneath them that prevents water from seeping out. This is often part of the reason a wetland even exists in an area - because water is there and it has nowhere to go. Wetlands that provide this service of groundwater recharge are often smaller wetlands, such as prairie potholes found in the midwest.

Filter contaminants/Improve water quality: There are multiple ways that wetlands remove pollutants such as organic and inorganic nutrients and toxic materials from water.

- Wetlands reduce water velocity when streams and runoff flow into them, causing sediments and chemicals to drop out of the water and settle to the bottom of the wetland.
- There are multiple chemical processes in wetlands which remove certain chemicals from the water. Some bacteria found in wetlands will remove chemicals. Phosphorus, a pollutant, will sometimes combine with iron or calcium compounds through co-precipitation. This new compound, less dangerous than phosphorus alone, will remain in the wetland.
- Some wetland plants will take up chemicals and incorporate them into their cells. There is an extremely high rate of productivity in wetland plants (i.e. they grow quickly), therefore more pollutants will be taken up by wetland plants than by other plants. When these plants die, the pollutants get buried in the wetland soil, where they are either slowly broken down, or taken up again by other wetland plants.
- Wetlands can bury and neutralize a certain amount of toxic residues. These are then reduced when taken up by plants. However, it is important to keep close track of how much toxic residue is entering a wetland - they can only hold so much.
- Wetlands can also act as wastewater treatment plants, for treating both animal and human wastes. They are able to do this because wetlands have a high rate of biological productivity, a high level of bacterial activity (which breaks down and neutralizes waste), and sediments that can bury waste. In fact, some cities such as Philadelphia and Arcata, California use wetlands in their wastewater treatment facilities!
See www.humboldt.edu/~ere_dept/marsh/ for more information on the Arcata wetlands.



Provide wildlife habitat: Wetlands provide wildlife habitat for a number of animals such as beavers, muskrats, waterfowl, fish, shellfish, and lots of invertebrates! Approximately 50% of endangered species depend on wetlands for survival. Many animals that are harvested either for food or pelts for humans also need wetlands. Waterfowl are an excellent example of wildlife that needs wetlands - 80% of the United States breeding bird population and more than 50% of the 800 species of protected migratory birds rely on wetlands for survival.

Provide plant habitat: Wetlands provide humans with consumables such as timber, as well as cranberries, blueberries, rice, and mint. And, of course, with more plant and wildlife habitat comes more biodiversity!

Source of extreme productivity: Productivity is generally defined as an organism (usually a plant) using solar energy to produce more mass. Plants are producers because they produce their own food from sunlight (as opposed to consumers, such as humans, who must consume food to get energy). Wetlands are especially productive places because there is plenty of water and nutrients the plants need to grow. Once these plants die, there are many microorganisms and other decomposers to break down the plants back into nutrients. Wetlands are even more productive ecosystems than tropical rain forests!

Aesthetics, recreation: Wetlands are also beautiful places to visit, simply for hiking, bird watching, or artistic inspiration. Although this function is difficult to quantify, it should not be dismissed as minor.

Remember the example of the Kankakee River riparian wetlands in Illinois? Here are all the figures for the replacement value of those wetlands:

Fish production	\$91,000
Flood control/drought prevention	\$691,000
Sediment control	\$100,000
Water quality enhancement	\$57,000
Total wetland value	\$939,000

It is clear that these wetlands provide essential functions for the communities along the Kankakee River that would be extremely costly to reproduce. This example is not out of the ordinary, either. Although the exact numbers might fluctuate, the overall result is that wetlands provide services of enormous value to people.

Wetland Habitat

The habitat of an organism is the food, water, shelter and space it needs to survive. Wetlands of course provide habitat for many plants and animals, as touched upon in the last section. Here we will elaborate on those organisms, and especially the adaptations they have to live in such a different environment.

Plants

Wetland plants, called hydrophytes (hydro=water, phyte=plant), have developed many adaptations that allow them to live in a water-logged environment. Wetland plants create oxygen through the process of photosynthesis, but also need to obtain oxygen from their environment for respiration through their roots. This presents a problem because wetland environments do not have much oxygen in their water or soil since the water is often stagnant, or non-moving. Some of the special adaptations hydrophytes have to help them obtain oxygen via their roots in a low oxygen environment are listed below.

Air spaces, or aerenchyma: Some wetland plants have extra air spaces in their roots and stems. These air spaces allow oxygen to diffuse from the above-water stems down to their underwater roots.

Adventitious roots: These roots, found in woody wetland plants, are also called *prop roots*. They extend above the water and have cells called *lenticels* that provide oxygen to the underwater roots. An example of a plant that has these roots is a mangrove tree which produces thousands of *pneumatophores*, (sometimes called *air roots*) that extend above the mud above the main roots and are exposed during low tides. It is thought that the *knees* of cypress trees are also pneumatophores.

Air spaces on leaves: Plants with these air spaces are called *floaters* since they float on top of the water. The air spaces they have on the surface of their leaves take in oxygen. A special pressure created by temperature and water vapor pushes this oxygen down into the roots of the plant.

Some wetland plants are presented with other challenges as well. Plants found in salt marshes, or even those found in freshwater marshes where there is some salt, must find ways to deal with that salt. It can be difficult to keep salt out of plant tissues because of osmosis, which essentially pushes the salt from the soil and water into the plants since the concentration of salt is greater outside the plant cells than inside. Some plants have salt glands that excrete salt out onto the leaves and stems of the plant. Other plants have a special chemical composition within their cells that keeps the salt out in the first place.

Animals

There are both aquatic and semi-aquatic animals, and even terrestrial animals that use wetland ecosystems. Aquatic animals need to have adaptations, as do the plants, that allow them to live in a low-oxygen environment.

Fish, as we know, have gills, which they use to breathe in water. These gills have blood close to the surface of the skin to facilitate the diffusion of oxygen from the water into their body.

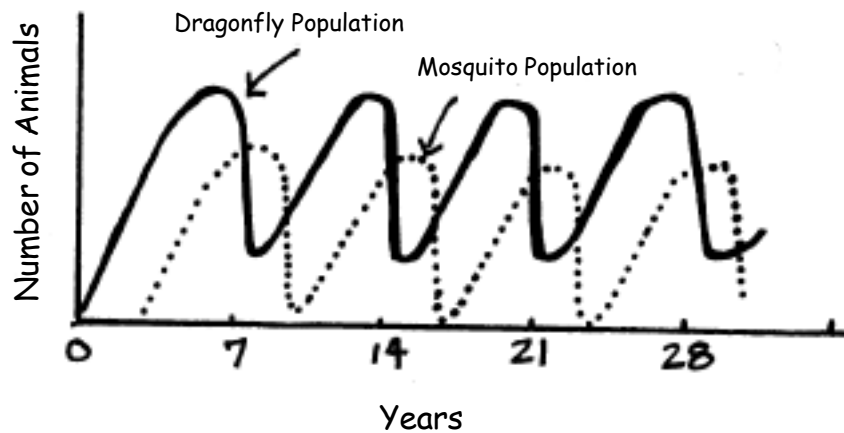
There are many invertebrates that either live in the water their entire lives, or only for the nymph, larval, or pupal stage of their lives. Invertebrates that live in the water have a few different adaptations to get oxygen. Some have gills, although they may look different from fish gills, and may be found on a different part of the body. For example, a mayfly nymph has its gills on its abdomen. Other invertebrates, such as diving beetles or water boatmen, carry air bubbles under their wings or trapped in the hair on their abdomens. These organisms often either have a very powerful heart, an increased density of blood vessels, or a very efficient circulatory system to be able to live in a low oxygen environment. They will also sometimes decrease their activity level when oxygen levels are extremely low.

In wetlands, some animals reproduce at different times depending on the temperature, food availability, water velocity, and other environmental factors. Eggs are sometimes released in response to environmental cues such as amount of sunlight or salinity. Other animals have no larval stage, or will reproduce asexually to survive conditions of wetland environments.

Predator-Prey Dynamics

As we have learned in recent years from the elk populations in Yellowstone becoming more balanced due to the reintroduction of wolves, their natural predators, the interactions between predators and prey are essential to maintaining a healthy ecosystem. The predators and prey keep their respective population numbers in check. Before the re-introduction of wolves in Yellowstone, elk populations were growing out of control. As a result, their food, especially during the winter, was dwindling, and many were starving to death. Once wolves were restored, the elk populations decreased, and sufficient food was available for the remaining herd.

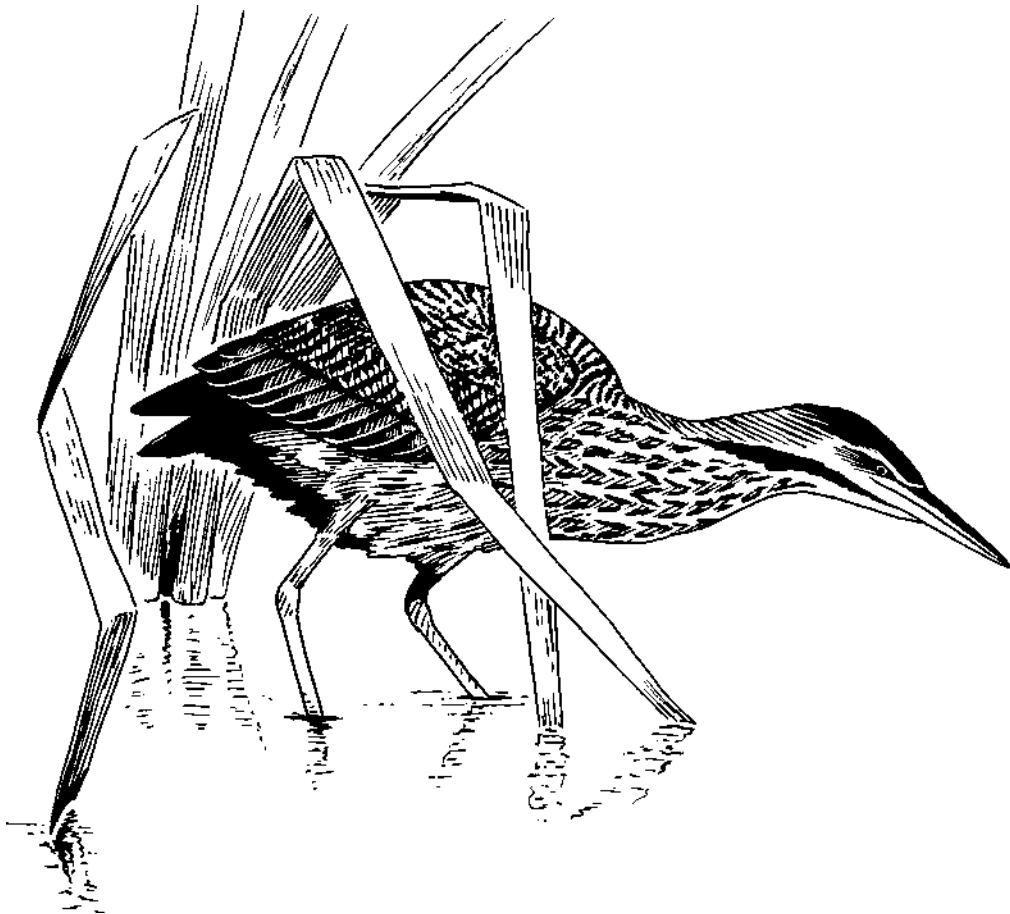
Wetlands have many natural predators, from coyotes to dragonflies. These predators keep the numbers of prey animals, such as muskrat, mink, or even mosquitoes, in check. The prey in ecosystems likewise keeps predator numbers at a reasonable level. If, for example, there was a drop in mosquito numbers, and if there was a dragonfly that solely ate mosquitoes, the dragonfly's population would drop as a result. As dragonfly numbers dropped then later mosquitoes could rebound. As this interaction continued through time, and the numbers of each kept going up and down, this would create an 'S-shaped', or sigmoidal curve for each population. Although they would increase and decrease over the years, it would not be likely that one population would either completely disappear or do the opposite, increase until it can no longer be sustained within the ecosystem.



Graph from Oh Deer, Project WILD Activity Guide, Council for Environmental Education, 2002.

Pre-Field Trip Activities

Getting your feet wet...



Mystery Topic

Summary Students will try to determine what the mystery topic is (wetlands) by investigating clues around the classroom.

Objectives Students will be able to:

- List items that can represent a wetland.

Materials

- Package of rice
- Bag of mud
- Toy frog
- Cattail
- Glass of water
- Picture of wetland
- Journals, pens/pencils

Background See Background Information on Wetlands

Time Involved 10 minutes per day for a few days in a row

Utah Core Standard V, Objectives 1b, 2a

Preparation Gather wetland clues listed above. Give each student a journal notebook for their upcoming unit, but don't tell them what the unit is.

Activity A few days before beginning your wetlands unit, display a new clue about wetlands each day. If possible, allow your students to discover the items on their own. Ask them to try to determine what the mystery topic is, without discussing with their neighbors. They can list the items in their journal so they can remember what was displayed each day. After they have observed all the items, ask them to guess what the mystery topic is.

Extensions None

Assessment After your students have figured out that they will be learning about wetlands, have them bring in things from home they think could represent a wetland.

Adaptation of Mystery Topic from WOW! The Wonders of Wetlands is used with permission from Environmental Concern Inc. For further information contact Environmental Concern Inc. at (410) 745-9620 or visit www.wetland.org.

Wetlands: *Wetting* Your Imagination

Summary	Students will describe their impressions of wetlands before learning more about them.
Objectives	Students will be able to: <ul style="list-style-type: none">• Use descriptive words to explain their feelings about wetlands.
Materials	<ul style="list-style-type: none">• Journals, writing instruments• Pictures of wetlands from magazines
Background	None
Time Involved	20 to 30 minutes
Utah Core	Language Arts: Standard I, Objective 1b; Standard VI, Objectives 1a, 2b
Preparation	Cut out pictures of wetlands from magazines, or print them from the internet.
Literature Connections	<p>Hickman, Pamela. <u>Wetlands</u>. Kids Can Press Ltd. 1993. An excellent, well illustrated and comprehensive book for providing elementary-aged children complete information about wetlands.</p> <p>Luenn, Nancy. <u>Squish! A Wetland Walk</u>. Atheneum. 1994. Designed to enhance the younger reader's appreciation of the wetlands. A boy begins to understand the abundance of life and activity the wetlands provide.</p>
Activity	<p>After your students have figured out that they will soon be learning about wetlands, try to determine what their impressions of wetlands are, before giving them any more information about wetlands.</p> <p>Ask your students to give you words to describe a wetland that you will put on the board. Do not write down organisms living in the wetland, but stress that you want them to give you 'feeling' words, or words that describe what you would sense, such as wet, beautiful, yucky, smelly, etc.</p> <p>After writing a number of words on the board, discuss why they gave you those words to describe a wetland. Then show them some pictures of wetlands that you found in a magazine. Ask them if they would change any of their words now, if so, why? Or why not?</p>

Wetlands: *Wetting Your Imagination, cont'd*

Extensions

Ask your students to do this activity on their own, using the environment in general instead. How do their descriptive words differ?

After visiting a wetland, do this activity again. Have their feelings or impressions of wetlands changed?

Assessment

Have your students compile their own lists of descriptive words for wetlands, then write a short essay or poem about those feelings in their journals.

Adapted from First Impressions, Project WILD K-12 Activity Guide, Council for Environmental Education, 2002.

Ecosystem Experts

Summary In this "activity", students will do a research project on a familiar Utah ecosystem.

Objectives Students will be able to:

- List some plants in the 3 main ecosystems in Utah: forests, deserts and wetlands;
- List some animals in these 3 ecosystems;
- Mark on a map where many of these ecosystems are in Utah;
- List physical differences between these 3 ecosystems.

Materials

- Computer and library access
- Writing materials

Background Although Utah is situated within the desert biome of North America, 3 main ecosystems are found in the state: forests, deserts, and wetlands. An ecosystem consists of both living and non-living things in an area, and how they interact with each other. Although there may be some similarities in organisms and the physical environment of each, they have some very basic differences. For wetland information, see Background - What makes a wetland a wetland?

Forests: Utah has both deciduous and coniferous forests. The deciduous forests are usually found at lower elevations, and coniferous forests at higher elevations. Deciduous forests have trees that lose their leaves each fall. Examples of trees in this type of forest in Utah include: maple, oak, birch, and cottonwoods. Coniferous forests are made up of trees that do not lose their leaves each year - they usually have needles and are called 'evergreens'. There are many animals that can be found in a forest ecosystem, including various birds, squirrels, and insects, not to mention mountain lions and bears! In temperate forests in general, rainfall averages between 30 to 60 inches per year. In Utah's desert biome however, rainfall in the forested areas ranges around 16 to 35 inches per year.

Deserts: The yearly rainfall in deserts is usually less than 10 inches. Temperatures have been known to reach up to 117 degrees Fahrenheit in the deserts of southern Utah. Plants living in the desert will often have a waxy coating to prevent evaporation from the heat of the sun, or needles, as cacti do, which actually offer shade. Animals in the desert have adapted as well. Many usually sleep during the heat of the day, or have developed a hard outer covering (such as in some insects) to limit loss of water. Examples of some desert plants include: joshua trees, sagebrush, juniper, yucca, cactus, and pinyon pine. Examples of some desert animals include: desert tortoise, road runner, horned lizard, kangaroo rat, and rattlesnake.

Time Involved Explanation of project: 15 minutes
Student completion of project: two, 60-minute sessions

Utah Core Standard V, Objectives 1a, 1b

Preparation You may want to do some extra research on Utah's ecosystems to better familiarize yourself with them.

Ecosystem Experts, cont'd

Literature Connections

Collard III, Sneed B. *Our Natural Homes*. Charlesbridge Publishing. 1996. Excellent, beautifully illustrated book for elementary-aged students sharing information about the world's biomes. Be careful, however, not to confuse biomes with ecosystems.

Activity

Divide your students into 6 groups. Assign 2 groups to research the forest ecosystem, 2 groups to research the desert ecosystem, and 2 groups to research the wetlands ecosystem. Ask them to use the internet and library resources to find out the following information about their ecosystem in Utah:

- Common plants and animals
- Type of soil
- Amount of water present
- Typical amount of rainfall
- Where in Utah these ecosystems are found

Have the students create a poster to present to the class. The poster may include drawings and words about their ecosystem. Prior to making their presentations, draw 3 columns on the chalkboard, labeled Forest, Desert, and Wetland, respectively. In rows next to the first column, write: Plants, Animals, Soil, Water, Rainfall, Where found? (see next page for chart). As they present their findings, write down this information in the correct square on the board, or have a designated student do this with help from you and the rest of the class. Your students may want to put this chart in their journals while you are putting it on the board. After they are done with their presentations, point out some of the most obvious differences between these ecosystems. Tell your students that although each of these ecosystems is different, they may have overlapping characteristics such as some of the same animals living in all 3. They are also all linked to each other in other ways. For example, you may find a wetland in the middle of the desert, as is found in western Utah. These wetlands and deserts will share the same animals, groundwater, etc. Remind them that they will be concentrating on wetlands for this unit.

Extensions

Have your students create a diorama of the ecosystem they researched (Note: this is a similar assignment to a later activity).

Have your students draw their ecosystem on a large piece of posterboard or chart paper. Tape these drawings next to each other and hang up around the room. Ask them to demonstrate linkages between ecosystems.

Have them do the Project WILD activity *Rainfall and The Forest*. Supplementary material for this activity can be requested from Diana Vos, Coordinator Project WILD, Utah Division of Wildlife Resources at (801) 538-4719 or dianavos@utah.gov.

Assessment

You can use a rubric to evaluate the students posters - did they attempt to answer all the questions? Did they answer they questions correctly? How was the layout of their poster? Was everything spelled correctly? You may ask the students the following questions:

- How are wetlands different from forests or deserts?
- What are some examples of living organisms in wetlands?
- Where do you think most of the wetlands in Utah are found? (Answer: 75% of Utah's wetlands are found around the Great Salt Lake).

Helpful Websites

<http://www.uen.org/Lessonplan/preview.cgi?LPid=2012> (this site has many helpful links)
<http://www.wildlife.utah.gov/habitat/sefauna.htm>
<http://mbgnet.mobot.org/sets/> (information on biomes - to ease the confusion between ecosystems and biomes)
<http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/B/Biomes.html>

Ecosystem Experts

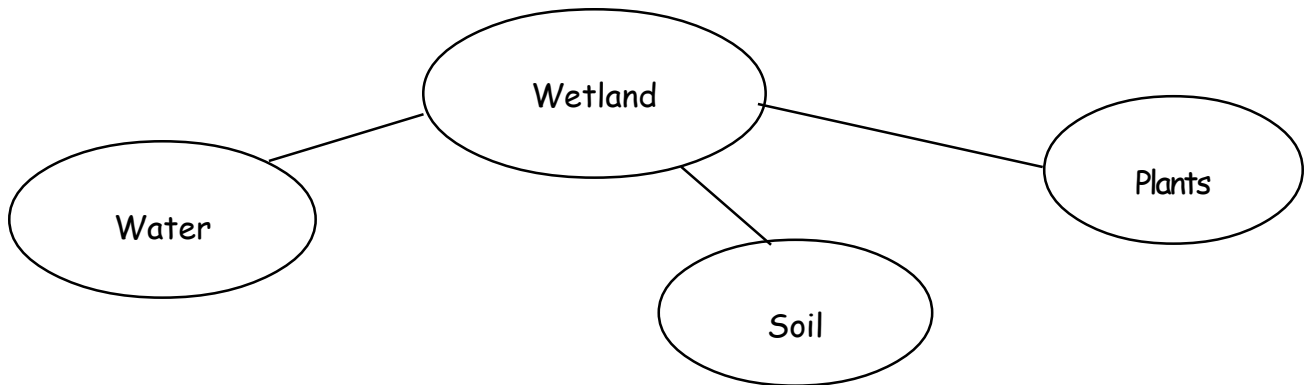
Student Page

	Forest	Desert	Wetland
Plants			
Animals			
Soil			
Water			
Rainfall			
Where Found?			

Wetlands: Worth a Thousand Words

Summary	Students will list words and will create poetry using their initial knowledge of wetlands.
Objectives	Students will be able to: <ul style="list-style-type: none">• Use descriptive words to convey what a wetland is;• List some plants and animals associated with wetlands.
Materials	<ul style="list-style-type: none">• Drawing materials: pencils, pens, markers• Construction paper• Scissors• Glue
Background	See Background Information on Wetlands
Time Involved	One or two 20-to 45-minute sessions
Utah Core	Standard V, Objective 1b
Preparation	Gather wetland pictures.
Literature Connections	<p>Ferra, Lorraine. <u><i>A Crow Doesn't Need a Shadow</i></u>. Gibbs Smith Publisher. 1994. A wonderful book to help kids create beautiful and thoughtful poetry.</p> <p>Williams, Terry Tempest. <u><i>Between Cattails</i></u>. New York, NY: Athaneum Books. 1985. A glimpse at a typical marsh habitat using lyrical text.</p>
Activity	Show the students pictures of wetlands that you have found in magazines, or from the wetlands trunk. You can also have the students bring in pictures they find of wetlands. On a chalkboard, ask them to list at least 100 words that have something to do with wetlands. Using this list of recorded words, ask the students to create word trees (graphic organizers) linking some of these wetland-related words as in the example on the next page.

Wetlands: Worth a Thousand Words, cont'd



When they have finished several word trees, have them use one or more to create a poetic definition of what wetlands are, or things related to wetlands. For example: "Wetlands are dark, slimy soils, water-loving plants, and slow-moving water." If your students don't enjoy creating poetry, try to ease them into it by reading some poetry first - even Mother Goose rhymes will work!

When they have completed their poetic definitions, have them write their poem on construction paper cut to artistically fit the feeling of their ideas. Arrange these cutouts on a wall or window for everyone to enjoy.

Extensions

Create a class book with each student's page included. Have your students write their poetic definitions at the bottom of the page and then illustrate their ideas - for example, with water colors - at the top of the page.

Assessment

Ask your students to do the following things:

- List 3 plants you can find in a wetland.
- List 3 animals you can find in a wetland.
- Write and illustrate a short story about a wetland and plants and animals living in it.

Helpful Websites

<http://www.poetryteachers.com>
<http://www.kidbibs.com/learningtips/l43.htm>

Adapted from Aqua Words, Project WILD Aquatic K-12 Activity Guide, Council for Environmental Education, 2002.

What Kind of Wetland is it?

Summary Students will learn how a flow chart and a dichotomous key work to identify anything from a plant to an ecosystem. They then will use this knowledge to key out each other and identify Utah wetlands.

Objectives Students will be able to:

- Use a flow chart and a dichotomous key;
- Describe characteristics to look for in identifying wetlands;
- Identify at least 3 different Utah wetlands by sight.

Materials

- Large copy of *Keying out Shoes* tree drawing - either poster or overhead
- Construction paper leaves
- Tape
- Copies of dichotomous key of Utah's wetlands
- Pictures of different Utah wetlands (found in back of binder)

Background See Background Information on wetlands, *Kinds of Wetlands*. A dichotomous key is a tool that scientists use for identification. They may use it to identify insects, trees or even rocks! A dichotomous key asks a series of questions allow you to choose between two options at each question to narrow down the possibilities of what you have and finally determine its identity. A flow chart is similar to a dichotomous key but may have more than two choices at each decision point of the key. Being a more visual tool, it may be easier for students to use when first learning about scientific identification keys.

Time Involved 40 minutes

Utah Core Standard V, Objectives 1b, 3a

Preparation Cut out construction paper leaves for students (or you may have them cut their own leaves out). Find additional pictures of Utah wetlands if possible. You can also print more pictures of Utah wetlands from www.wildlife.utah.gov/wetlandsed.

Activity *Keying out Shoes: This is a kid-friendly introduction to using a flow chart. Ask your students to each remove one of their shoes. Give each student a construction paper cutout of a leaf. Ask students to write their name on their leaf. Have them use the Shoe Key Tree to identify their shoes based on physical features: their own gender, shoe color, whether or not the shoe has writing on it, what kind of binding it has, and whether or not it has lights. Modify the classification scheme if there would be a more appropriate way to identify your students. Have students work to the smallest branch on the tree and attach their leaf at the end. At the end of the activity, each student will have a place on the tree for their shoes. You could also make the tree into a poster that could lay on the floor. At the end each student could place their shoe on the appropriate place on the tree.

What Kind of Wetland is it? cont'd

Utah Wetlands Dichotomous Key: Now that your students understand how a flow chart works, have them try to key out different kinds of wetlands found in Utah using a more scientific, dichotomous key. Put the students into 8 groups (or more if you have more pictures), and hand each group a picture of a wetland (from the pocket in your binder). Have them start at the top of the Key to Utah Wetlands, and make choices about what their wetland looks like at each step until they identify their particular wetland. Some wetland pictures can be found on the UDWR website at www.wildlife.utah.gov/wetlandsed. Have them look at the clues about the wetland on the back of the picture. You will need to cover the answer on the bottom. After they have finished, you can have groups exchange pictures and see if they come up with the same answers. At the end, show all pictures to your entire class, and go through each on the key. See if everyone agrees on the answers.

Extensions

Another option for using this Key to Utah's Wetlands is to use it at an actual wetland. When at a wetland site it is easier to discern the amount of water, the amount of vegetation, and its elevation.

Assessment

Ask your students to list 3 types of wetlands found in Utah and the differences between them.

Have your students create a key for some common objects, such as buttons, or candy.

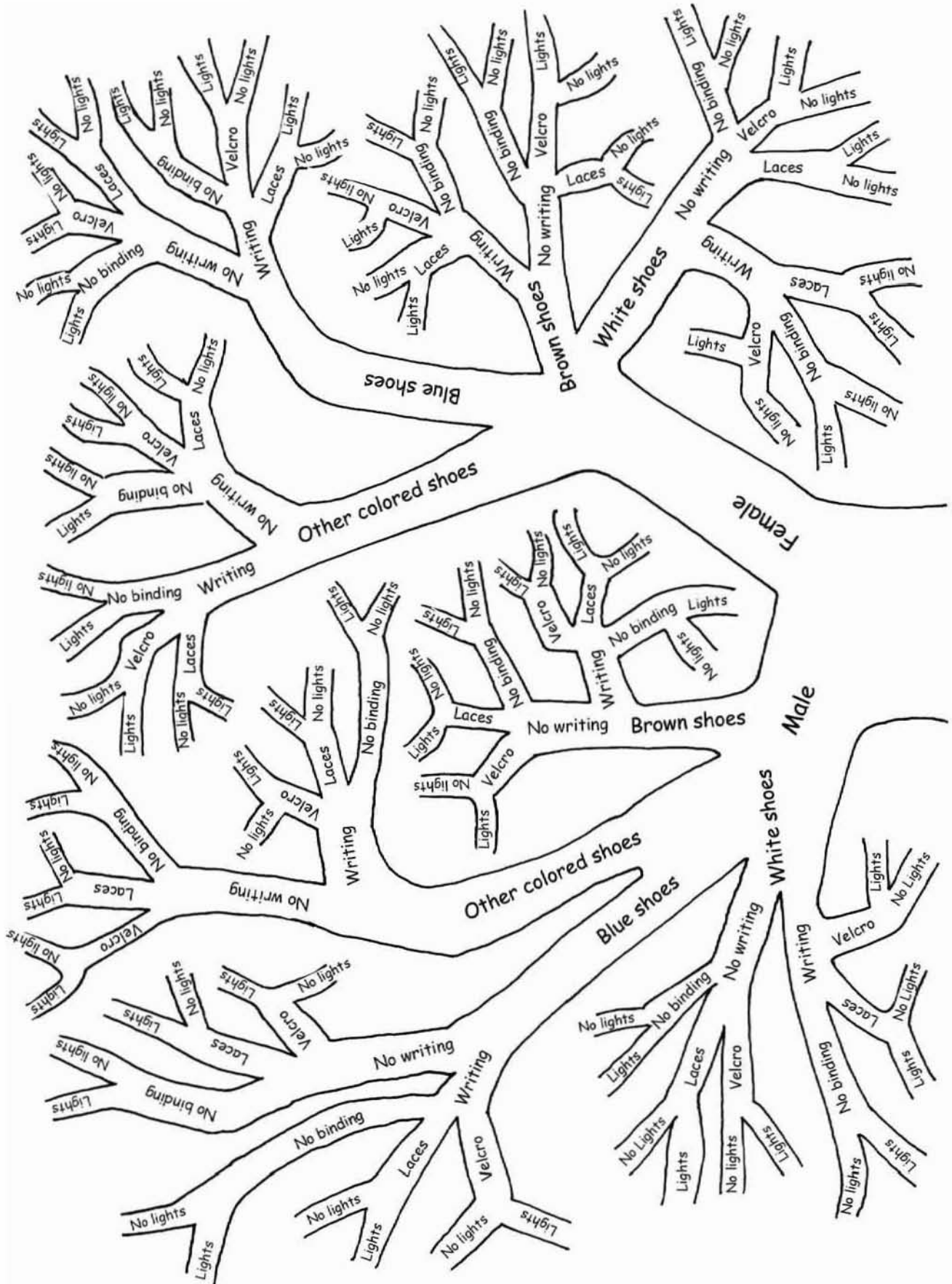
Have your students draw a picture of a Utah wetland, and give the correct name for the type of wetland they each draw.

Helpful Websites

<http://www.park.edu/bhoffman/courses/bi225/labs/Dichotomous%20Keys%202.htm>
http://wetlands.fws.gov/Pubs_Reports/Class_Manual/class_titlepg.htm

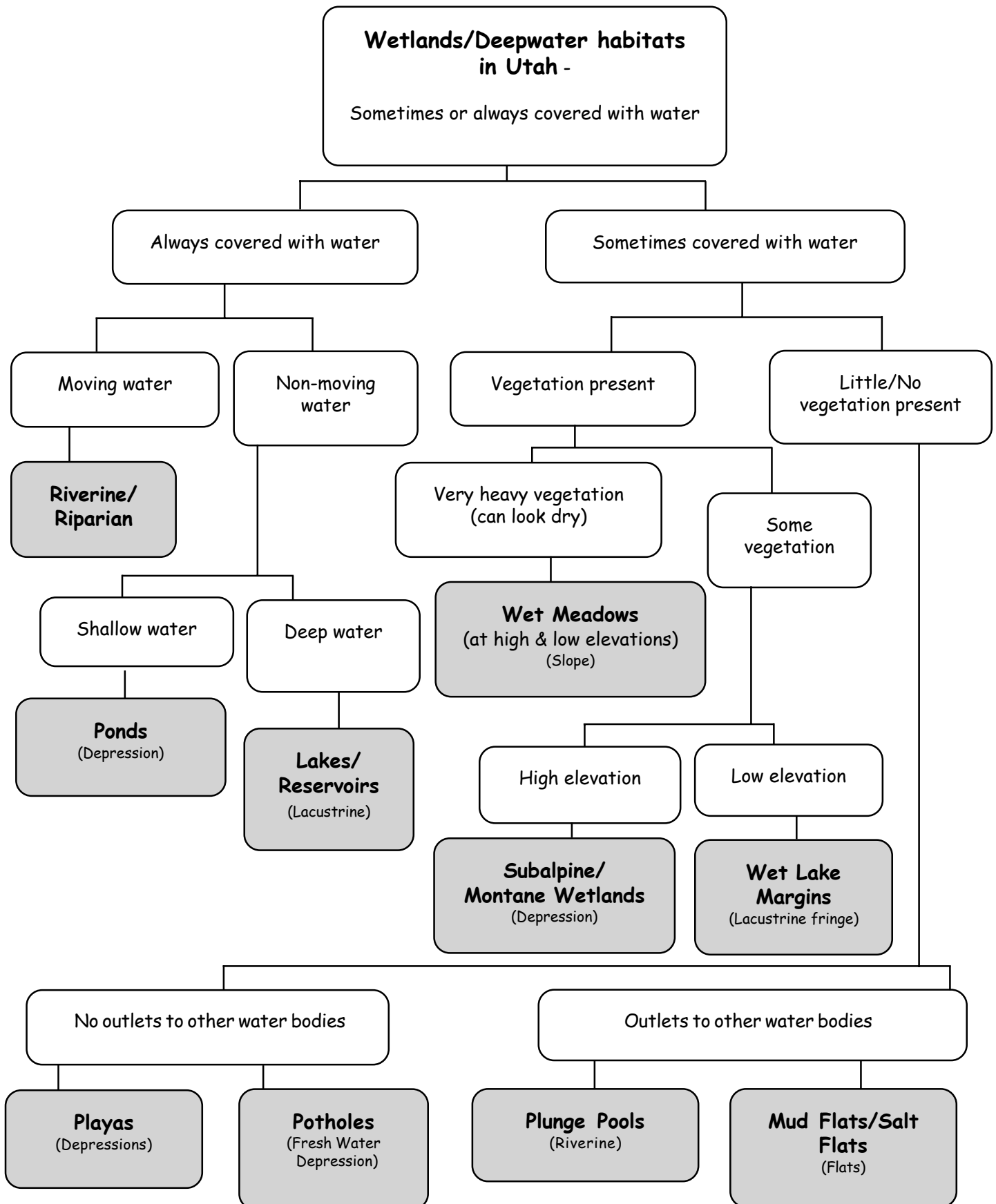
**Adapted from Keying out Kids, Trees are Terrific, Ranger Rick's Naturescope, National Wildlife Federation, Judy Braus, editor, 1998. Reprinted with permission of the McGraw-Hill Companies, publisher.*

Keying Out Shoes Tree



Adapted from Keying out Kids, *Trees are Terrific, Ranger Rick's Naturescope*, National Wildlife Federation, Judy Braus, editor, 1998. Reprinted with permission of the McGraw-Hill Companies, publisher.

Key to Utah Wetlands



Where are the Wetlands?

Summary Students will determine where wetlands can be found in Utah.

Objectives Students will be able to:

- Read maps;
- Describe some basic geographical features of Utah;
- Explain where some wetlands in Utah are found.

Materials

- Map of local area
- Copies of blank outline map of Utah (1 per student)
- Copies of color map of Utah Wetlands and Ecoregions (back of binder)
- Pens or colored pencils

Background Wetlands can be found throughout the state of Utah, although 75% of them are located around the Great Salt Lake. Wetlands in southern Utah are more likely to be either reservoirs or riparian areas. The wetlands identified by symbols on the map of Utah showing wetlands (found at back of binder) are only a sample of the wetlands found in Utah. They include some of the wetlands the Wetlands Biologist at UDWR is studying. Other wetlands shown on the map from other data sources are riverine/riparian lands, wet lake margins, open water, additional wetlands and wildlife management areas. Wetlands found under the "additional wetlands" category includes ponds, playas, wet meadows, etc., but they are not distinguished as such due to the data source not having those specifics. Wildlife Management Areas includes only those state lands where a significant portion of the land includes wetlands. There are also many rivers shown on the map. Not all rivers necessarily have wetlands always associated with them, but sometimes they do. If you have a river accessible to you and want to use it for your field trips, check it out first to see if there are any areas next to the river that seem to have soggy soil and wetland plants. These would probably be the easiest and best indications of a wetland. There are also other wetlands in Utah that aren't shown on that map. Mapping wetlands in Utah is still a work in progress! Finally, the ecoregions on the map are not that important for the students to understand. They are essentially areas of the state divided up according to climate and topography, and somewhat by species present. They are included on this map to assist the students in distinguishing between different parts of their state.

Time Involved 30 minutes

Utah Core Standard V, Objectives 1c, 1d

Preparation Make copies of blank maps for students.

Activity Have your students make an outdoor map of your local area. You may want to begin by having you and your students walk around the school, and if possible, your school's neighborhood. Ask them to look for wetlands, including anything resembling a wetland. For this activity, you could even consider a puddle on the grass a small "wetland," although technically, it is not truly a wetland. Have your students bring along their journals for the walk, to make a rough draft of a map on the way. They should put landmarks, such as the school, churches, houses, etc. on their maps, as well as "wetlands" in the area.

Where are the Wetlands?, cont'd

After returning to the classroom, show your students a real map of the local area, highlighting where the school is. Ask your students to find where their homes are on the map. Then ask them to create a more detailed map of the area similar to the map you just showed them, emphasizing where wetlands are, or where they might be. Discuss with them places where wetlands could possibly be, such as next to drainage ditches, or where backyards are often flooded when it rains. Your students may wish to create a map with a perspective other than from above, which is fine. Discuss a list of requirements for the map, such as labels indicating distances and directions; landmarks and habitat elements such as trees, boulders, ponds, a map legend, etc. Review the cardinal directions with them (North, South, East, West). Have the students put arrows and directions on their map. Ask some students to share their maps and discuss where they thought wetlands would be and why.

After they have created this local map, explain that they will now be looking for wetlands throughout Utah. Luckily, someone already did the hard work for them and found many wetlands in Utah-they don't need to drive all over the state! Pass out one copy of a blank map of Utah to each student. Next, pass out a map of Utah showing the ecoregions and wetlands in the state. Assign each group of students a different kind of wetland to search for, such as ponds or wet meadows, etc. Then, while looking at the wetland map, have groups locate as many of their type of wetland as possible, draw them in on their blank maps, and label them. When finished, ask each group to report their findings to the rest of the class. Discuss the different kinds of wetlands they have found and why they think that kind of wetland was found in that part of the state. They can use the Ecoregions as clues or just their own general knowledge of the state.

Extensions

Use the website listed below to look for more wetlands in Utah. You should investigate this website before introducing your students to it, as it may be confusing for them. It shows wetlands throughout the country. Since this is a work in progress, data on the wetlands in some states is more accurate than for other states. The information on Utah's wetlands is far from being complete, but it does show many wetlands, including some that are not found on the map accompanying this curriculum. Have your students look for wetlands with this mapping tool. You will notice that the names for wetlands on this map are different from wetlands on the map included with this curriculum. Don't worry about it-scientists do not agree on the names for different kinds of wetlands. As your to students find other wetlands on the web map and have them place these new wetlands on their own maps. They can use the labels that are found on the web for these. Ask them to share their findings again.

Assessment

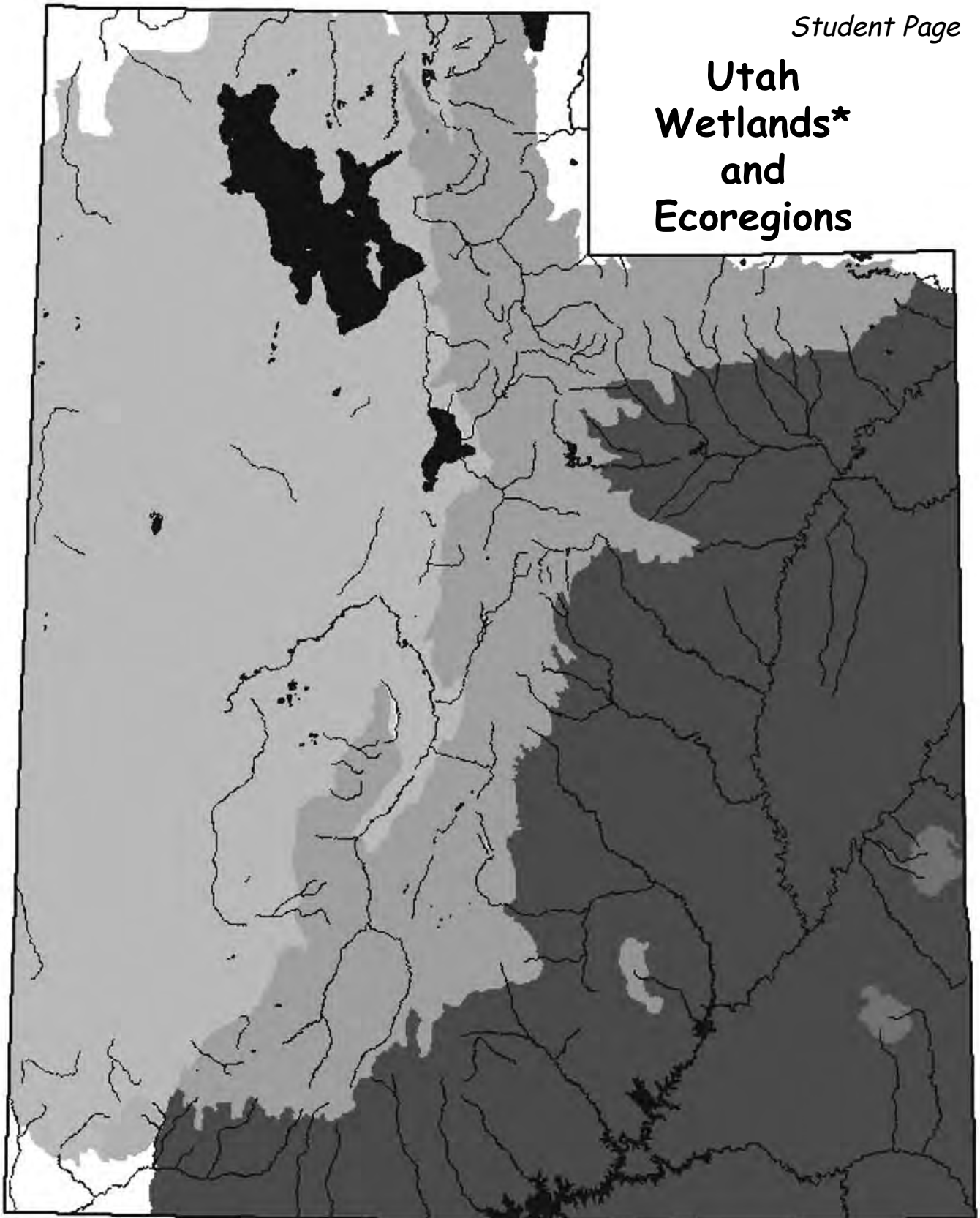
Assess your students on the accuracy of the maps they created. They do not need to be perfect, but look to see if they seemed to understand the general concept of the activity. Ask them if there are wetlands on their maps that they think are missing (for example, there are probably more wet lake margins around other lakes - some wetlands are so small that they won't appear on a map of this scale). They can place possible wetlands on their maps. They can also place their neighborhood wetlands on their maps in the appropriate places. Ask the students if they think the map of Utah's wetlands will ever change. If so, why?

Helpful Websites

<http://wetlandfws.er.usgs.gov>
<http://www.terrafly.com>
<http://www.globexplorer.com/>

Adapted from Map Your Habitats, Arctic Nesting Shorebirds Curriculum for Grades K-12, 1998.

Utah Wetlands* and Ecoregions



LEGEND	
	Ecoregions
	Southern Rockies
	Colorado Plateau
	Wasatch - Uinta Mountains
	Northern Basin & Range
	Other
	Wetlands
	Subalpine - Montane
	Potholes, Plunge Pools
	Ponds
	Playas
	Low Elevation Wet Meadows
	High Elevation Wet Meadows
	Riverine - Riparian Lands
	Open Water
	0 10 20 40 60 80 Miles

* Includes only Wetland Research Study Sites in Utah

Do You Dig Wetland Soil?

(Pre- and field site activity)

Summary Students will make a wetland soils color chart using Crayola crayons, then during the field study they will dig a hole to examine the characteristics of wetland soil.

Objectives Students will be able to:

- Describe differences between wetland and upland soils
- Use keys to recognize wetland soils

Materials

Part A (Pre-field trip):

- Crayola Crayons®, 64-color boxes
- Scissors
- Paste/glue
- Posterboard or manila folders
- Copies of the Color Me Wet! student pages

Part B (Field trip):

- Examples of different kinds of soil (sand, silt, and clay)
- Soil probe or shovel
- Pencils
- Hand lenses
- Copies of Soils Data Chart

Background See Background information - What makes a wetland a wetland? Wetland soils are hydric - saturated with water for long periods of time. Because of this saturation, wetland soils are different in color from upland soils. Mineral wetland soils can sometimes be *gleyed*. Gleyed soils usually form when the soils are saturated all the time, and are characterized by neutral gray, greenish, or bluish gray colors. Mottled soils form in areas where the soil is wet some of the time, and dry some of the time. When the soil is wet, minerals like iron and manganese collect in the soil. Then when air moves through, as it dries, the mineral concentrations of iron and manganese oxidize, and essentially rust. This leaves mottled shades of red, orange, and yellow, or sometimes black areas in the soil.

When you dig deep enough into the ground, you eventually see different soil layers, called 'horizons', layered on top of one another. These horizons which differ in color, represent years of accumulation, compaction, and different stresses on the soil. Scientists use a tool called a Munsell Soil Color Chart to identify soils. The color chart students create in Part A of this activity is a simplified version of the Munsell book.

Other soil characteristics, besides soil color, to examine include texture and moisture. By putting all of these characteristics together, one can identify the type of soil in a wetland.

Time Involved Part A: 30-40 minutes
Part B: 60 minutes

Do You Dig Wetland Soil, cont'd

Utah Core

Standard III, Objectives 2d, 3b;
Standard V, Objectives 1a, 1b

Literature Connections

Anderson, Margaret, Nancy Field and Karen Stephenson. Leapfrogging through Wetlands. Dog-Eared Publications. 1998. An excellent activity-oriented book for elementary-aged children to explore a wetland ecosystem.

Hickman, Pamela. Wetlands. Kids Can Press Ltd. 1993. An excellent, well illustrated and comprehensive book for providing elementary-aged children complete information about wetlands.

Luenn, Nancy. Squish! A Wetland Walk. Atheneum. 1994. Designed to enhance the younger reader's appreciation of the wetlands. A boy begins to understand the abundance of life and activity the wetlands provide.

Preparation

Make copies of student pages.

Activity

Part A: Making a Soil Color Chart - Hand out copies of the color chart student page and review directions. Explain that this is a simplified version of something called the Munsell Soil Color Charts. Have the students color the chart using the Crayola® color names given. It is important that they use the indicated colors in order to identify the soils correctly. On the color charts, numbers 1, 5, 6, 9, 10, 13, 14, 15, 16, and sometimes 2 are probably wetland soils (on the left side of the chart). Have the students complete the other steps to prepare the charts (see directions on the Student Worksheet for this activity). Have students look at and feel the different kinds of soil (sand, silt, and clay). Ask them to describe the differences between the soils. Have them use their soil charts to see if any of these soils match their charts.

Part B: Dig In! - At the wetland - either dig a 2 foot deep hole in the ground using a shovel or use a soil probe to get soil that is about 2 feet below the surface. Remove some of the soil at the indicated depths on the Soils Data Chart. Ask students to examine these soil samples. Have the students record observations and characteristics of the soil samples in the Soils Data Chart, using the color chart from Part A and the word lists of soil characteristics that accompany the data chart. After completing the Data Chart, share answers and use the 'Dig In' Discussion Questions to discuss soils in more depth.

Extensions

Make a mud picture/painting with the different colors and kinds of soil you find.

Invite a soil scientist or University Extension agent to talk to your class about his/her career working with soils.

Ask your students what kind of soil they think they'll have in their backyard. Get permission for them to dig a small hole at home, and have them check out their soil at home.

Do You Dig Wetland Soil, cont'd

Assessment

Gather different kinds of upland and wetland soils. Place samples around the room, and label them 1, 2, 3, etc... Have your students go to each sample individually or in pairs, and have them write on a sheet of paper whether they think each sample is a wetland or an upland soil. Gather their answers and correct as a quiz.

Helpful Websites

<http://www.cnr.umn.edu/sci/StudProj/Wetlands2.html>

http://piru.alexandria.ucsb.edu/~buchel/catalog/show_collection.php/www?record_id=417

<http://vathena.arc.nasa.gov/curric/land/wetland/ttalk.html#dirtdet>

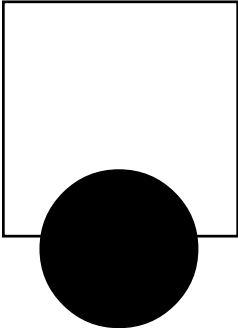
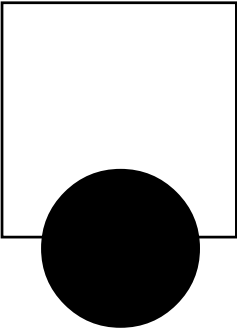
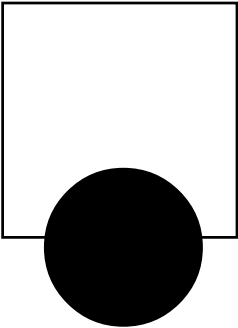
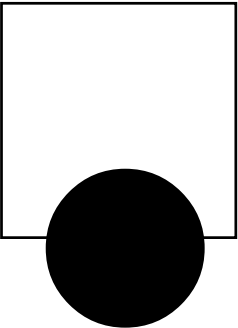
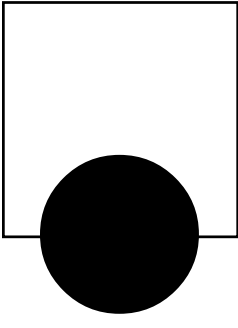
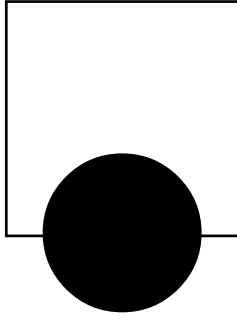
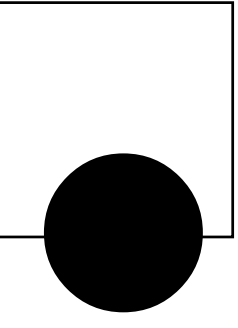
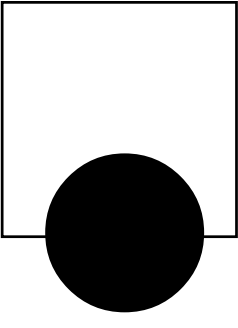
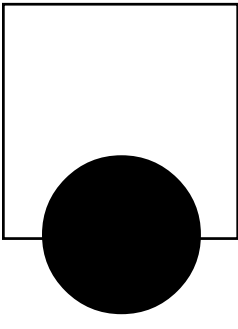
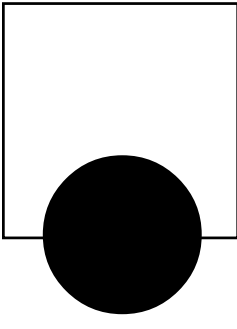
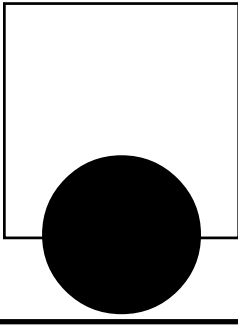
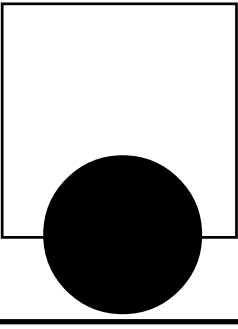
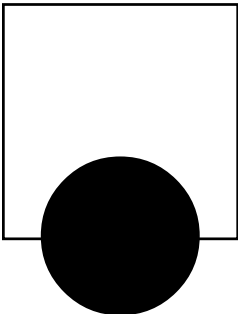
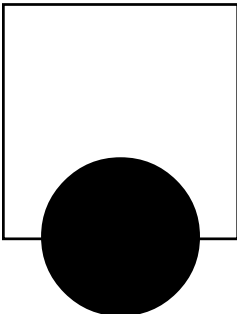
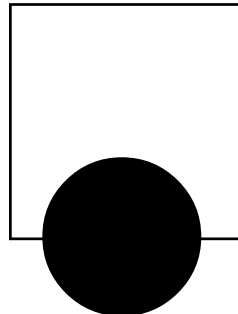
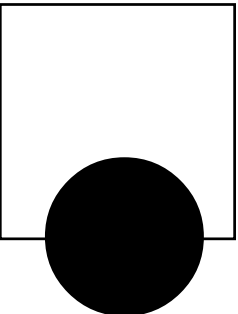
Do You Dig Wetland Soil from *WOW! The Wonders of Wetlands* is used with permission from Environmental Concern Inc. For further information contact Environmental Concern Inc. at (410) 745-9620 or visit www.wetland.org.

Use Crayola Crayons® to color in the squares on the chart below. Then cut out the entire chart and paste it on some posterboard. Finally, carefully cut out the black circles through both the posterboard and the paper.

Scientists use a color chart similar to this one to identify wetland soils when they are out in the field. When you are out in a wetland, hold up a sample of wetland soil behind the chart, so that it is visible only through one of the holes. Try to look at only the main color in the soil. Move the soil sample around below the holes in the color chart until you have found one or two colors that nearly match the main color of the soil sample.

Wetland Soils Color Chart

WET _____ **DRY**

1. Gray (light) +White 	2. Olive green (light) + White 	3. Peach 	4. Goldenrod 
5. Gray 	6. Brown + Gray 	7. Tan 	8. Bittersweet 
9. Black 	10. Black + Sepia 	11. Olive green + Raw sienna 	12. India red 
13. Sea green + Gray 	14. Forest green + Gray 	15. Pine green + Gray 	16. Sky blue + Cornflower + Gray 

Soils Data Chart

Student Page

Record the words or phrases that apply to each soil sample in the chart below.

Texture/moisture:

Rub the soil between your fingers. Choose words that describe how it feels.

- dry, moist, wet, very wet, or drippy
- falls apart, sticks together, sticky (sticks to fingers)
- feels like clay (easily molded into shapes)
- slippery, oozes (extrudes between fingers when you squeeze it)

Soil particles:

Draw the size and shape of the particles. What is the sample made of?

- sand (feels gritty)
- minerals (tiny bits of rock)
- clay (like dry cat litter)
- silt (like flour or powder; slippery when wet)
- pebbles
- organic matter (bits of leaves, twigs, bark, etc.)

Color: Use color chart

Other features or creatures:

What does the soil smell like? List or describe any rocks, dead plants, or other nonliving materials in the soil. List or describe any living things such as worms, roots, or insects. Do you see any roots with "rusty" red or orange soil around them?

Depth from Soil Surface	Texture/ Moisture <small>(how does it feel?)</small>	Soil Particles <small>(describe or identify them)</small>	Color # <small>(use color chart)</small>	Other Features or Creatures
2" (5 cm)				
4" (10 cm)				
6" (15 cm)				
12" (30 cm)				
18" (45 cm)				

Dig In! Discussion questions

1. *What soil characteristics did you observe?*

Share data and observations from the soil data the students completed. Wetland soils may have any of the characteristics listed below. If you were able to dig down into the wetland soil, the students' charts should in one way or another match these descriptions:

- some shade of dark brown or black (see color chart)
- feels like sticky clay and is some shade of gray, green, or darker color (see color chart)
- made up of peat or organic material, sand and/or other minerals, clay, silt, loam, or some combination of these materials in layers or mixtures
- when squeezed, sticks together or oozes out of fingers in a ribbon-like strand
- broken surfaces of the samples reveal mottles or splotches of color throughout the sample in some shade of red, orange, or yellow (see color chart)
- no earthworms in very wet, saturated soil (they would drown or suffocate!)
- sulfur gas from anaerobic activity; smells like rotten eggs

2. *How did soil at the bottom of the hole differ from soil near the surface, in color and texture?*

This depends on the type of wetland you were in and the level of the water table in your sample area. You may have observed layering of soils similar to the diagram shown here. Most wetland soils have a dark layer of (aerobic) organic soil at the top, where oxygen is exchanged with the atmosphere, and (anaerobic) mineral or organic soil below.

3. *Can you find evidence around your sample area that shows where the soil particles came from?*

Most organic topsoil is the result of the breakdown of fallen leaves and dead plants. Organic wetland soil is the accumulation of organic material that has not decayed because of the anaerobic soil condition. Mineral soils are formed over time from weathering of rocks. Wetland soils on the banks of streams and rivers may have formed through the gradual deposition of soil particles that were carried in (and eroded by) water.

4. *Can you tell where the water and soils in this area are coming from? What watershed drains to this spot?*

Have the students look at factors that bring water into the area. This is informative since it is the degree of wetness and how it affects the condition of the soil that is of importance. Look at topographic features of the area and weather conditions. For example, if the wetland lies in a depression at the bottom of a slope, runoff from the slope will end up in the wetland, eventually seeping into the soil to make or keep it wet.

5. *Did you find anything that was not natural (i.e. human-made) in the soil? How do you think it got there?*

In many cases, human products (e.g. litter, chemical pollutants) enter a wetland just as deposited soil and other natural materials do - with the inflow of water. These materials are introduced to the environment at some point, whether intentionally or unintentionally. Discuss these possibilities with the class. Have students speculate on the source of any human-made materials they have found.

6. *Compare wetland soil to soil you have observed at home and around school. How do the soils differ, and what makes them different?*

The primary difference is that wetland soil is wet or saturated for an extended period, and upland soil is not saturated. The colors of the 2 soils are different because chemical reactions that occur in anaerobic (saturated) soils differ from those that occur in aerobic soils. The differences that students may observe in wetland and upland soils depend on the areas sampled - there are many possibilities. If the entire hole is made up of organic soil, it must be a wetland soil. Usually this would be peat.

What's this Plant?

Summary Students will use dichotomous keys to identify wetland plants.

Objectives Students will be able to:

- Use a dichotomous key to classify plants;
- Explain why scientists use dichotomous keys;
- Identify differences between general groups of plants;
- Identify differences between species of plants.

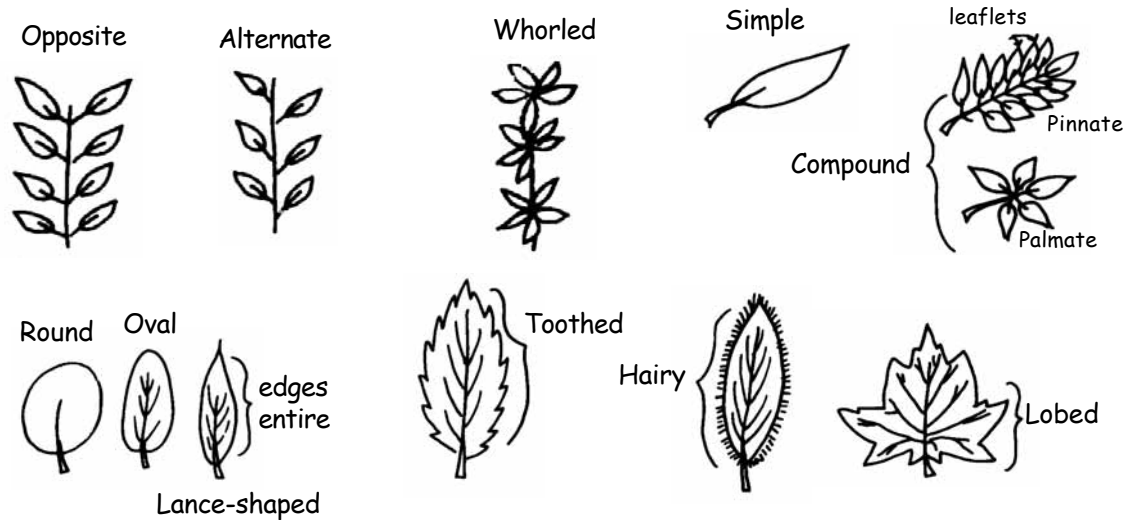
Materials

- Pictures of wetland plants
- Field guides
- Hand lenses

Background For information on dichotomous keys, see *What Kind of Wetland is it?* activity.

In order to identify plants, there are some terms you should know to help you and your students describe characteristics of the plants.

Leaves can be arranged on the stem in different ways:



(Plant drawings from *This Plant Key is all Wet, WOW! The Wonders of Wetlands* are used with permission from Environmental Concern Inc. For further information contact Environmental Concern Inc. at (410) 745-9620 or visit www.wetland.org.)

Time Involved 30-60 minutes

Utah Core Standard V, Objectives 2a, 3a, 3b

What's this Plant, cont'd

Preparation

Gather wetland plants, or wetland plant pictures. Make copies of keys for students.

Literature Connections

Anderson, Margaret, Nancy Field and Karen Stephenson. Leapfrogging through Wetlands. Dog-Eared Publications. 1998. An excellent activity-oriented book for elementary-aged children to explore a wetland ecosystem.

Lasky, Kathryn. Pond Year. Cambridge, MA: Candlewick Press. 1995. Two young girls enjoy playing and exploring in a nearby pond where they discover tadpoles, insects, wildflowers in the summer, and a place to skate in the winter.

Activity

Review with your students what a dichotomous key is used for. If you did not do the *Keying out Kids* activity from the *Where are the Wetlands?* activity, you may want to do it now to help your students understand flow charts and dichotomous keys. Also review with your students the different plant characteristics described on the previous page. You might even make up a quick quiz to help them remember the characteristics when they are looking at plants.

What Type of Plant is it?: This activity demonstrates how to use a dichotomous key by using general plant categories. Have your students use the key as directed on the student page. Students will determine the differences between vines, trees, shrubs, emergent aquatic plants, etc. (*Adaptation of This Plant Key is all Wet from WOW! The Wonders of Wetlands is used with permission from Environmental Concern Inc. For further information contact Environmental Concern Inc. at (410) 745-9620 or visit www.wetland.org.*)

What Species of Plant is it?: This is a more advanced activity where students use a dichotomous key to identify species of plants. You can either gather wetland plants, or use pictures of wetland plants in Appendix B.

Divide your class into groups of 2 to 4 students. Hand each group a few plants or plant pictures, and a wetland plant dichotomous key. Instruct your students in using this dichotomous key, emphasizing that this is similar to the flow chart they used in the 'Keying out Kids' activity. Tell them to start at the top of the key and answer questions at each step, which will eventually take them to the point where they determine the kind of plant they have. After they have keyed out one plant, tell them to write down their answer, then attempt another plant. Try to have them key out at least 3 plants. At the end, ask them to share their answers, and tell them if they were correct or not, and why. Since this may be a difficult activity for 4th graders, you may want to do this as a class activity first, before having students do it on their own.

What's this Plant, cont'd

Extensions

If your students are advanced, they can also try to key out plants while on the field trip. You can pick a few select plants for them to identify, or have them attempt to identify any plant they find. But, there are many different plants out there, and they may not fit into one of the categories described in 'What Type of Plant is it?' They can also use the Key to Common Wetland Plants to identify some plants. But, again this may be a bit difficult for them.

Have your students create their own dichotomous key using something simple such as a set of different shapes and sizes of buttons.

Assessment

Ask your students why a scientist might use a dichotomous key. Are there other ways to identify objects or places?

Have each student demonstrate to you how they used their key to identify a plant or group of plants.

Helpful Websites

<http://www.nr.utah.gov/tputah/four7.htm>

<http://www.npwrc.usgs.gov/resource/plants/florawe/index.htm>

What's this Plant? Key

To use this key, look at a plant or picture of a plant and then, starting with question #1, answer the first question. At each step, proceed to the next question you are told to go to, depending on the answer you choose, until you find the kind of plant it is.

1. Are the stems or other parts of the plant woody and rigid, like a tree?

Yes.....Go to 2.
No.....Go to 6.

2. Is the plant growing above the ground but leaning on other plants?

Yes.....It is a **VINE**.
No.....Go to 3.

3. Is the plant growing above the ground and standing on its own?

Yes.....Go to 4.

4. Is the plant 20 feet tall or taller?

Yes.....It is a **TREE**.
No.....Go to 5.

5. Does the plant have more than one main stem?

Yes.....It is a **SHRUB**.
No.....It is a sapling (young) **TREE**.

6. Is the plant a soft (herbaceous) plant, like grass?

Yes.....Go to 7.
No.....Start over.

7. Is the plant growing in open water that is always there, such as a pond, lake or permanent stream?

Yes.....Go to 8.
No.....Go to 10.

8. Is the plant growing completely underwater, freely floating on the surface, or does it have floating leaves?

Yes.....It is an **AQUATIC PLANT**.
No.....Go to 9.

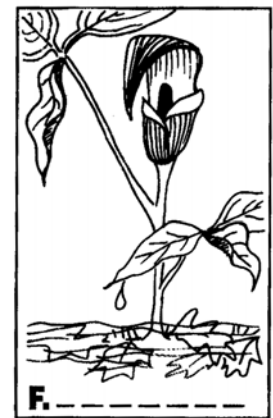
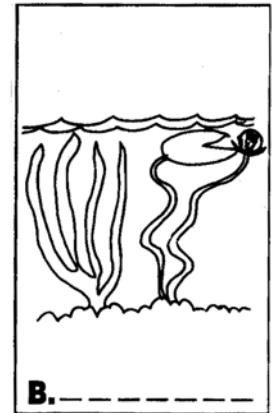
9. Is the plant growing with roots and part of the stem under water, but the rest sticking up above the surface?

Yes.....It is an **EMERGENT PLANT**.
No.....Go to 10.

10. Is the plant growing in soil that is saturated, wet, spongy, or appears to have been wet at one time (remember that wetlands are not always covered by water)?

Yes.....It is an **EMERGENT PLANT**.

Write the plant name on the dotted line in each block.



Key to Wetland Plants

Student Page

1. Plant is a grass, or looks like a grass Go to 2.
Plant is not like a grass. Go to 5.
2. Plant is a GRASS (has hollow stem with buldges that look like joints) Go to 3.
Plant looks like a grass (does not have a hollow, jointed stem). Go to 4.
3. Grass seed head is soft and feathery; seeds are small. Reed canarygrass
Grass seed head is stiff; seeds are large. Wheatgrass
4. Plant stem has edges (is triangular) - it is a SEDGE. Go to 6.
Plant stem is round (but not hollow) - it is a RUSH. Go to 7.
5. Plant is soft and herbaceous (not woody like a tree) - it is a FORB. Go to 8.
Plant has woody stems or branches - it is a TREE or SHRUB. Go to 9.
6. Stems are thick, greenish-brown, spotted, with soft edges. Hardstem Bulrush
Stems are narrow, bluish-green with sharp edges. Nebraska Sedge
7. Flower is at the end of the stem Spikerush
Flower is at the side of the stem, but near the end. Baltic Rush
8. Leaves and/or stems are prickly. Go to 12.
Leaves and stems are mostly smooth. Go to 13.
9. Stem and branches have stiff thorns. Russian Olive
Stem and branches are smooth. Go to 10.
10. Leaves are narrow and long. Go to 11.
Leaves are shaped like a triangle, and have bumpy edges (serrated). Fremont Cottonwood
11. Leaf buds are covered by one scale. Willow
Leaf buds are covered by several scales. Narrowleaf Cottonwood
12. Leaf edges are prickly and lobed. Thistle
Leaf edges are prickly and bumpy (serrated), stem is prickly. Teasel
13. Leaves are long and smooth, all leaves are found at the bottom of the stem. Cattail
Leaves are either opposite or alternate, are variable. Other forbs

Adapted from Key to Some Common Cache Valley Wetland Plants, by Barbara Daniels, UDWR.

Plants and their Watery World

Summary	Students will demonstrate their understanding of wetland plant adaptations by creating their own wetland plant.
Objectives	Students will be able to: <ul style="list-style-type: none">• Identify some adaptations wetland plants have allowing them to live in a water-logged environment;• Identify differences between wetland and upland plants.
Materials	<ul style="list-style-type: none">• Variety of art and scrap materials, such as: styrofoam, popsicle sticks, toothpicks, pipe cleaners, foil, yarn, toilet paper tubes, egg cartons, paper cups, clay, etc.• Habitat cards
Background	See Background Information on Wetlands - 'Wetland Habitat'
Time Involved	60-90 minutes
Utah Core	Standard V, Objectives 2a, 3a, 3b
Literature Connections	Anderson, Margaret, Nancy Field and Karen Stephenson. <u>Leapfrogging through Wetlands</u> . Dog-Eared Publications. 1998. An excellent activity-oriented book for elementary-aged children to explore a wetland ecosystem.
Preparation	Make wetland plant niche cards from topics below (write these descriptions on index cards or scraps of paper): Niche Cards: Lives underwater in a pond Lives along a swiftly moving stream Lives along edge of a freshwater marsh Floats on the surface of a pond Lives along the edge of the Great Salt Lake (in water that is salty) Lives in a high elevation mountain bog
Activity	Discuss with your students the kinds of adaptations plants have that allow them to survive in a wetland. How does it stand upright in mushy soil? How does it get oxygen? How does it get rid of salt if it lives in salty water? How does it disperse its seeds? How can it float on top of water? Hand out one "Niche Card" per student. Have each student create a plant that can survive in a wetland environment as stated on their card. Provide a variety of art and recycled materials for students to use. Have students share their creations and explain how the adaptations of the plant enable it to survive in the niche described on the card.

Plants and their Watery World, cont'd

Extensions

Perform an experiment in which pairs of small, identical potted plants are treated exactly the same except that one plant of the pair is immersed in water up to the soil line and the other is watered and allowed to drain normally. You can use some native plants, and some exotics or ornamentals. Have students predict what they think will happen. Measure and graph the growth and general condition of the plants each week. Compare results after one month. Have your students discuss or write an essay on what happened to these plants, and how this relates to wetland plants and the adaptations they have.

Assessment

Judge how well your students explained their plants' adaptations for their wetland plant's niche using a rubric.

Did they explain: how it gets oxygen? How it gets rid of salt (if it lives in a salty environment)? How it disperses seeds? How it survives living in water all the time? You may give your students points for each of those questions, and additional points for the following questions: Did they attempt to make a (somewhat) original plant? Did they give a name to their plant, etc.?

Adapted from Create-A-Plant, Washington Department of Ecology Discover Wetlands, 1995.

Wetland Who's Who?

Summary	Students will learn about wetland animals by guessing what animal card they have pinned to their back.
Objectives	Students will be able to: <ul style="list-style-type: none">• Identify animals found in a wetland;• Use descriptive characteristics to describe animals to others.
Materials	<ul style="list-style-type: none">• Wetland animal cards• Clothespins (1 per student)
Background	See Background Information on Wetlands - 'Wetland Habitat - Wetland Interactions'.
Time Involved	20 minutes
Utah Core	Standard V, Objective 2c
Literature Connections	<p>Becker, Julie. <u>Animals of the Ponds and Streams</u>. Minneapolis, MN: EMC Corporation. 1977. Describes 10 animals of ponds and streams.</p> <p>Cole, Henry. <u>I Took a Walk</u>. New York, NY: Greenwillow Books. 1998. This richly illustrated book takes you through woods and meadows and beside streams and ponds, where you discover butterflies and box turtles, wildflowers and water birds.</p> <p>Hodge, Deborah. <u>Beavers</u>. Kids Can Press. 1999. Great book for elementary-aged children featuring interesting facts about the life history of beavers.</p> <p>Kirkpatrick, Rena. <u>Look at Pond Life</u>. Raintree Children's Books. 1978. Easy-to-read text exploring plant and animal life in the pond.</p> <p>Michels, Tilde. <u>At the Frog Pond</u>. Lippencott. 1989. Describes the animal life at a secluded pond during spring and summer days.</p> <p>Parker, Nancy Winslow and Joan Richards Wright. <u>Frogs, Toads, Lizards and Salamanders</u>. New York, NY: Greenwillow Books. 1990. Colorful book about animals common to wetlands.</p> <p>Rosen, Michael J. <u>All Eyes on the Pond</u>. Hyperion Press. 1995. In this book for early elementary-aged children, each drawing focuses on one inhabitant of the pond and looks at the world through its eyes and at its level in the pond. This book can be used by teachers to teach kids to see different perspectives.</p> <p>Sanders, Scott Russell. <u>Crawdad Creek</u>. Washington, DC: National Geographic. 1999. This book describes, from season to season, the animals that live in and around a creek, as observed by Michael and Elizabeth.</p>

Wetland Who's Who?, cont'd

Preparation Make wetland animal cards. You can use the pictures in Appendix C, or you can find your own in books and magazines.

Activity To get kids started thinking about wildlife in wetlands, have them come up with their own list of wildlife species they think might live in a wetland. List them on the board.

You can either leave the list on the board for the rest of the activity, or erase it to make the activity more difficult. After making the list, describe the activity and tell your students the rules:

- Each person will have the picture of a wetland animal pinned to their back, but they will not know what that animal is.
- The purpose of the activity is to guess what wetland animal you 'are'.
- The way you do this is to go around to each person in the class, and ask them each 3 questions that will help you determine what you are. They must be questions that have either a yes or no answer - no exceptions! And, no cheating and getting your friends to tell you the answer!
- You can give them examples of questions they might ask, such as: Am I large? Am I small? Do I have 4 legs? Am I covered with fur? Am I covered with scales? Do I eat other animals?, etc.
- When you think you know the answer (and are pretty confident about it), go to an adult and tell them what you think you are. They will tell you yes or no. You are only allowed to tell the adult what you think you are 3 times, then you're done, and must wait for everyone else to finish.

Now go around to each student and using a clothespin, pin a wetland animal picture card to the back of each student's shirt. The person should not see what animal is pinned on them. Give them about 15 minutes to try to figure out what animal they are.

If you have some students who cannot figure out what they are, have them come to the front of the class. The class can give hints until they each figure out what animal they have. At the end, go over everyone's wetland animals.

Extensions Have each student write a short paper on the animal that they were. Have them include habitat requirements: the amount of food, water, shelter and space they need, along with other interesting facts about their animal.

Assessment While students are participating in the activity, circulate among them to observe students asking questions of other students. Do they use good, creative, descriptive words, or are they obviously doing the bare minimum? Evaluate them on their attempts.

Draw a rough picture of a wetland on the board or on a large sheet of paper. Include shallow water, deeper water, and plants, including cattails and cottonwood trees and other typical wetland plants. Ask each student to put the name of one animal on the board, or they can draw it, where they think that animal lives. Tell them that they must use a different animal from the one that they "were".

Helpful Websites

<http://www.lethsd.ab.ca/mmh/grade5/wetlands/page4.htm>
<http://dwrncdc.nr.utah.gov/ucdc/>

Migration Views

Summary Students will create maps showing places where migrating waterfowl travel.

Objectives Students will be able to:

- Identify areas where migrating waterfowl travel and stop to rest;
- List ways that migrating birds find their way on their migratory route;
- List some migratory waterfowl.

Materials

- Modeling clay
- Paints
- Toothpicks or pushpins
- Yarn
- Cardboard or posterboard

Or, more simple option:

- Posterboard or large drawing paper
- Markers, crayons, colored pencils or paints

Background When birds migrate, they use many clues to find their way along their migratory route. During the day they may use mountain ranges, rivers, coastlines as visual cues. At night, some species can also use the stars to navigate their way. Scientists have even found that birds use the Earth's magnetic field to determine the general direction they are supposed to travel. Birds usually travel along what is called a 'flyway'. There are 4 main North American flyways: Atlantic, Mississippi, Central, and Pacific flyways.

Utah's Great Salt Lake draws migrants primarily from the Pacific flyway, although some come out this way from the Central flyway also. Shorebirds and waterfowl make up the majority of the migrants. The wetlands of the Great Salt Lake provide habitat for over 5 million birds of some 250 different species. To learn more about these birds and their migration, attend an International Migratory Bird Day festival. These celebrations are usually held the second Saturday of May, but can be celebrated on various weekends throughout May or June.

Time Involved Two, 40 minute sessions

Utah Core Standard V, Objectives 2a, 2c, 4a

Literature Connections Carlstrom, Nancy White. Catching the Wind. Mulberry Books. 1994. A book about geese and other birds.

Cherry, Lynn. Flute's Journey. Gulliver Green. 1997. Follow the life of a wood thrush from Maryland to a Central American rainforest. Although the wood thrush is not a wetland bird, the story of migration is wonderful.

Preparation Find pictures of North and South America (you can try <http://www.worldatlas.com>) to show to your students.

Migration Views, cont'd

Activity

Ask your students if they have ever flown in an airplane and looked at the ground below. What did it look like? If they haven't flown on an airplane, have them imagine what the Earth would look like from high above. What would they/did they see? Help them understand that they would probably only see the largest, most obvious parts of the Earth, such as mountains, rivers, lakes, coastlines, etc. Explain that these are the same features birds see when they are migrating, and in fact, these are the clues birds use to navigate their way over thousands of miles.

Instruct your students to make a map of North and South America, showing major coastlines, rivers (such as the Mississippi), lakes (Great Salt Lake, Great Lakes), and mountain ranges (Rockies, Appalachian, Andes), and any other pertinent geographic information. Then have them research a migratory bird species that travels through Utah (see list below). After researching, have your students mark multiple places on their map where their species might be found on its migratory route, especially the beginning and ending points.

Birds that live in Utah for part of the year:

- Peregrine falcon
- White-crowned sparrow
- Black-chinned hummingbird
- Broad-tailed hummingbird
- Ruddy duck
- Wood duck
- Black-crowned night-heron
- Common merganser
- Forster's tern
- Franklin's gull
- Greater white-fronted goose
- Green-winged teal
- Lesser yellowlegs
- Long-billed curlew
- Northern shoveler
- Red-breasted merganser
- Sandhill crane
- Snow goose
- Snowy egret
- Spotted sandpiper
- Tundra swan
- Virginia rail
- White-faced ibis
- Western sandpiper
- Least sandpiper

Ask your students to write down some 'Gee Whiz' facts about their bird, especially as it relates to migration. For example, how far does it fly, how much does it need to eat to build up fat (for energy) for its trip, what flyway does it use, etc. Have them share this information with the class.

Extensions

Have your students map more than one bird's route. They can map a bird that migrates a farther distance, and maybe one that migrates a shorter distance. They can then compare the differences between the birds, and hypothesize why they migrate different distances.

Do the Project WILD Aquatic activity, *Migration Headache*.

Assessment

Have your students write a story from the perspective of their migrating bird throughout one entire year. Have them describe their migration route, how they find food as the weather changes, if they find a mate, etc.

Helpful Websites

<http://www.birdnature.com/migration.html>
<http://www.ebird.org/content/>
http://whyfiles.org/006migration/fact_sheet.html
<http://birds.fws.gov/imbd/educators.html>
<http://sssp.fws.gov/index.cfm?pagename=migrationmap&linktype=2>

The Great Traveler

Summary Students will imagine themselves transforming into a bird (American avocet), then picture the migration journey that bird takes.

Objectives Students will be able to:

- Identify the parts of a bird;
- List ways that migrating birds find their way on their migratory route;
- Describe the migration route of the American avocet.

Materials

- Copy of the migration journey
- Journals
- Writing materials

Background See *Migration Views* background information. American avocets are among the largest migrating shorebirds. Because they are large, they can only migrate short distances. They do, however, migrate in large groups of hundreds to thousands of avocets. Most of the avocets found around the Great Salt Lake can be found there from the end of March until September or October. They spend their winters in Tepic, Mexico, a coastal area of western Mexico from around October/November to April/March of the next year. When in the wetlands of the Great Salt Lake, avocets eat the brine shrimp in the lake, as well as other invertebrates found in the water and soil. They will also sometimes feed on the plants associated with wetlands such as sago pondweed, saltgrass and bulrushes. When in the estuaries and wetlands in Mexico their food includes similar invertebrates and plants. Avocets are wading birds, but are also good swimmers, using their partially webbed feet to swim. They usually migrate at night. When not migrating at night, they will often feed instead.

Time Involved 20 minutes

Utah Core Standard V, Objectives 2a-c, 4b
Language Arts: Standard I, Objectives 1a, 1b;
Standard VI, Objectives 1a, 1b, 2b, 3b;
Standard VII, Objectives 1a, 1b, 2a-e, 2g, 2i

Literature Connections Carlstrom, Nancy White. *Catching the Wind*. Mulberry Books. 1994. A book about geese and other birds.

Cherry, Lynn. *Flute's Journey*. Gulliver Green. 1997. Follow the life of a wood thrush from Maryland to a Central American rainforest. Although the wood thrush is not a wetland bird, the story of migration is wonderful.

Preparation None

The Great Traveler, cont'd

Activity

Ask your students to get comfortable and close their eyes. Tell them that they will soon be going on an imaginary journey to far away places where they have probably never been. But before starting on this journey, they will be changing their bodies, and turning into birds, since they will be undertaking a migration journey.

Tell them they will have to listen very closely while they have their eyes closed. Then read them the following story:

Imagine that slowly, one part of your body at a time is changing into a bird. First your feet are becoming long and thin, and look - you only have 4 toes, and they are partially webbed! Your legs are also getting much longer and thinner than they were. Next your body is becoming lighter, as your bones become hollow and fill with air. Your nose and mouth are changing into one body part - a beak that is very long, and curved up. Your eyes are getting much larger in your skull, enabling you to see farther than you have ever seen before. Your arms and fingers are becoming wings you can use to fly thousands of miles. And finally feathers sprout and cover your whole body. Now you are ready to begin your journey - you are an American avocet, a large migratory shorebird.

Your journey as an American avocet begins at the end of winter, in Marismas Nacionales, Mexico, a coastal swamp with many invertebrates for you to eat during the winter. The weather is changing, and the days are starting to get longer, and it is time for you to move on. It is nighttime, but this is the best time for your migration. With just a few flaps of your wings, you, and thousands of avocets around you, are airborne. You watch the Mexican wetlands that were your home for a few months grow smaller and smaller below you as you rise into the sky. As you fly, you follow the Mexican coastline for a while before heading slightly east. Using the stars and the gravitational pull of the earth to guide you, you eventually reach the Salton Sea in California. Although you can fly for long distances without stopping, you still must stop to rest and eat every so often. Your stomach is starting to rumble - no wonder - you burned off a lot of fat for energy and now you weigh much less than you did this morning! The Salton Sea is large enough that there is plenty of room for you and your partners in flight to land.

After finding your stopover spot, you come in for a landing. Sweeping your bill back and forth through the water, you gorge yourself on the many invertebrates living in the wetland. Afterwards, you take some time to rest before taking off again on your journey.

You travel like this for hundreds and hundreds of miles, stopping when you need to rest and eat, then continuing on your journey. Finally, you reach your destination - the Great Salt Lake! This will be your home for at least 5 months. Here you will lay eggs and raise your young until they are ready to migrate back to Mexico along with you.

Your time as an avocet has now come to an end. Your feathers disappear, and your arms and legs reappear, and you become you once again. When you are ready, slowly open your eyes.

After you have read the story to your students, have students share how they felt on their journey as an avocet. Have them draw a picture of their favorite time on their journey. Also ask them the following questions: Why do birds migrate? What clues do you think they use to find their way? Is it all instinct, or are there physical clues that help them out along the way? What dangers do they think birds face when migrating? Is there anything people can do to help migratory birds?

The Great Traveler, cont'd

Extensions

Place a map of North America in your classroom where everyone can see. Place a pin in Mexico, and one at the eastern edge of the Great Salt Lake. Tell your students that they are going to track the movements of American avocets migrating either north or south, depending on the time of year you are doing this activity. Each day, move the pin representing the avocets along their migration journey. At each stop, ask your students to write in their journals a paragraph or two about what the avocets did on that day - what they saw, if they stopped and ate, what went on in the flock, etc. Ask some students to share their stories with the class.

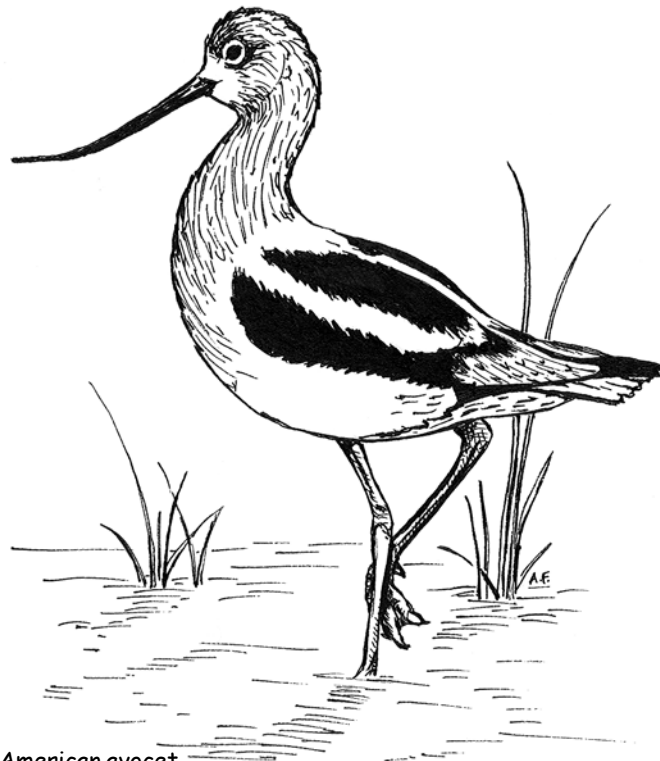
Assessment

Ask your students to draw a picture of a bird, labeling all the appropriate bird parts, such as beak, feet, large eyes, etc. They can create their own bird with its own specific characteristics - they do not need to draw a real bird. Then have them make up a story about their bird's migration route - where does it go? What clues does it use to find its way? How often does it stop to rest? You can put up a map of North and South America on the wall, and let your students go up to the map to decide where their bird travels.

Helpful Websites

See websites for *Migration Views*.

Also: <http://www.mbr-pwrc.usgs.gov/bbs/htm96/map617/ra2250.html>



American avocet

Heap o' Hazards

Summary Students will discover factors that influence migratory shorebird survival by becoming migratory shorebirds traveling from their wintering areas to their breeding habitat and back.

Objectives Students will be able to:

- Describe factors that influence migratory shorebird survival;
- Describe the role predators have in shorebird survival;
- Generally describe the basic survival rates of shorebirds migrating.

Materials

- Large playing area (100 x 50 feet)
- Tokens (about 5 per student)
- Chalk or rope to mark borders and regions
- 1 Jump rope
- 7 hula-hoops
- Hat to designate a predator
- Cardboard box (add one of each of the last two items depending on the class size).

Background Many shorebird species undertake incredible, long-distance migratory journeys between their wintering homes and breeding grounds each year. Many travel upwards of 15,000 miles round trip and some, nearly 20,000 miles. Several factors can limit the survival of migrating shorebirds. First of all, suitable wetland habitat is, of course, essential in both the areas where shorebirds spend the winter and in the northern areas where they breed. On the way, they also need wetlands where they can rest and build up fat reserves to continue on their migratory journeys. These wetland resting sites are called stopover sites or staging areas.

Time Involved 30 minutes

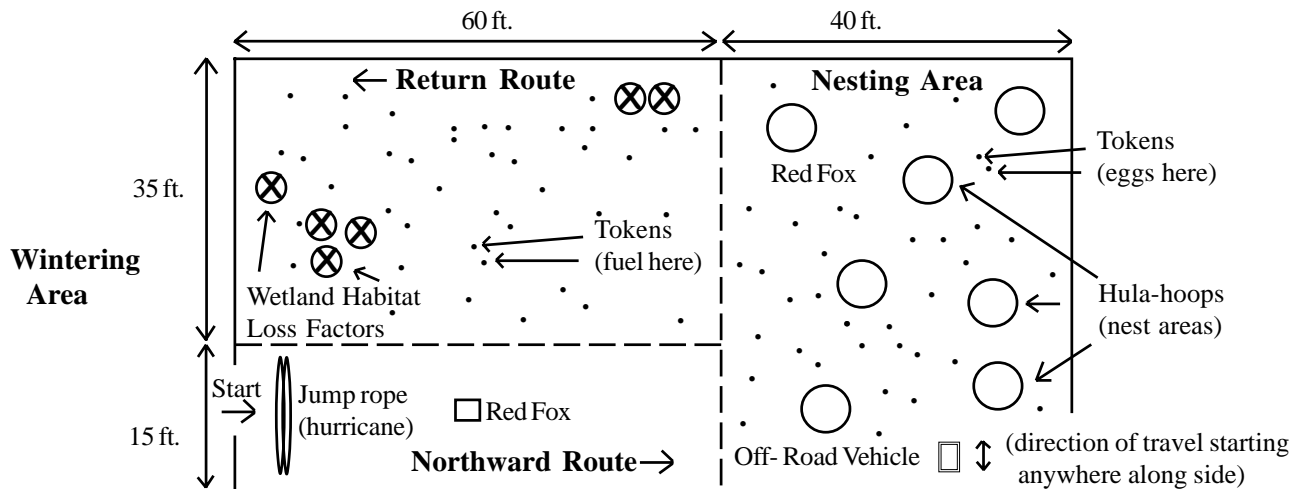
Utah Core Standard V, Objectives 2a, c, 4a
Physical Education: Standard 1, Objective 1;
Standard 2, Objective 1;
Standard 4, Objectives 1, 2, 3

Literature Connections Carlstrom, Nancy White. Catching the Wind. Mulberry Books. 1994. A book about geese and other birds.

Cherry, Lynn. Flute's Journey. Gulliver Green. 1997. Follow the life of a wood thrush from Maryland to a Central American rainforest. Although the wood thrush is not a wetland bird, the story of migration is wonderful.

Preparation Prepare the playing site as depicted in the diagram on next page. Scatter half the tokens in the nesting area and half on the return journey route.

Heap o' Hazards, cont'd



Activity

Begin by having students speculate some of the hazards that might affect the survival of migrating and nesting shorebirds. Hazards in this simulation will include a hurricane which blows shorebirds off course, a predator such as a red-fox that can prey upon shorebirds and their eggs, off-road vehicles that can run-over and crush nests, and loss of essential wetland stopover habitat sites needed for resting and refueling.

Next, explain that the students will be pretending to be shorebirds migrating in the spring from their winter homes in the south, north to their breeding grounds, and then back again in the fall. Walk through the course with students first, explaining the rules and designating roles of hurricane makers, predator(s) and the off-road vehicle operator(s). Then conduct the simulation. Start at the wintering grounds in the southern hemisphere shown in the diagram.

Rules:

- Shorebirds begin migrating from the starting point (wintering habitat) north along the northern route on the right side of the playing field. On the way, they must pass through a hurricane (jump rope being spun). If they are touched by the jump rope the hurricane has blown them off course and they must move to the return route side of the playing field and where they become wetland habitat loss factors such as housing developments, roads, drained or polluted wetlands and other factors that impact essential wetland stop-over sites needed by shorebirds making the return journey.
- Those that survive the hurricane continue on towards the breeding grounds. A hungry red fox (a student recognized by a hat or other prop) lives along the northward migration route and can capture (using both hands) migrating birds to make them more wetland habitat loss factors. Those that avoid being caught can continue on to the breeding grounds and attempt to nest.
- Shorebirds on average lay about four eggs and their nests are usually very well camouflaged. Shorebirds on the breeding grounds must each attempt to pick up four tokens without being captured by the red fox (the fox that was capturing shorebirds along the northern migration route previously) or having their nest crushed by an off-road vehicle.

Heap o' Hazards, cont'd

- Shorebirds are safe from the red fox only when they have both feet within a hula-hoop which represents their camouflaged nest. Only three shorebirds can occupy one hula-hoop at any time. Late arriving shorebirds may have to wait until a hula-hoop space becomes available before they begin gathering tokens. And shorebirds venturing out to gather tokens may lose their spot if they are not quick. A red fox can capture a shorebird only when it is outside the hula hoop (do not scatter egg tokens too near to each hula-hoop to keep shorebirds from just reaching outside of the hula-hoop without leaving it.) The red fox must escort each captured shorebird to the return route portion of the playing field.
- The off-road vehicle operator must place one foot inside the cardboard box. He/she can only move across the breeding area in a direction parallel to the short borders of the playing field (he/she can travel up or down only along the side borders). The vehicle operator must catch a shorebird with two hands, either inside or outside of its nest. When caught, the shorebird loses its nest and eggs must be taken by the off-road vehicle operator to the return route portion of the playing field. The vehicle operator can temporarily leave the box at the capture spot and then return after escorting the captured shorebird away.
- Shorebirds all tend to depart the breeding grounds at a similar time in the fall. In this simulation, however, once a shorebird has managed to safely pick up four eggs, it can begin the journey back to the wintering grounds following the return route on the left side of the playing field. In nature, along the return route, shorebirds must stop at stopover sites to rest and refuel. To simulate this, shorebirds on the return route must pick up two more tokens to represent food and rest. The tokens will be scattered throughout this area, but all of the former shorebirds that were either blown off course, caught by the red fox or had their nest destroyed by the off-road vehicle will be standing at random points along the course representing factors that eliminate essential wetland habitat. They cannot move from their spot but can reach out in an effort to capture shorebirds. If a shorebird attempting to pick up a token is caught by any of the wetland habitat loss factors then that shorebird too becomes a wetland habitat loss factor standing somewhere along the return route.
- Shorebirds able to successfully reach the wintering grounds with a total of six tokens survive their migratory journey. Four of the tokens represent their young.

Complete the simulation and review assessment questions below with your students.

Extensions

- 1) Have students research the migration routes of several different shorebird species.
- 2) Have students find out about the laws protecting migratory shorebirds and other migratory species.
- 3) Have students investigate efforts being made by people to help shorebirds.
- 4) Invite a biologist to discuss shorebird migration with your class.
- 5) Take students on a field trip to visit a wetland preserve to observe shorebirds.

Assessment

After the simulation, engage the students in a discussion. Ask them to summarize what they have learned about shorebird migration and nesting. Address the survival rate of shorebirds, the number of young that were successfully produced, the role of predators in shorebird survival and the role of people. Have them postulate ways they can help to enhance migratory shorebird survival.

Helpful Websites

<http://sssp.fws.gov>
See also websites for The Great Traveler and Migration Views.

Adapted from Hooks and Ladders, Project WILD Aquatic Activity Guide, Council for Environmental Education, 2002.

Wetland Web

Summary

Students will represent living and nonliving items found in a wetland and will demonstrate how everything is interconnected.

Objectives

Students will be able to:

- Identify some of the living and nonliving components of a wetland ecosystem;
- Demonstrate how components are interconnected.

Materials

- Cards representing living and nonliving things in a wetland
- Twine

Background

See Background Information on Wetlands - 'Wetland Habitat - Wetland Interactions'.

Time Involved

20 minutes

Utah Core

Standard V, Objectives 2a, 2c

Literature Connections

See book list for *Wetland Who's Who?* activity. Additionally:

Collard III, Sneed B. *Our Wet World*. Watertown, MA: Charlesbridge Publishing. 1998. Describes the lives and interactions of animals and plants that inhabit the many worlds of water.

Gorvett, Jean. *Life in Ponds*. McGraw-Hill. 1971. Discusses the food cycle and interrelationships of the living things in a pond. Gives suggestions for identifying and observing plants and animals.

Lauber, Patricia. *Who Eats What? Food Chains and Food Webs*. Harper Collins Publishers. 1995. Fun, colorful and educational non-fiction book for younger students featuring a variety of animal and plant food chains and webs from various ecosystems.

Zolotow, Charlotte. *When the Wind Stops*. Harper Trophy. 1997. In this book for early elementary-aged kids, a mother explains to her son that nature has beginnings and endings as well as cause-and-effect relationships.

Preparation

Make living/nonliving cards. For living organisms, you may use the plant and animal cards found in the Appendices. To find non-living items, look in books, magazines or internet clipart sites for pictures of such objects as the sun, rocks, dead leaves, wind, water, etc.

Wetland Web, cont'd

Activity

To introduce this activity, ask your students if they think we really need all the species of plants and animals in the world. Is there anything they think we could do without?

Group the students into one circle. Hand out one card to each student. Have them tell the rest of the group what is on their card. Tell the group to pay attention to what everyone is because they will need to know this for the rest of the activity.

After everyone has told the group what they are, hand one end of the twine to one person in the group. You may want to begin with the sun, because it is the source of all energy on Earth, and therefore, the beginning of all food chains. Tell that person to find something else in the circle that their wetland item in some way is connected to. For example, a marsh wren could be connected to an insect it eats, or a cattail upon which it can perch. Pass the end of the twine to the second person. Now have the second person do the same thing, and so on until everyone in the group is holding the twine in just one place.

Ask the group if they think we could get rid of anything in the circle. They often will say *mosquito*. Tell the mosquito (or whatever the component is) to tug on its part of the twine. Now ask who felt that pull, and have them pull their piece of twine. Eventually everyone in the circle should feel the pull. Ask the students what this tells them - what would happen if we lost all the mosquitoes? The students should grasp the concept that everything is connected to everything else, and even mosquitoes (or whatever they chose) have a place in the world.

An alternate way to demonstrate this concept is to have the unwanted component drop his/her twine, and have anyone who feels the drop, let go of their piece until the entire twine is on the ground. This may better demonstrate actually losing an organism.

Extensions

Do this activity as only a food web game. Connect in a series only those things that eat or derive energy from each other in some way. The students may need to think a bit. For example, the relationship between a tree and a raccoon might be that the tree could die, and then invertebrates would start decomposing it, and the raccoon would eat the invertebrates.

Have each student make a piece of a 'chain' using a piece of construction paper rolled into a circle (like with Christmas garlands). Have them write the name of their wetland object on the chain piece, and start connecting the pieces together as they are connected in the real world. They can do this as one long chain, or as a web of linked chains.

Assessment

In a group have students write and act out a fictional short story about some organisms living in a wetland, and the wetland components to which they are naturally connected.

Helpful Websites

http://www.greenwing.org/teachersguide/fall_98_folder/omnivores/More_About/more_about.html

<http://www.cwmb.sa.gov.au/kwc/section5/5-05.htm>

Wetland Metaphors

Summary Students will use everyday items to understand a wetland and the services it provides.

Objectives Students will be able to:

- Describe the functions of wetlands;
- Evaluate the importance of wetlands to wildlife and humans.

Materials

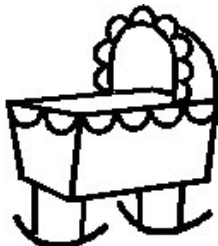
- A container such as a large pillowcase, bag, or box
- Sponge
- Small pillow
- Soap
- Eggbeater or mixer
- Small doll cradle
- Sieve or strainer
- Paper coffee filter
- Antacid tablets
- Small box of cereal
- 3X5 cards with pictures that could be used to show other wetland metaphors (a zoo could represent the idea of wildlife diversity in a wetland, a lush vegetable garden could represent the idea of a productive wetland in which food is abundant, a vacation resort could represent the idea of a resting or wintering place for migrating waterfowl, an artificial rose could represent the idea that wetlands are pretty, enjoyable places.)

Background See Background Information - Wetland Functions. Wetlands provide many functions for people and the environment alike. The list of objects below are everyday things that some way or another represent a wetland - they are metaphors for wetlands.



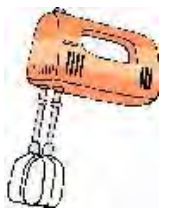
Object
sponge

Metaphoric Function
absorbs excess water caused by runoff; retains moisture for a time even if standing water dries up (eg. sponge placed in a small puddle of water absorbs water until saturated, then stays wet after standing water has evaporated)



pillow or bed
mixer or eggbeater
cradle

a resting place for migratory birds
mixes nutrients and oxygen into the water
provides a nursery that shelters, protects and feeds young wildlife



sieve or strainer
filter
antacid
cereal
soap

strains silt, debris, etc. from water
filters smaller impurities from water
neutralizes toxic substances
provides nutrient-rich foods
helps cleanse the environment, as wetlands do

Wetland Metaphors, cont'd

Time Involved 30 minutes

Utah Core Standard V, Objectives 1a, 1b, 2a

Literature Connections Anderson, Margaret, Nancy Field and Karen Stephenson. Leapfrogging through Wetlands. Dog-Eared Publications. 1998. An excellent activity-oriented book for elementary-aged children to explore a wetland ecosystem.

Calhoun, Mary. Flood. New York, NY: Morrow Junior Books. 1997. A story about a young girl and her family who are displaced because of the flooding of the Mississippi River. A good story to use to describe why wetlands are important (they help prevent flooding).

Preparation Prepare a "Mystery Metaphor Container" - pillowcase, bag, or box. It should be possible for students to put their hands into the container and pull out an object without being able to see inside the container. You can have as many as one metaphoric object per student, but have at least enough for one per group of 4 students.

Activity Give the students some background information on some of the functions wetlands offer as an overview. You may include the following:

- sponge effect - absorbs runoff
- filter effect - removes silt, toxins, wastes, etc.
- nutrient control - absorbs nutrients from fertilizers and other sources that may cause contamination downstream
- natural nursery - provides protection and nourishment for newborn wildlife

Bring out the *Mystery Metaphor Container*. Tell the students that everything in the container has something to do with what a wetland can do. Have the students divide into groups of 2 or 4. Have one person from each group take something out of the container. Tell them that as a group, they need to figure out how this thing could represent something a wetland does.

Allow them to discuss this among themselves, then have each group report its ideas to the class. Some groups may need more assistance than others.

Following discussion and review of the functions represented by each metaphor, ask the students to summarize the major roles that wetlands perform in contributing to habitat for wildlife. List the ways in which wetlands are important to humans. Why do humans convert wetlands to other uses? Ask them if their own attitudes about wetlands are different now. If yes, how? If not, why not?

Finally, encourage the students to understand how the condition of a wetland depends upon each of us. Many kinds of wildlife depend upon wetlands. Our own well-being is also dependent on wetland ecosystems. Strengthen the students' understanding of how humans are connected to wetlands. Recreation, aesthetics, utilitarian use, good environmental quality and nature study are but a few of the connections we each have with wetlands.

Wetland Metaphors, cont'd

Extensions

When in the field, explore these metaphors again. Have the students identify and discuss any limitations to the appropriateness of these metaphors. Ask them what seem to be the most compelling attributes of the metaphors in helping them understand the characteristics and nature of the wetland. Have them expand on their understanding of these metaphors and identify other metaphors.

Investigate local, county, state and federal regulations and laws that govern uses of wetlands.

Assessment

Ask your students to explain why wetlands are called one of the world's most productive ecosystems.

Wetlands are important to a range of organisms in the animal kingdom, from zooplankton to humans. Select five species of wetland animals and describe how wetlands are important to each. Have them describe how wetlands are important to them as well.

Helpful Websites

<http://www.epa.gov/watertrain/wetlands/>
<http://www.epa.gov/region01/students/pdfs/wetch3.pdf>
<http://water.usgs.gov/nwsum/WSP2425/functions.html>
<http://www.epa.gov/owow/wetlands/facts/contents.html>
<http://www.sierraclub.org/wetlands/factsheets/>

Adapted from Wetland Metaphors, Project WILD Aquatic K-12 Activity Guide, Council for Environmental Education, 2002.

How Did They Live?

- Summary** Students will read a story about a boy growing up in prehistoric times along the shores of the *Great Salt Lake*. Afterwards they will describe their own lives during a year, juxtaposing their own lives with that of the boy.
- Objectives** Students will be able to:
- Use reading abilities to read and understand the story *Naatse'e - A Boy of the Desert*;
 - Use writing abilities to construct a story of their own lives during a year;
 - Compare and contrast these two life stories for similarities and differences.
- Materials**
- Copies of the story *Naatse'e - A Boy of the Desert*
 - Journals
 - Writing materials
- Background**
- This story takes place in the *Great Basin*. Though it is mostly a desert, the *Great Basin* has wetlands throughout it as well. Most of these wetlands are found around the *Great Salt Lake*. The wetlands have plants such as cattail, bulrush and mustard. They also contain fish and waterfowl, especially during spring and fall. Sometimes playas are found around the marshes, but very few plants and animals live around playas. Mountain ranges rise from the desert floor. The snow in the mountains melts in the summer creating streams that travel across the desert floor and drain into the *Great Salt Lake*.
- Before the arrival of the Euro-Americans to the region, hunter-gatherers had learned to live in this unusual place. Because they did not have horses, all of their hunting and gathering was done on foot. They had to know which foods were good to eat, and where to find food in the marsh, on the playas, and in the mountains, during all seasons of the year. In the fall they worked hard to store enough food for winter.
- Time Involved** 45 minutes
- Utah Core**
- Standard V, Objective 2a
Language Arts: Standard IV, Objective 3
Standard V, Objectives 1a, 1b, 2a, 2b
Standard VI, Objectives 1a, 1b
Standard VII, Objectives 1a, 1b
Standard VIII, Objectives 1-5, 6a, 6b, 6c
- Literature Connections**
- Caduto, Michael J and Bruchac, Joseph. *Keepers of Life: Discovering Plants through Native American Stories and Earth Activities*. Fulcrum Publishers. 1994.
- Denver, Norma et al. *Stories of Our Ancestors: A Collection of Northern Ute Indian Tales*. Uintah-Ouray Ute Tribe. 1974.
- Smith, Anne M. *Shoshone Tales*. University of Utah Press. 1993. (You may want to copy only certain stories from this book - some will not be appropriate for children).

How Did They Live?, cont'd

Preparation Make copies of the story and vocabulary on next page.

Activity Students will read the story *Naatse'e - A Boy of the Desert*. You may either have them read it individually, in small groups, or as a class. After reading the story, have your students write their own short stories about their own lives in one year. But, before they write their stories, introduce the following questions to help guide their stories: How will their stories be different from Naatse'e's? What do they depend upon to live? Where do they live? What do they eat? Where does their food come from? Are they stationary, or do they move around a lot? What does this tell them about the native people's lives and connections to the environment compared to their life?

Extensions Ask your students to write a new story, placing themselves 300 years ago in the Great Basin. Ask them to write about what the roles of their different family members would be - what would their father do? What would their mother do? What would they do on a daily basis? They can make the story take place over a day, a week, a year, or whatever they wish.

You can also ask them the following questions: If you lived in the Great Basin 300 years ago, how might you have felt about killing your first deer? The coming of spring? The onset of winter? Moving to a new location? What else would you like to know about hunter-gatherers?

Assessment Ask your students questions related to the story to determine their reading comprehension. The questions related to their story and the extension questions above are also good assessment tools.

Helpful Websites

<http://www.greenriver-utah.com/fremont.shtml>
<http://historytogo.utah.gov/nativeamer.html> (very detailed account of Utah Native Americans)
<http://historyforkids.utah.gov/amnind.html> (kid-friendly short history of Utah Native Americans)
<http://www.onlineutah.com/indians.shtml>

Activity adapted with permission from Prehistoric Subsistence in the Great Salt Basin, Great Salt Lake Story Activity Guide with permission from the Utah Museum of Natural History, 1997.

Vocabulary

cache - a secure place to store food, tools, gear and raw materials.

cordage - several strands of fiber twisted together; string or rope.

cordage net - nets of various sizes made from cordage and used in hunting rabbits, ducks and fish.

mano - the shaped, hand-held stone used to grind grains, nuts, seeds and mineral pigments by moving it back and forth on a metate.

metate - a shaped stone slab used as a base upon which grains, nuts, seeds and mineral pigments are ground with a mano.

molt - to shed an outer covering such as feathers, cuticle or skin, which is replaced periodically by a new growth.

playa - a flat-bottomed basin that becomes a lake when surface water is available.

rabbit drive - included all band members; a long net was used and rabbits were clubbed or speared by all the people; sometimes fire was used.

tumpline - a strap slung across the forehead or the chest to support a load carried on the back.

wickiup - a small temporary structure usually constructed of brush and poles, and usually conical in shape.

Naatse'e - A Boy of the Desert

Student Page

My name is Naatse'e and I am 12 years old. I live in a land of wide open spaces. All around me mountains rise out of the desert, their peaks blue in summer and white in winter. The sun shimmers off the surface of the salt water lake that lies below the mountains. Greasewood, iodine bush, and other plants grow on the playa that extends from the lakeshore. The cry of water birds rises from the freshwater marsh not far from where my family and I are camped. Journey with me through one year of my life.

Summer

Summer is my favorite time of year. The days are hot and long with lots of time for hunting, fishing and playing in the streams that feed the marsh. My family and two other families arrived here only days ago. A large cave nearby provides shelter from the sun and rain.

For a few weeks during the summer, the ducks molt their feathers and they cannot fly, so they are easy to catch. My father and some of the older people wade into the marsh and chase the ducks onto the land. The rest of us quickly capture them with our hands. I am a swift runner and usually capture more ducks than anyone else. It is exciting to catch them, knowing that everyone in camp will be happy for a dinner of duck. Sometimes my uncle swims under the ducks with a cattail reed shaft for breathing, and captures them by grabbing their feet.

While we are duck hunting, mother collects the cattails which grow in the pond. Cattails have many uses. Mother uses the leaves to make baskets for storing seeds and cooking stews. The stalks are woven into sleeping mats which soften and warm our beds. The inside stem can be used to make cordage. Cordage is used to make animal snares, to tie willows together when making our wickiups or to tie bundles of iodine bush to our backs. Cattail root adds flavor to our meals and the down is used in my baby sister's cradle board as a diaper. For a few weeks in the summer we can collect cattail pollen and use it to make delicious cakes.

The marsh streams provide an escape from the long, hot days. My friends and I fish and play games in the cool water. We use a cordage net to capture the little fish and take them home to eat. When the stream is low, we collect shellfish easily.

Some days I help grandmother grind seeds into flour with the mano and metate. Grandmother uses the flour to make cakes for our evening meal. Sometimes I watch grandfather making arrowheads for hunting. He is teaching me to make arrows for my bow.

During these quiet times grandmother tells stories from her childhood. My favorite story is about the time a flood covered the marshes she and her people depended on for food.

Grandmother was just a little girl then. She and her family lived near the marsh every spring and summer, harvesting plants and hunting animals. For a couple of seasons it seemed that the marsh had fewer plants and animals. For a long time, the salty lake had been slowly rising and flooding the marsh, making the water salty and killing the plants that grew there. It was getting harder and harder to gather enough food.

Naatse'e - A Boy of the Desert

Student Page

One very warm spring, water melting from unusually deep snows, roared out of the mountains, filling the streams that flowed into the marsh. The salty lake rose higher than ever, flooding the marsh with salt water. The cattails and bulrushes died and the ducks would not settle there between migrations. Grandmother's people knew that finding enough food in the marsh would soon be almost impossible.

That spring her family moved closer to the shadows of the mountains. It was a difficult time for Grandmother and her people. Without food from the marsh, they had less to eat. She remembers how her stomach hurt from hunger.

Before coming to the marsh we spent time in the surrounding foothills, where the women gathered ricegrass seeds. They cut the stems of the grass and carried them to areas of the playa baked hard by the sun. In the evening or early morning, the coolest times of the day, they built small fires, moistened the grass so it would not burn quickly, and laid them in the fire. As the stems burned, the seeds roasted and dropped to the hard ground where they were scooped later into a basket. Some of the seeds were ground into flour for daily meals. Many of the seeds were carried in baskets back to our winter camp and stored in a cache.

Before the seed harvest began we constructed small wickiups and brush shelters to protect us from the sun. Wickiups are made from a willow frame, circular at the bottom and peaked at the top, with sagebrush or cattail mats tied around the outside. A space is left open for a door. The brush shelters are taller, with four sides open to the summer breeze and a sagebrush or willow roof for shade.

Fall

It is fall, and the days are getting shorter and cooler. Excitement fills the air because soon we will move to the mountains to collect pinyon nuts and to hunt. Many other people will join us, making it a time of celebration - a great time for dancing and making new friends. A scout returned to camp yesterday and reported that the pinyon nut harvest looks promising this year. Nuts were scarce the last two years, so a good harvest will make everyone happy. We will be able to store them for use this winter. It is more difficult to find food in the winter, so any seeds and nuts we can store will help.

We will hunt deer and mountain sheep from our mountain camp. This is my first year to hunt and I can't wait. I have made many arrows for my bow and practiced all summer. Mother has promised to make me a pair of deerskin moccasins since I have outgrown my old pair.

After harvesting pinyon nuts, hunting and drying meat, we move to the foothills for the winter where four other families join us. Before settling in, we build our wickiups and prepare caches to store the seeds and nuts we have harvested. I help my mother make the caches. I dig holes in the ground near our wickiups, and Mother lines the holes with clay. When the clay has dried, she places the seeds and nuts inside, then puts clay over the top to prevent moisture and rodents from getting inside.

After we are settled and the first snows have fallen we organize a rabbit hunt in the sagebrush fields near our camp. Everyone in camp works together. First we make a U-shaped corral of sagebrush. Inside the corral are 100 foot long cordage nets. We set out around

Naatse'e - A Boy of the Desert

Student Page

mid-morning, my friends and I walking arm-in-arm. Some distance from the corral, we all spread out across the land. Together we move through the sage, beating the bushes and making noise. The rabbits begin to run, and as they run before us our formation becomes smaller and smaller as we approach the corral. Finally, we chase the rabbits into the opening. Hunters quickly kill the trapped animals.

Rabbits are very important. They provide food and their skins are used to make robes which keep us warm. My robe is my most treasured possession.

Winter

It is cold. Snow covers the earth, hiding the plants and providing shelter for the little mice. Winter is not my favorite time of year. The days are short and cold, and fresh food is hard to get. In the long, dark nights I dream of the hot sun and of hunting fat ducks in the marsh.

We spend winter days preparing daily meals, repairing moccasins, making cordage, sharpening stone tools, hunting, telling stories and playing games. I like sitting in the warm winter sun making cordage and telling stories. We brought enough dogbane, a plentiful wetland plant, with us this winter to make a lot of cordage. We strip the outside bark from the stems and use it to make the string. Father makes fine rabbit nets. They require many yards of cordage, so I usually help him.

Spring

Everyone looks forward to spring! We wait for warm weather and the return of the ducks, the sprouting of fresh green plants, and the fish spawning in the streams. There is nothing better than fresh food after a long winter, so it is time to move to the marsh. Mother packs a carrying basket with the harvesting and cooking baskets, our rabbit skin robes, and some food and medicine. She will carry this basket on her back, supported by a tumpline fitted across her forehead. After winter in the camp, it is good to be on the move again. We will gather roots and greens along the way.

The first sounds of ducks squawking overhead bring shouts of excitement. Soon we will be hunting them again. The thought of fresh duck meat makes my mouth water. At this time of year we use a cordage net to hunt ducks. We string the net over the pond at an angle, supporting the ends on forked sticks stuck in the mud. We then sit quietly waiting for the ducks to swim under it. Once they do, we scare them into flying up into the net where they are easily captured. Equally as good as fresh duck are the eggs the ducks will soon lay. This once-a-year treat is always awaited with great excitement.

Seeds of various types ripen throughout the spring months, so we will move over the landscape to harvest them from different areas. If it is a good growing season we will not stay long in any one place, until it is time to move to the marsh again for summer.

Cattail Ducks

Summary Students will make cattail toys from cattail leaves, as did the Native Americans in this and many other areas of the country.

Objectives Students will be able to:

- Explain why Native Americans needed to make cattail ducks and dolls;
- Make their own cattail duck or doll.

Materials

- Scissors
- Cattail leaves (about 1 per student)

Background For thousands of years, Native Americans used cattails, bulrushes and the tule plant to make floating decoys for luring waterfowl to roosting sites to be captured for food. Once lured in, the ducks would either be bow-hunted, netted or snared. Archaeologists working in Nevada found almost a dozen 2,000 year old ancient duck decoys cached in Lovelock Cave, a large cave that opens up onto fossil Lake Lahontan. Fishhooks, nets and hooks on setlines were also found stored near the decoys in a cave. The lake that was present then was probably shallow and fluctuating. Archaeologists believe that the climate 2,000 years ago was cooler and more moist than today.

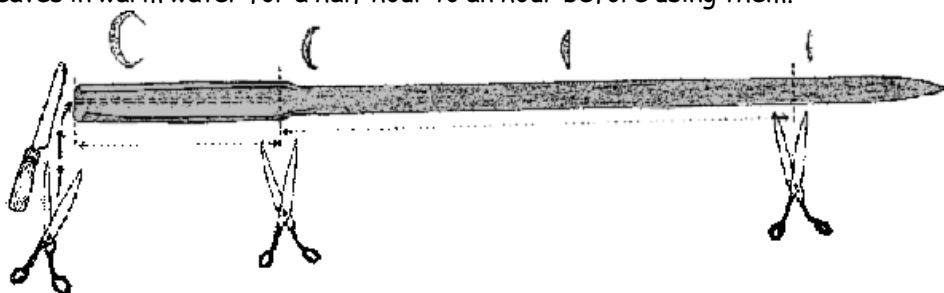
These decoys were made from tule reed, a plant species related to bulrush. Although they were found in the West, similar decoys were probably made all over the country. Even today in the Great Lakes region some are made with flexible tamarack sticks by the Cree Indians. Chippewa Indians make floating toy decoys from cattail leaves for their children.

Time Involved 20 minutes, plus time to collect, dry, and soak the cattail leaves.

Utah Core Visual Arts: Standard 4, Objectives 1, 2, 3

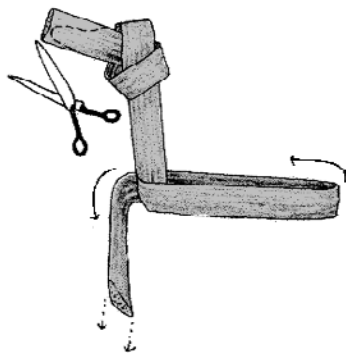
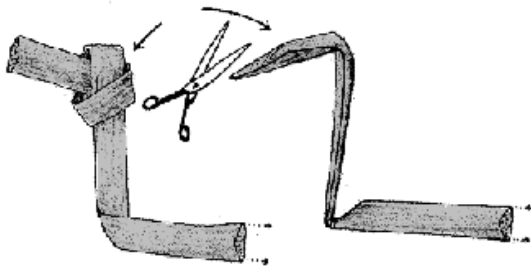
Literature Connections Caduto, Michael J. and Bruchac, Joseph. Keepers of Life: Discovering Plants through Native American Stories and Earth Activities. Fulcrum Publishers. 1994.

Preparation Gather cattails in late summer. Separate and rinse the leaves. No center stalks are needed to make the duck. Cut just above the water-line to leave the root of the cattail intact. You can use fresh cattail leaves or you can dry them for use at a later time. To dry them, place the separated leaves in the shade or partial sun for 1 to 3 days. Soak the leaves in warm water for a half hour to an hour before using them.



Cattail Ducks, cont'd

Activity



Cut off the thin leaf tip because it is brittle and not buoyant. Cut off and save the thick, white end of the leaf to later make a tie for the duck's body.

Leave the thicker end of the leaf for the duck's head. To create the head, tie a knot with the thick end of the cattail as shown in the picture.

Fold the rest of the cattail at a 90 degree angle, with approximately 2 inches above the fold for the neck, and the rest below the fold for the duck's body.

To create the body, leave 2-3 inches from the 90 degree fold to form a core. Then start wrapping the leaf around and around the outside of the body core until the end is reached. Just insert a new leaf under the end and continue wrapping. If your leaves are short, you may need to use 2 cattail leaves to fill out the wrapped body. After 10-15 wraps, end the duck's body by snipping the leaf on a diagonal to create a wing effect.

Tie the body tightly with a thin strip of the thick white end of the cattail leaf. You can also use a thin, stripped willow branch. Knot the tie at the bottom center of the duck's body so it won't show while it is swimming.

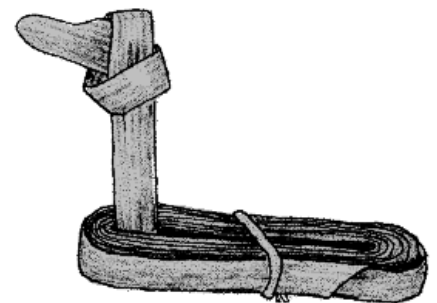
Extensions

You can also have your students make cattail dolls. See www.nativetech.org/cattail/catdoll.htm for instructions.

Discuss with your class why Native Americans made these decoys and dolls. Discuss how Native Americans lived - that there were no grocery stores or malls for them to buy food and toys. Ask your students to go home and try to find toys that are made of natural materials. Have them make a list of these toys, then share their lists with the class the next day. Ask them if they would like to make their own toys. Why or why not?

Assessment

Observe your students cattail ducks for approximate accuracy and interest in the work. Ask them if they think there are other ways that Native Americans could have lured animals besides by using decoys. Explain that although Native Americans used decoys, as we also now do to hunt ducks, other ways of luring animals can be illegal. For example, in some states it is illegal to place bait out to lure in a bear to kill it. Ask them why they think this would be illegal. Sometimes it is believed that this practice eliminates "fair chase," where the animal has a fair chance of getting away before being killed. Discuss with your class these ideas and whether or not they agree with them. They could also write a short essay on the subject.



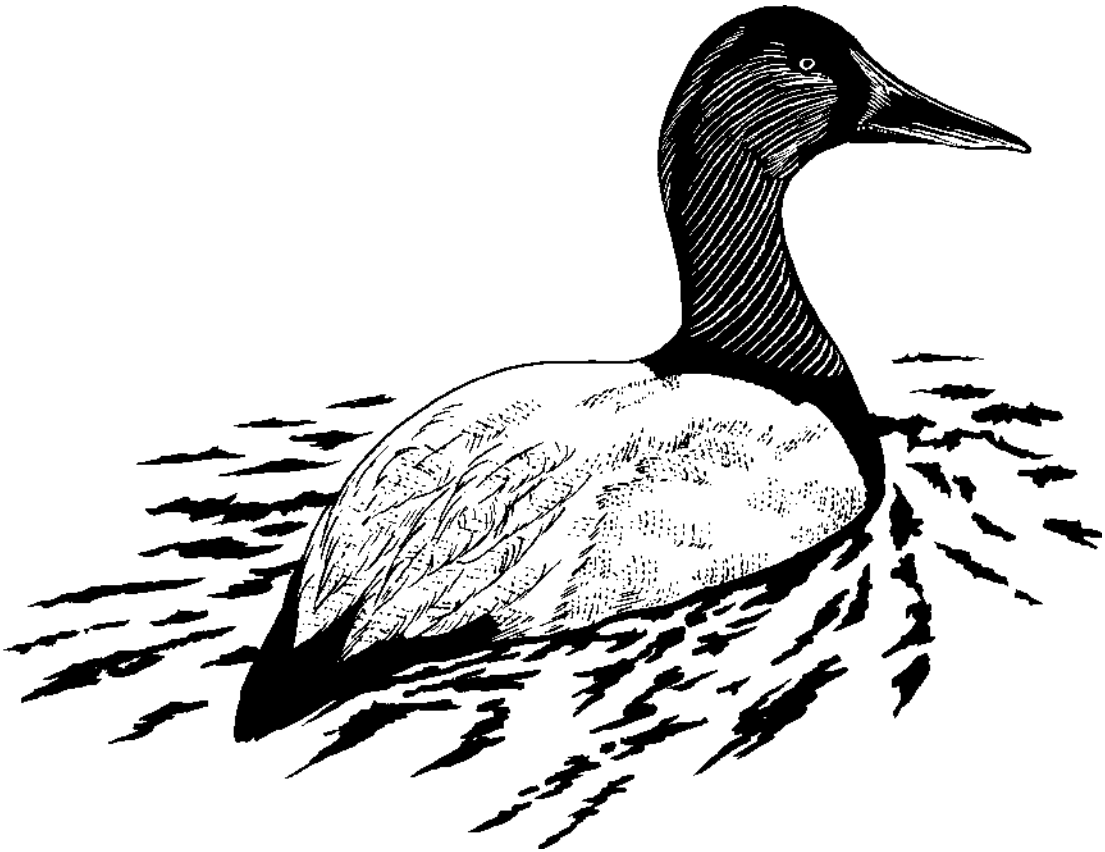
Helpful Websites

www.nativetech.org/decoy/DUCKDECOYS.htm

Activity and drawings © 2003, Tara Prindle, NativeTech: Native American Technology and Art

Field Trip Activities

Swimming Along!



Outdoor Etiquette

As you take your students into the wilds of a wetland for the first time, it is a good idea to speak with them first about how people should behave when in the outdoors. This is a great time to start instilling ethical behavior in your students when they go outdoors, or reinforcing it if they already are aware of these behaviors.

Some things you and your students should think about when exploring the outdoors:

- *Be as quiet as possible.* A wetland is not a playground. In order to get the most out of this experience, to hear animals, and even to be able to see better, it is important to speak and move as quietly as possible.
- *Always put natural items back where you found them.* If you scoop for macroinvertebrates, return them to the same area from which you got them when you are finished with the activity. If you dig a hole, place the soil back when you are finished. If you turn over a log to look for invertebrates, place it back when you are done.
- *If you handle any animals, handle them carefully, including macroinvertebrates.* Animals may be more fragile than we realize when handling them.
- *Pick up any litter you see (be sure it is safe, of course), and do not leave any litter behind.* As visitors to this wetland site it is your responsibility to keep the site as clean as possible.
- *Try not to walk on vegetation as possible.* If you must walk through plants, have your class walk in a line to minimize the impact they will have on that ecosystem.
- *Before leaving the site, look at it and have your students ask themselves whether the site looks as beautiful as it did before they came.* If it doesn't, do what you need to do to make sure it is as beautiful as before they arrived.

Things to think about before heading out on your field trip

Objectives - Decide what the objectives will be for your field trip.

Resource Person - If you know a local volunteer who was trained in this program, contact them to find a date that is good for both of you. You can also use a person who was not trained in this program if needed, to lead some of the less complicated activities, but you may want to prep them first.

Select your wetland site - The closer to the school, the better. This is true for obvious reasons, such as a shorter bus ride, but also, students are more likely to identify with a local wetland because it is in their community.

Select your date - Obtain permission to visit the wetland site, if needed.

Arrange transportation

Select activities you will do before, during and after the field trip.

Prepare the schedule for the field trip. Consider what activities you will be doing, the number of groups you would like your students to be in for the activities, and rainy day alternatives.

Recruit teacher aides and parents for assistance during your field trip. You may want to have at least one adult for every 7 students. Before the field trip, make sure your helpers are aware of their duties and your expectations of them. Some things to consider include:

- They should have a list of all students they are responsible for, and refer to this list any time the group moves.
- They should not use a cell phone at all during the field trip, except in the case of an emergency. Using a cell phone distracts the students and diverts their attention away from their tasks in the wetland.
- They should participate in the activities whenever possible. When adults are interested in an activity, children are more likely to also be interested, and will be more willing to participate.

Give instructions to your class. Let them know where they are going and what is expected of them. Discuss etiquette and safety with your students.

Send home permission slips and a list of what they need to bring on the field trip. Get emergency medical information from all students.

Gather and make (if needed) all field equipment. If you have the opportunity, practice using equipment.

Adapted from Arctic-Nesting Shorebirds Curriculum for Grades K-12, 1998.

Permission Slip

Dear Parent,
Our 4th grade class is planning a field trip to _____ ,
the site of a local wetland on _____ (date). This field trip will
be a culmination of our unit of study we have conducted on wetlands this year. Please
keep the top half of this sheet, and send your child to school on our field trip day with
the following items:

- Clothes that can get dirty
- Old pair of sneakers or other closed-toe shoes that can get dirty/wet
- Sunscreen
- Hat
- Bug spray (already applied before coming to school)
- Water
- Bag lunch that can withstand heat
- Lots of excitement!

Please return the bottom half of this paper with your child to bring to his/her
teacher.



I _____, give permission for my child,
(parent/guardian)
_____ to attend the wetlands field trip on
(child's name)
_____.
(date)

Does your child have any allergies? _____ If so, please explain, especially allergies
to medication.

Emergency Medical Information:
Who to contact? _____
Phone number _____

Alternate contact _____
Phone number _____

Sensing a Wetland: There's Nothing Like the Real Thing

Summary	Students will use their senses to experience a wetland.
Objectives	Students will be able to: <ul style="list-style-type: none">• Use 4 senses - touch, smell, hear, see - to learn about a wetland.
Materials	<ul style="list-style-type: none">• Blindfolds (optional)• Journals - 1 per student
Time Involved	40 minutes
Utah Core	Standard V, Objective 1b
Literature Connections	Baylor, Bird and Peter Parnall. <u>The Other Way to Listen</u> . Charles Scribner's Sons. 1978. Written in beautiful prose, this is a story about how to listen to nature with all the senses, as illustrated through the ears of a boy in the desert. The story reminds students of the importance of using all the senses to learn about nature.
Preparation	None
Activity	There's nothing like having kids experience a wetland themselves - allow their senses to be their guide. Start by explaining that usually when people lose one sense, such as sight, their other senses become strengthened. Therefore, for most of the following activities they will not be able to see. After the activities, to help them remember their wetland encounters, have them keep a journal of what they learned and felt in the wetland.
 Touch -	Wetlands have many neat things to feel such as mud, leaves from plants, shells from snails, and other such items. Have the children pair up. Have one child close his/her eyes, while the other child places something from a wetland in his/her hand. The child holding the item then tries to describe what is being felt. Then have them switch and use a different item.
 Smell -	Have the children close their eyes and take a few deep breaths while at the wetland. Ask them to use adjectives to describe the smell. Then ask what they think a smell the opposite of this one would be. While they have their eyes closed, pick up a clump of mud and hold it in front of each child's nose while their eyes are still closed. Ask what it smells like.

Sensing a wetland: There's nothing like the real thing, cont'd



Hear - Have the children close their eyes once more, and hold up one hand in a fist. Ask them to listen for sounds. Tell them to put up one finger for each different sound they hear. After listening for a period of time, have them share what sound at least one of their fingers represents.



See - Play 'I Spy' with different items in the wetland. Have the children guess what it is that you are/were looking at. Have them lead their own 'I Spy' game using descriptive words for colors, textures and shapes.

Pulling it all together - Spread the children out in a small area of the wetland. Allow them to have a 'silent sit' to reflect on their experiences in the wetland. Have them each secretly choose one element of the wetland to describe in their own way in their journal. The element can be anything in the wetland - a plant, insect, or even something like the wind or sun. When they are finished, have them switch papers with a partner, and have them try to figure out what their partner's 'wetland element' was. Afterwards have them share their descriptions with the rest of the class.

Extensions

In the classroom, you can introduce the sense of taste. Buy or make food that comes from a wetland and serve a wetland meal to your students! Some examples of wetland food include: cranberries (dried ones are sweeter), wild rice and fresh mint. You can also make biscuits with cattail pollen (see recipe below)! You can also pick pickleweed from a wetland near the Great Salt Lake. Don't forget to get permission from parents to serve your students this food - you never know who might be allergic to cranberries or pickleweed!

Assessment

Have your students record in their journal what they experienced in the wetland while using their senses.

Cree Bannock Biscuits

2 cups flour
1 cup cattail pollen
4 tablespoons margarine, butter, shortening, or lard
4 teaspoons baking powder
3/4 teaspoon salt
1 tablespoon sugar
7/8 cup milk or water

Mix together flour, pollen, margarine, baking powder, salt and sugar until like oatmeal (similar to pie dough crust). Add in milk slowly, adjusting amount to make a nice dough that is not too sticky. Knead dough into a ball and then flatten with hand, roll out with rolling pin to 1/2 inch thickness.

Cut into biscuits or cook in one whole piece (traditional way). Bake in oven at 350 F for about 15 minutes until golden brown. Or, cook in cast iron fry pan with a little butter melted in it for about 10 minutes per side on low heat...will feel light when turning over. Or, cook on a flat rock heated in a fire for about 10 minutes or so. Bannock will be lightly browned when done and light to pick up.

Eat hot with butter, jam or honey.

Collecting cattail pollen: Cattails usually start blooming at the beginning of the summer, and end in the middle of the summer. The pollen is yellow and forms on the male flower spikes, which grow up from the brown, hot dog looking female flower heads. To collect the pollen, bend the cattail stalk over and shake the pollen into a bucket or bag. (Get permission from landowners before collecting cattail pollen).

What Went on at the Wetland?

Summary Students will look for evidence of the presence of animals in their wetland, and try to determine what those animals were doing while in the wetland.

Objectives Students will be able to:

- Identify some animal clues such as tracks and scat, and link this to behavior of the animals;
- Explain interrelationships between animals and plants, and other aspects of their environment.

Materials

- Clue cards
- Grid sheet
- Clipboards, paper, pencils
- Copies of Student Pages
- 8 foot pieces of rope

Background Wherever animals are found, they are bound to leave behind clues, or *signs* about who they are, and what they were doing when the sign was left. Tracks are probably the clue people most commonly look for when they are trying to figure out what animal may be in an area. By looking at an animal's *tracks* you can determine:

- the species of animal
- the direction it was moving
- whether it was running, walking, trotting, etc. (advanced naturalists can tell this)
- what the substrate was like when the animal was there (for example, if it was muddy or relatively dry - if the hooves or paws look more spread out, the substrate was probably moist).

Another clue animals leave behind is *scat*, the scientific name for animal droppings. From looking at *scat* you can determine:

- the species of animal
- what the animal ate
- whether or not it is healthy (if parasites are present, it is probably unhealthy - leave determination of this to the professionals, though!)

You may be able to see animal *homes*, which can include:

- different sized holes in the ground or in logs
- nests
- beds (places where grass is matted down)

Other clues to look for include: animal *runs* - trails animals follow over and over again, broken or chewed twigs or branches, feathers or fur, eggshells, bones or teeth, and scents in the air such as that of a skunk.

Time Involved 40 minutes

What Went on at the Wetland?, cont'd

Utah Core Standard V, Objectives 2a, 2b, 2c, 4a, 4b, 4c

Literature Connections

Arnosky, Jim. Secrets of a Wildlife Watcher. Lothrop, Lee & Shepherd Books. 1983. Explains the techniques used in finding wild animals such as owls, turtles, squirrels, foxes, beavers, and deer, and in getting close enough to study their behavior.

Dorros, Arthur. Animal Tracks. Scholastic. 1991. Introduces the tracks and signs left by various animals, including the raccoon, duck, frog, black bear and human.

Fisher, Aileen. Animal Houses. Economics Press. 1973. Describes in rhymed text, a variety of animal homes.

George, Lindsay Barrett. Around the Pond: Who's Been Here?. New York, NY: Greenwillow Books. 1996. While picking blueberries on a warm summer afternoon, Cammy and her brother see signs of unseen animals and their activities including footprints, a dam, and a floating feather.

National Geographic Society. Animal Architects. 1987. Discusses the structures built by many different kinds of animals for protection, food gathering, storage and nesting.

Preparation

If desired, make clue cards, index cards with a picture of an animal or track on each one. Punch a hole in one corner and tie a loop of yarn to it so the card can hang on something like a branch.

Activity

Take your students to a part of the wetland where the ground is soft and there appears to be a diversity of plants and possible animal signs. You may need to check out the area before taking your class.

Hand out copies of Student Pages with pictures of animal signs to each student. Divide your class into groups of 3 or 4, and assign each group to a certain area. If possible, set up quadrats before the field trip, and assign each group to one quadrat. If you cannot do this before the field trip, have the students set up the quadrats during the field trip. Give each group a piece of rope that is 8 feet long and marked every 2 feet. Ask them to use the rope to make a square as accurately as possible. They should place a flag at each corner and every 2 feet around the edge, making an invisible grid inside the quadrat.

Have them try to find as many animal clues as possible within their grid. They may want to walk around the outside of their quadrat, at least in the beginning, so they don't walk on any clues. Examples of clues they might find include tracks, scat, chewed sticks, chewed/broken cattails, fur, nests, etc. Tell them that when they find a clue, they can place a clue card at that place if they wish. More importantly, they should draw on their paper grid where their clues were found. They should decide on particular symbols for different sign, such as a track to represent tracks, or a leaf to represent a plant.

After everyone is done, have each group explore the quadrats of the other groups, taking care not to step on any clues. Have the group in the quadrat being explored explain what they found. Discuss what kind of animals left the signs, what the animals may have been doing at the time the clue was left, and any other inferences they can make.

What Went on at the Wetland?, cont'd

Extensions

Your students can use rubber animal track replicas* to make their own track print poster (you can buy these from www.museumproducts.net or www.acornnaturalists.com). Or get a large white sheet and have students make mystery tracks on the sheet. They can show where something was eaten by another animal by adding other tracks on the sheet. Who was the predator that ate the prey? Were there other animals around, either before or after the incident? Have them try to put together clues to make a story showing what happened.

Assessment

Ask your students to draw animal tracks that might be found in a wetland. Show them pictures of different scat and tracks and ask your students to identify them.

Make a matching activity out of pictures of scat and/or tracks and the animals associated with them.

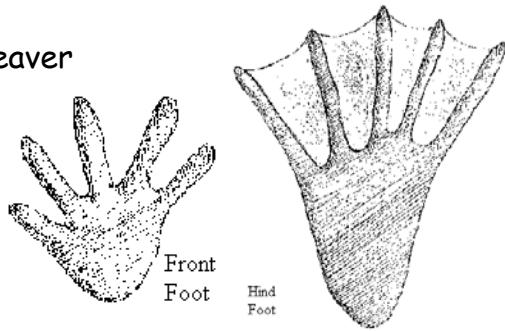
*Note - These rubber animal track replicas can also be borrowed if you attend a Project WILD training. Contact Diana Vos, Coordinator Project WILD, Utah Division of Wildlife Resources, (801) 538-4719 or dianavos@utah.gov.

Helpful Websites

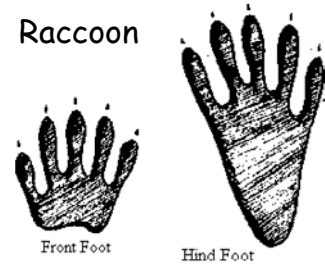
<http://www.sjcparks.org/pdf/files/trackit.pdf>
<http://www.yahooligans.com/content/animals>
<http://www.bear-tracker.com/index.html>
<http://www.geocities.com./Yosemite/9152/wildlife.html>

What Went on at the Wetland?: Animal Tracks!

Beaver



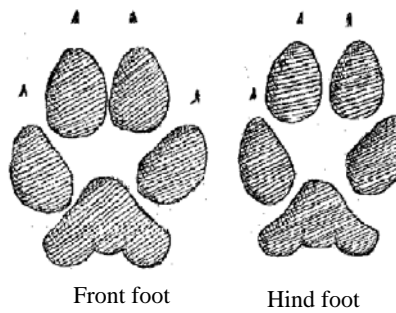
Raccoon



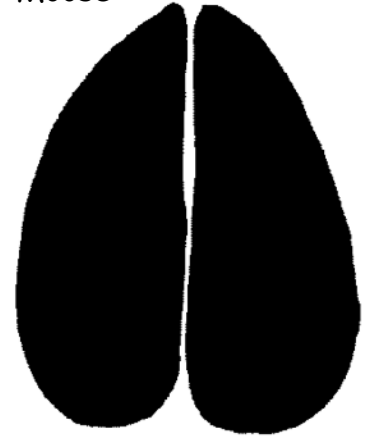
Muskrat



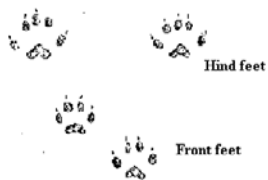
Coyote



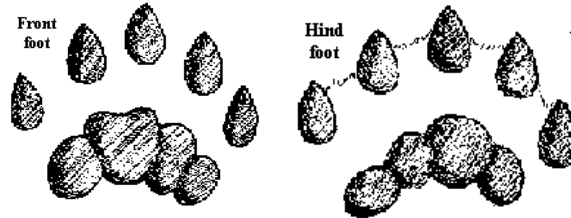
Moose



Mouse



River Otter



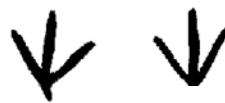
Mule Deer



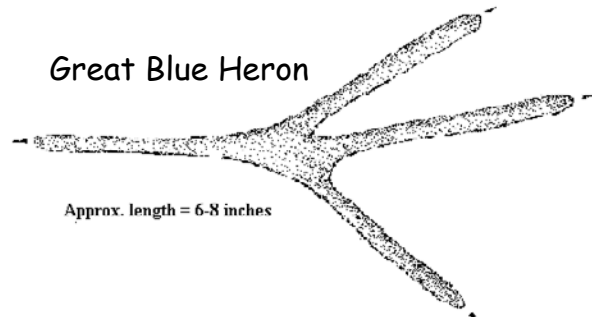
Skunk



Killdeer



Great Blue Heron



Toad

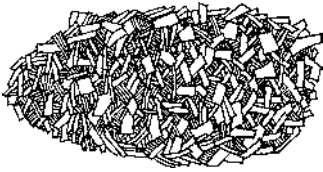


Animal track drawings (except muskrat & mule deer) ©Kim Cabrera, 2002. Used with permission. Tracks not to scale.

What Went on at the Wetland?: Animal Scat!

Student Page

Beaver



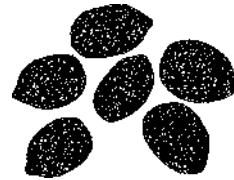
Muskrat



Moose



Mule Deer



Mink



Coyote



Raccoon



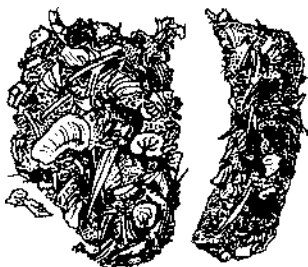
Skunk



Shrew



River Otter



Long-tailed Weasel



What Went on at the Wetland?

Student Page

<u>Key</u> <u>Item</u>	<u>Symbol</u>

I See a Bird!

Summary

Students will observe and learn how to identify some of the most common Utah wetland birds.

Objectives

Students will be able to:

- List ways to identify birds, including bird characteristics;
- Name and identify some of the most common Utah wetland birds.

Materials

- Binoculars (if available)
- If real binoculars are not available, students can make pseudo-binoculars using 2 toilet paper tubes, string/yarn, and glue or rubber bands
- Bird field guides
- Bird field marks sheet
- Journals

Background

Birds are some of the most common wildlife seen in wetlands, and can be very interesting to students, especially if they learn how to properly identify them. Using real binoculars is a big plus in this activity. It gives students an opportunity to use a real scientific tool, which also happens to be fun to use. However, if obtaining binoculars is difficult, having students make and use their own, pseudo-binoculars helps by making them focus on a small area, even if it is not magnified.

When observing and attempting to identify birds, knowledge of field marks is extremely helpful. The diagram on the student page points out bird field marks one can look for. When looking at a bird, have them observe what color the marks are, and sometimes, whether certain marks are present or not, such as eye rings or tail stripes.

Other ways to identify birds include:

- What habitat is it in? If it is in a forest, is it in the treetops or on the ground?
- What does its song sound like? Learning bird songs can be very difficult, but there are some, such as the chickadee, Canada goose, or killdeer that are very easily recognized.
- If you can't see the field marks of the bird, sometimes just seeing the silhouette can be helpful, especially in determining its size. There are essentially 7 size categories: very small, sparrow-sized, robin-sized, pigeon-sized, crow-sized, goose-sized, and very large.
- What is the shape of different parts of the bird, such as the beak or legs?
- What is its behavior? If it is in water, does it dive down under the water, or dabble just under the surface? If it is on land, does it run or walk, or bob its head? If it is in the air, is it soaring or flapping its wings? If it is flapping, is it quickly or slowly?

All of these clues can be used to help determine what bird species is in a wetland ecosystem.

I See a Bird!, cont'd

Time Involved 30-60 minutes

Utah Core Standard V, Objectives 2a, 2b, 2c, 4a

Literature Connections Fleishman, Paul. I am Phoenix: Poems for Two Voices. Harper & Row. 1985. A collection of poems about birds to be read aloud by two voices.

Preparation If you do not have access to real binoculars, having students make binoculars is an option that often works well. Each child should have 2 toilet paper tubes, some yarn to go around their neck, and drawing materials. Have the child decorate the tubes using markers, crayons, or even glueing pretty items on it, like glitter. This can be done either before or after assembling the binoculars. Attach the toilet paper tubes together with either staples or glue. Then punch one hole on each of the outside edges of each toilet paper tube (2 holes total). Tie one end of the yarn to each hole to make a 'necklace' with the tubes and yarn. Now the kids have a way to focus on a bird. Although it will not magnify the bird as real binoculars do, pinpointing a bird in their pretend binoculars will help them concentrate on that particular bird.

If you do have access to real binoculars, make sure that you know the proper way to use them so that you can instruct your students. See <http://shorebirds.pwnet.org/monthly/binoculars.pdf> for instructions on how to properly use binoculars.

Activity Classroom: Ask your students to name some birds found in your area. Do any of your students' families have bird feeders at home? Make a bird list on the board. Now talk about what makes birds different from other animals on Earth. The main characteristic your students might think of is that birds are the only animals that have feathers. They also have wings, somewhat hollow bones (to make them lightweight for flying), lay eggs, have specialized feet and beaks (depending on where they live and what they eat), and are warm-blooded. All these characteristics together make a bird a bird.

Now go over some of the different ways to identify birds as described in the background section of this activity. If you have bird field guides, they can be very helpful to the students. The guides will usually have a picture of the bird, along with a description. Pick out some of the more common birds in your area to observe with the students. Ask them to describe one bird at a time, using the background section as a guide for what to include in their description.

Another approach would be to either photocopy some bird pictures out of a book, or print them off the internet. Print enough for each pair of students to have one bird, and also a small booklet that would contain every other bird the class has. Put the pictures on some heavy-weight paper. Hand out the individual pictures and the packets of pictures to pairs of students. Tell them not to share the individual bird that they have with anyone - it's a secret. Then have one pair of students at a time describe their bird, without using its name. Have them describe the color, size, shape of beak, foot structure, as well as specific field marks the bird has. While they are doing this, the rest of the class should be going through their booklets to try to determine which bird they are describing. After they have described their bird, ask the other students what bird they think it is. Keep asking until they have identified the correct bird.

I See a Bird!, cont'd

Field: Now that your students can identify some local wetland birds from pictures, take them to the wetland to identify some live birds. If you have real binoculars, instruct your students as to how to use them. Make sure to let them know that binoculars are easily damaged, therefore they should handle them very carefully. Two really important rules are: 1) the strap should always stay around their neck at all times; and 2) never walk with the binoculars in front of your face. Tell them that if they need to use the binoculars, they must stop walking, then use them.

Explore the wetland's birds. Remember to be extremely quiet, as birds are easily disturbed by noise. Also, you may often hear a bird, but never get to see it. Encourage your students to use the descriptive characteristics they used in the classroom to also describe the birds out in the field.

When finished bird watching, wrap it up by making a bird list. They can also put this list in their journal, and maybe draw their favorite bird they saw showing all its identifying descriptive characteristics.

Extensions

Now that your students know about different bird characteristics, have them create-a-bird using various characteristics from different birds to make a brand new bird.

Assessment

If you have your students create-a-bird, they can use that bird for this assessment. If not, hand each student a bird picture. Have them tape or glue that picture onto a larger sheet of paper. Ask them to circle identifying characteristics on the bird, and describe that characteristic, such as white eye ring, yellow rump, or hooked beak to tear meat. Check their characteristics to see if they are appropriate.

Helpful Websites

http://www.birding.com/Bird_Identification.asp
http://www.enature.com/guides/select_Birds.asp
<http://birds.cornell.edu/>
<http://www.birdnature.com/id.html>
<http://migratorybirds.pacific.fws.gov/birding.htm>
http://hardenp.tempdomainname.com/waterfowl_id/index.htm
<http://www.ducks.org/waterfowling/gallery/index.asp>
<http://www.americanwaterfowl.com/DuckDist/duckdist.htm#contents>

Macroinvertebrate Messages

Summary Students will search for aquatic macroinvertebrates in their wetland and attempt to determine whether their water is clean or polluted.

Objectives Students will be able to:

- Identify several aquatic organisms;
- Assess the water quality by identifying these types and abundance of organisms.

Materials

- White dishpans (1 per group)
- Plastic spoons (1 per student)
- Pipets (1 per student)
- Identification sheets (1 per group - found at back of binder)
- Bug boxes (a few per group)
- Sampling net (1 per group)
- Petri dishes (1 per student)
- Tweezers/forceps (1 per student)

Background All insects go through changes during their lives as they grow. This process is called metamorphosis. There are 2 types of metamorphosis: complete and incomplete. In complete metamorphosis, the organism goes through 4 main stages:

1. Egg
2. Larva
3. Pupa
4. Adult

Each of these stages is extremely different from the next. Examples of invertebrates that go through complete metamorphosis include: mosquitoes, butterflies, and moths.

In incomplete metamorphosis the organism usually goes through 3 stages of life:

1. Egg
2. Nymph (or naiad)
3. Adult

The nymph stage looks somewhat similar to the adult stage. It usually grows gradually, and as it grows it sheds its exoskeleton. Each time it sheds its exoskeleton it is called an *instar*. A naiad is simply an aquatic nymph.

Macroinvertebrate Messages, cont'd

Scientists will often use aquatic macroinvertebrates to determine if water is polluted or not. There are some macroinvertebrates that are very tolerant to pollution, such as leeches and certain snails, and some that are very intolerant to pollution, such as stoneflies and mayflies. And, of course, there are those macroinvertebrates that are somewhere in between - *somewhat intolerant* to pollution, like dragonflies and damselflies, and those that are *somewhat tolerant* to pollution, such as beetles. In polluted water you will find only those invertebrates that are tolerant to pollution, but in unpolluted water you can find invertebrates that are both tolerant and intolerant to pollution. As you are looking for invertebrates, keep this in mind, and ask your students to try to determine whether or not the wetland you are visiting is polluted.

Time Involved 45 minutes

Utah Core Standard V, Objectives 2a, 2b, 2c, 4e

Literature Connections

Allen, Marjorie. Changes. Macmillan Publishing Co. 1991. Describes in rhymed text and illustrations show how things in nature change as they grow and develop.

Hidetom, Oda. Insect in the Pond, Nature Close Ups. Raintree Publishers. 1986. Discusses how insects play an important role in maintaining a pond's ecosystem.

James, Betsy. Tadpoles. New York, NY: Dutton Children's Books. 1999. Designed for pre-school to 2nd grade, this is a cute story that juxtaposes the development of a little brother to that of a tadpole.

Johnson, Sylvia A. Water Insects. Lerner Publications Co. 1989. A good nonfiction book for elementary students describing the physical characteristics, behavior and life cycles of some insects that spend most of their lives in the water.

McClung, Robert M. Green Darner, The Story of a Dragonfly. William Morrow & Company. 1980. This book describes the life of a darner dragonfly as he grows from a tiny nymph through molting periods to adulthood.

McLaughlin, Molly. Dragonflies. Walker Publications. 1989. Text and amazing photographs reveal the life cycle of a dragonfly.

Simon, Hilda. Dragonflies. New York, NY: The Viking Press. 1972. Provides information on dragonflies including their origins, mating rituals, and life cycle.

Tagholm, Sally. Animal Lives: The Frog. Kids Can Press. 1999. Lyrical narrative and exquisite artwork offer a glimpse into the life of frogs, weaving in details of their physical attributes, diet, predators, behavior, breeding habits, life cycle, and development.

Preparation Select the site where you will be looking for macroinvertebrates. Try to find a site that will not be greatly impacted if your class samples there.

Macroinvertebrate Messages, cont'd

Activity

Discuss with your students how to handle living things. Emphasize also that they should try to have as low an impact as possible on the habitat. Explain that they will be returning the organisms back to their home at the end of the activity.

Talk to your students about what they will be looking for. Macroinvertebrates are invertebrates that are large enough to see without a microscope. Explain how some invertebrates can be found living in polluted water, whereas some can only live in unpolluted water. Discuss that depending on what organisms are found, they may be able to determine the quality, or cleanliness, of the water.

Show your students pictures of organisms that can be found in each kind of environment - polluted and unpolluted. You can photocopy and enlarge pictures of macroinvertebrates found at the back of this guide.

Also discuss with them the fact that many of the organisms they will be looking at are the young, or immature stage, of invertebrates that live on land. They are going through metamorphosis. Young invertebrates can either be in the larva, pupa or nymph stage of life. Others will be adults - some can even swim underwater, then crawl out on land and fly!

Divide your class into groups of 3 students. Give each group a dishpan, a sampling net, an identification sheet, and enough bug boxes, spoons, and pipets for each person in the group. Have them put clear water in their dishpan (not muddy water). Instruct them to each take turns using their sampling net to scoop invertebrates out of the water, then turn their net inside out into the dishpan water. After each person has had one turn, have them put the sampling net away (at least temporarily) and look for invertebrates in their water. They can use the spoon, forceps or pipet to get them out of the water and into a petri dish. Examples of some of the more common invertebrates they might find include: mayfly nymphs, dragonfly nymphs, damselfly nymphs, predaceous diving beetles, whirligig beetles, back swimmers, waterboatmen, crawling water beetles, midge larvae (bloodworms), various snails and beetle larvae. What you find may depend upon where you are looking, and what kind of wetland you are visiting.

At the very end, ask the different groups what organisms they found and whether they think the water is polluted or unpolluted. You can gather your students into a circle and have each of them bring either a petri dish or bug box with one "cool" invertebrate in it to pass around the circle in one direction. As they are being passed around, comment on individual invertebrates and give the kids 'gee whiz' facts about them. Here are some examples of these facts:

- The feathery-looking structures along the side of a mayfly are its gills. This is how it breathes.
- A dragonfly is a predator as a nymph and as an adult. It has a huge jaw as a nymph to gobble up yummy smaller invertebrates.
- To breathe underwater, diving and crawling water beetles, water boatmen and back swimmers keep an air bubble underneath their wings and periodically collect new air from the surface to replace the oxygen.
- Backswimmers swim upside down, using their long hind legs as oars.

After they have found an organism, encourage them to try to identify it and determine whether it is found in polluted or unpolluted water.

After searching and identifying organisms, have your students make drawings of some of their organisms in their journal. If possible, have them identify the organism in their journal as well. After everyone has looked at their invertebrates, have the students place them back where they came from.

Macroinvertebrate Messages, cont'd

Extensions

Do other water quality tests on your wetland. Some of the easier tests to do are tests for dissolved oxygen and pH.

Try to find out whether you were right about the water being polluted or unpolluted. Look on the web for this information, or try to contact a local water quality extension office.

Assessment

Have your students explain why some organisms might be found in polluted water, and some in unpolluted water.

Hold up drawings of some of the most common invertebrates your students found and ask them to identify the invertebrates.

Macroinvertebrate charades: Ask your students to move like a macroinvertebrate they found, and have the rest of the class try to guess which type they are.

Have your students do the Project WILD activity, *Micro Odyssey*.

Helpful Websites

<http://www.dnr.state.wi.us/org/caer/ce/eek/critter/watercritter/wacky.htm> (great information, including a dichotomous key and great pictures of aquatic macroinvertebrates)

Adapted from Water Canaries, Project WILD Aquatic K-12 Activity Guide, Council for Environmental Education, 2002.

Flatten Your Plant!

Summary	Students will search an area for wetland plants, will collect a few, select plants, and create a new name for a plant.
Objectives	Students will be able to: <ul style="list-style-type: none">• Use their imagination to name a plant;• Collect, press, and mount plants as scientists do.
Materials	<ul style="list-style-type: none">• Plant field guides• Plant press (you can either have the students make their own plant presses, or you can buy a plant press. See the end of the activity for more information on making a plant press)• Small hand shovels (1 per group)• Journals• Pencils
Background	<p>See 'What's This Plant?' background.</p> <p>Kids are always interested in collecting things, and making a plant collection can be a great way for them to learn from this interest. If you do not have, or cannot obtain plant field guides, don't worry. You may be able to use the Wetland Plant Identification Key from "What's this Plant?". You can also have them name the plants themselves, as in that same activity.</p> <p>For a plant press, there are a few options. You can buy a plant press from Acorn Naturalists at www.acorunnaturalists.com, or Museum Products at www.museumproducts.net, or you can make them, or have your kids make their own. The last page of this activity has directions for making your own plant press.</p>
Time Involved	45 minutes
Utah Core	Standard V, Objectives 2a, 2b, 3a, 3b
Literature Connections	Anderson, Margaret, Nancy Field and Karen Stephenson. <u>Leapfrogging through Wetlands</u> . Dog-Eared Publications. 1998. An excellent activity-oriented book for elementary-aged children to explore a wetland ecosystem.
Preparation	Collect plant field guides, if possible. See Appendix for pictures and descriptions of some wetland plants.
Activity	Divide your students into groups of 2 or 3. Assign each group a quadrat in the wetland. Have them search for plants in their assigned section of the wetland. When they find a particular species of plant, have them carefully pull the plant out of the ground, getting as much of the roots as possible.

Flatten Your Plant!, cont'd

Have them clean off the soil and put the plant between a few sheets of newspaper on their plant press. They should only pick one plant of each species, and only if there is plenty of that plant around. When they find the next plant they want to keep, they should put it on a new piece of newspaper or blotting paper in the plant press. Be sure to emphasize that this collection is for scientific purposes, and that they should not remove plants from a wild area unless given permission. Even then they should take as few plants as possible.

Have groups collect about 5 different kinds of plants. After they are done collecting, ask them to sketch a picture of each plant on a different page in their journal. Ask them to pay attention to details such as: the shape of the leaves, where the leaves are placed on the stem (opposite or alternate?), if the stems are hairy, the shape of the flowers and number of petals, if there are any, etc. Ask them to choose their favorite plant they collected, and give it a name. Encourage adjectives such as: spiked, smooth, color, tall, short, etc. Have them put more detail into the drawing of this plant, and use crayons and colored pencils if possible. Ask a few students to share their drawing with the rest of the class.

After their plants have been pressed for about 2 weeks, your students can mount them. They can use Elmer's glue to mount the pressed plant onto blotting paper. At the bottom right-hand corner of the paper they should place a label with the following information:

Name of Plant: _____
Collected By: _____
Location: _____
Date: _____
Habitat: _____
Comments: _____

Extensions

You can also have your students come up with new names for plants they already know, or animals they do or don't know. Introduce the concept of scientific names and binomial nomenclature. Discuss how they are formed from Latin or Greek words so that scientists around the world, no matter what language they speak, will recognize the name. A scientific name usually comes from either the way the organism looks, or the person that originally discovered it.

Assessment

Look at their journals to see if they completed the assignment, and how well they completed it. Are there drawings? Do they show details of the plant and written descriptions for the characteristics of the plant? Can your students name any characteristics of the plant?

Helpful Websites

http://www.tpwd.state.tx.us/edu/activities/time/plant_press.htm

<http://collections.ic.gc.ca/tod/teacher/plant.htm>

<http://www.npwrc.usgs.gov/resource/OTHRDATA/WESTFLOR/species.htm>

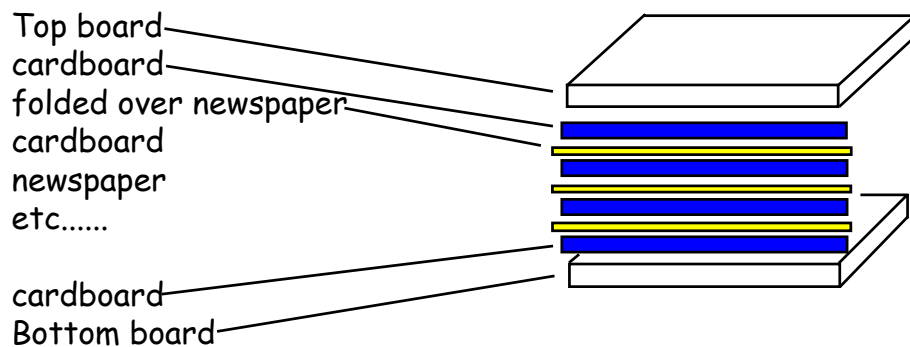
Instructions for making a Plant Press

Materials:

- Boards cut to 12 x 18 inches (2 per student) (Note: ideally this board would have holes drilled in it to allow humidity to be released. Pegboard is a good option.)
- Cardboard cut to 12 x 18 inches (6 per student)
- Newspaper sheets (5 pieces, folded in half)
- White paper (optional)
- Straps with sliding buckles or large rubber bands (2 per student)

Directions:

Cut the board, cardboard and newspaper to appropriate sizes. Place the materials together as follows:



After collecting plants, place each individual plant between the piece of folded newspaper. If you have identified the plant, you may want to either make the label for it, or simply write the name where it can be seen on the newspaper. Put together all the materials as listed above, then cinch it together using either straps, rubber bands, or even placing it under some very heavy books. You may also put white paper directly next to the plant to prevent possible ink markings. It may take up to 2 weeks for plants to become fully dried and pressed.

For further pictures and instructions, see:

<http://herbarium.usu.edu/K-12/Collecting/default.htm>

OR

<http://www.uen.org/utahlink/pond/buildpress.htm>

Treasure Hunt!

Summary	Students will go on a treasure hunt in their wetland to look for natural items.
Objectives	Students will be able to: <ul style="list-style-type: none">• Identify various living and nonliving things in a wetland;• Use their senses to find various items in a wetland.
Materials	<ul style="list-style-type: none">• Copy of Wetland Bingo Board, preferably laminated (found at back of binder)• Markers for the Wetland Bingo board, such as buttons, sticks, rocks or dry beans.
Time Involved	20-40 minutes
Utah Core	Standard V, Objectives 2a, 2b, 2c
Literature Connections	<p>Kirkpatrick, Rena. <u>Look at Pond Life</u>. Raintree Children's Books. 1978. Easy-to-read text exploring plant and animal life in the pond.</p> <p>Leslie, Clare Walker. <u>Nature All Year Long</u>. Greenwillow books. 1999. Nature is revealed as an interesting treasure hunt, full of discovery, adventure and unexpected events. Students choose an animal, plant or landscape to follow through the year to see change over time.</p> <p>Luenn, Nancy. <u>Squish! A Wetland Walk</u>. Atheneum. 1994. Designed to enhance the younger reader's appreciation of wetlands. A boy begins to understand the abundance of life and activity wetlands provide.</p> <p>Rosen, Michael J. <u>All Eyes on the Pond</u>. Hyperion Press. 1995. In this book for early elementary-aged children each drawing focuses on one inhabitant of the pond and looks at the world through its eyes and at its level in the pond. This book can be used by teachers to teach kids to see different perspectives.</p>
Preparation	None
Activity	Divide your class into pairs. Hand each pair at least 10 markers to place on the bingo board. Show them the Bingo board, and go through the items on the board. Tell them that they are to find as many things as they can on this board. When they find it, then can put one of their items (such as one button) on the board. The first group to get a row, wins. You may want them to show what they found to an adult to verify their finds, or they can write what they found on the board. Grease pencils work well for writing if the board is laminated.

Treasure Hunt!, cont'd

Extensions

You can extend the bingo fun to include: getting all 4 corners, all outside rows, the entire 'bingo card', etc.

Before doing this activity in a wetland, make up a treasure hunt to do at school, around the playground. Or, you can have them do the same treasure hunt using this bingo board around the school grounds, and compare and contrast what they find at each site.

Assessment

Ask your students to create their own wetlands bingo board, trying not to use items already on the bingo board. It may be difficult for them to create the whole board while out in the field, but they can at least write down the items they want to be included. When you get back to the classroom the students can create one large bingo board using everyone's ideas. Hang this up outside your classroom to show the rest of the school what you found on your field trip to the wetlands.

Post-Field Trip Activities

Flying Off!



Designing a Wetland Habitat

Summary Students will identify the components of an animal's wetland habitat and create a model of their own wetland habitat.

Objectives Students will be able to:

- Identify the 4 main components of habitat;
- Identify the living and nonliving components of a wetland habitat.

Materials

- Shoeboxes (1 per student)
- Creative items to make a diorama: clay, construction paper, scissors, glue, pipe cleaners, recycled materials, string, papier mache, markers, crayons

Background See Background Information - Wetland Habitat. See Glossary for definitions of habitat, community and ecosystem. This may clear up any confusion you may have about these ecological terms.

A habitat consists of 4 main parts: food, water, shelter and space (in a suitable arrangement). A habitat is technically associated with one particular species - i.e. a beaver's habitat is different from a muskrat's habitat, even though they might live in basically the same ecosystem - they have different needs.

Time Involved 90 minutes

Utah Core Standard V, Objectives 1a, 1b, 1e, 2a, 2b, 2c

Literature Connections

Dewey, Jennifer Owings. At the Edge of the Pond. Little, Brown and Company. 1987. Explores the levels of life from muddy shore to murky bottom of the pond.

Kirkpatrick, Rena. Look at Pond Life. Raintree Children's Books. 1978. Easy-to-read text exploring plant and animal life in the pond.

Lesser, Carolyn. Dig Hole, Soft Mole. Orlando, FL: Harcourt Brace & Company. 1996. A mole travels underground and underwater, exploring a marsh and pond. Written in rhyme.

Mazer, Anne. The Salamander Room. Knopf. 1991. A young boy finds a salamander and thinks of the many things he can do to make a perfect home for it.

Preparation Make 3 x 5 cards of wetland animals, one animal per card. Examples you can use include: beaver, great blue heron, largemouth bass, diving beetle, river otter, water strider, pintail duck, cutthroat trout, northern harrier (hawk), moose and leopard frog. You can also use the wetland animal pictures found in Appendix C.

Designing a Wetland Habitat, cont'd

Activity

Hand one card to each student or pair of students. Have them find the habitat requirements for their specific animal by doing research in the library or on the internet. Once they have found the correct habitat requirements for their animal, have them create a mini-artificial habitat for their animal using the creative materials. Make sure they include all 4 essentials for a habitat - food, water, shelter and space (in a suitable arrangement).

Once the models are complete, ask each student or pairs of students to report to the rest of the class what they found out about their animal, including its basic biological needs as well as habitat requirements. They should also point out how their habitat model is designed to meet the needs of the animal.

Extensions

Instead of having your students design a habitat for just one animal, have them design an entire wetland ecosystem including many wetland animals in a corner of the classroom.

Assessment

Have your students list the components of a habitat that are necessary for most wetland animals to survive.

Have your students compare the biological characteristics and habitat requirements of 2 organisms found in a wetland. Are there any differences in terms of their needs? Are these related to their biological characteristics?

Helpful Websites

http://www.wcc.nrcs.usda.gov/watershed/UrbanBMPs/pdf/water/volume/wet_an_habitat.pdf (this site shows how to make a real wetland habitat)

Adapted from Designing a Habitat, Project WILD Aquatic K-12 Activity Guide, Council for Environmental Education, 2002.

Our Wonderful Wetland Guide

Summary	Students will use information they gathered while in the field to create their own wetland guide
Objectives	Students will be able to: <ul style="list-style-type: none">• Identify the main components in a field guide;• Use information they gathered while at a wetland to create their own guide;• List plants and animals they found at a wetland.
Materials	<ul style="list-style-type: none">• Field guides (on an ecosystem, such as a wetland, or species, such as birds, amphibians, etc.) (You can check these out of a library if necessary)• Any information gathered in the field while on the wetland field trip• Pencils, markers, colored pencils, crayons, paper• Journals
Background	<p>Scientists use field guides to help them identify both living and non-living objects, from birds to rocks. By having your students create their own guide to their wetland, they can make something unique for their wetland, and they can share this with other students or adults who might be visiting that area.</p> <p>Not all of your students need to be wonderful artists to create this guide. There are many aspects that do not include pictures. And the artists in the class can perhaps draw the pictures needed to help people identify what they found in the wetland. There are many ways that this can be accomplished - you can divide your students into groups, or you could even let the class decide how they would like to accomplish the task. Use your creativity and your students' creativity to your advantage!</p>
Time Involved	90 minutes
Utah Core	Standard V, Objectives 1a, 1b, 2a, 2b, 2c, 4d, 4e
Preparation	None
Activity	Have your students look at a sample of field guides. Discuss the reasons why people use field guides (e.g. to organize information to identify objects or places). Ask them to write down what they think are some of the most important parts of the field guide. Ask them how they might organize all the information they gathered on their wetland into one field guide so that someone could learn all about their wetland by reading this field guide.

Wetland Guide, cont'd

Some parts that could be in their field guide include:

- directions to the wetland
- region of the country in which your wetland is found
- type of wetland it is
- map of the wetland
- soil characteristics
- plant species
- animal species and habitat
- drawings, poetry, writings done on the wetland

You can divide your class into groups to assemble each chapter. Make sure that everyone's information is included in the field guide.

Extensions

After making the field guide, the class can display their guide in a common area of the school for other students to examine.

Your class can make this field guide available to other classes that go to a wetland to help them identify organisms in the wetland. They could also make their wetland field guide into a Powerpoint presentation to possibly put on the internet or present to other classes.

Assessment

Ask your students why they think field guides are important. Why do they think people use field guides? Are there ways for people to identify organisms or places other than using a field guide?

Helpful Websites

<http://enature.com/main/home.asp> (Click on Field Guides, or Zip Guides. Zip Guides will give you a list of organisms found in your general area by group, such as birds, amphibians, etc.)

Adapted from Bringing it All Together - Making a Field Guide, A World in Our Backyard, U.S. Environmental Protection Agency.

The Choice is Yours

- Summary** Students will use their own values to make decisions about their actions related to the environment.
- Objectives** Students will be able to:
- Examine their own values and beliefs related to wetlands;
 - Listen to and respect the rights of others to have different values and beliefs about wetlands;
 - Evaluate impacts of possible actions they might take on wildlife and the environment.
- Materials**
- Dilemma cards
 - Writing materials
- Background** This activity is designed to give students the opportunity to examine their own values and beliefs related to wetlands. It is not the intent of this activity to prescribe "right" or "wrong" answers for the students. One exception is in the areas where information about laws is conveyed. Students should come to their own conclusions about what they think are the most responsible and appropriate actions to take in these situations.
- Time Involved** 30-45 minutes
- Utah Core** Language Arts: Standard I, Objective 1b;
Standard V, Objectives 1a, 1b, 2a, 2b;
Standard VI, Objectives 1a, 1b;
Standard VII, Objectives 1a, 1b, 2
- Literature Connections**
- Cherry, Lynne. *A River Ran Wild*. Gulliver Books. 1992. An environmental history of the Nashua River. The story begins with the Native Americans that used it, to the Industrial Revolution that polluted it, to the people who eventually cleaned it up.
- Cone, Molly. *Come Back Salmon*. Sierra Club Books for Children. 1994. In this story for elementary students, enterprising children and their teachers clean up a creek and reintroduce salmon to its waters. This true story demonstrates a way classrooms can become involved with their surrounding environments.
- Turner, Ann Warren. *Heron Street*. Harper & Row. 1989. Over the centuries as people settle near the marsh by the sea, herons and other animals are displaced.
- Preparation** Copy and cut apart cards. If you like, you can create additional cards appropriate for your area.
- Activity** Divide your class into groups of 4 and give each group 2 dilemma cards. You may need to make multiple copies of cards so there are enough for everyone. Place the stack of cards face down in the center of the group. One student chooses a card and reads it aloud to the rest of their group.

The Choice is Yours, cont'd

First each person considers the dilemma themselves. Then when everyone is ready, the group discusses what each of them has decided they would do about this dilemma. They should also describe the reasoning behind their decisions. Make sure each person in the group discusses their opinions. This gives the students a chance to listen to other peoples opinions, but also form their own opinion. The students do not need to reach a consensus as a group as to what to do with the dilemma. There are no "right" answers.

Extensions

Ask your students to devise their own dilemmas to share with the class. They can then either discuss these dilemmas in small groups again, or as a class.

Assessment

Have your students choose a dilemma and write a short paragraph on the positive and negative effects of all the options listed for that dilemma. Ask them to indicate what additional information, if any, is necessary in order to make a responsible and informed decision. Have them give 2 options on how to respond to this dilemma. Ask your students to identify which response is the most responsible, in their opinion, and have them explain their reasoning. Have them explain how someone else could reach a different, yet valid, opinion with the same information.

Adapted from Ethi-Reasoning, Project WILD K-12 Activity Guide, Council for Environmental Education, 2002.

Water Use-

Because of a drought in recent years in Utah, there is a ban on watering lawns from 8 am to 6 pm every day during the summer. You notice your neighbors watering their lawn at 3 o'clock in the afternoon, one of the hottest times of the day. Would you:

- Offer to help them water their lawn during the regulation hours?
- Report them to your local water conservation office?
- Not butt in, and let them keep watering their lawn that way?
- Ask them if they are aware of the regulations on watering lawns, and tell them that they should not be watering their lawn when they are?
- Do something else? What?

Duck Hunting -

While out duck hunting with your uncle, you see another duck hunter shoot and kill a duck that is on the water. Being a responsible duck hunter yourself, you know this is illegal. Your uncle was watching other waterfowl, and did not see it. When you tell him what you saw, he doesn't believe you. Would you:

- Talk to your parents about what you saw?
- Let it go and not tell anyone else?
- Report the hunter to a conservation officer?
- Try to talk to the hunter about rules of duck hunting?
- Call the state Help Stop Poaching hotline at 1-800-622-DEER
- Do something else? What?

Farm

Your family owns a 500 acre farm. A tributary of a high-quality fishing stream runs along the boundary of your property. The fertilizer your family is using to increase crop production is carried to the stream by rain run-off. This type of fertilizer is increasing algae growth and is negatively affecting the fish population. The farm is your only source of income, but your family loves fishing and doesn't want to lose the fish from the stream. Would you:

- Suggest your family change fertilizers even though it might make you have less crops?
- Encourage them to allow a portion of your land along the stream to grow wild and create a riparian area that might be able to absorb some of the run-off?
- Do nothing?
- Do something else? What?

New Home

Your family wants to move to a new home because your current home is too small. You have had enough of rooming with your brother! But, the only house they can afford is in a new housing development where the houses are nice, affordable, but are also where a wetland used to be. The developer had to fill in a wetland to build the houses, but also by law had to create a new wetland close by. You know how important wetlands are, but you really want a new house. Would you:

- Tell your family you think it's ok to move into the new house because a new wetland was created to make up for the one filled in?
- Ask your family to consider looking for a house not built on a filled-in wetland?
- Move into the new house and help volunteer for a group that is helping to restore the new wetland?
- Don't give your family your opinion and leave it entirely up to them?
- Do something else? What?

Car Washing

It has been a while since your parents washed their car - in fact, there is still some salt on it from the winter which will rust the car if you don't remove it soon. You want to wash your car at home because it is cheaper, but because of the drought you are not supposed to. You could ask your parents to drive to a more expensive car wash, where they recycle and treat their water, but it's about 15 minutes away. Would you:

- Wash their car at home anyway?
- Not wash your car and just figure that next time it rains the salt will come off?
- Ask your parents to drive to the car wash and spend the money to have it washed there?
- Wash your car on your lawn - that way, at least the water will help keep your lawn green?
- Do something else? What?

Golf Course

Your family belongs to a club that just bought some land that has a wetland on it. The club members have just voted to make that land a golf course where the wetland will be removed, replacing it with a pond by draining the wetland. The pond will not perform the same functions as the wetland did. There will be less wildlife, and it will not filter pollutants the way the wetland did. But, you and your family love to play golf. Would you:

- Let them build the golf course without saying anything, and enjoy golfing at a new place?
- Try to call for a re-vote, and before the next vote, attempt to educate the club members about the benefits of wetlands?
- Try to talk your family into leaving the club?
- Ask your club to change the plans for the pond, so it looks and functions somewhat still like a wetland, but will also work well in a golf course?
- Do something else? What?

Eagle

Your family has purchased a beautiful 10-acre property near an undisturbed wetland to build a summer home. One side of the property has a beautiful view of the wetland and is your choice spot for your home site. However, you discover there is an active bald eagle nest site on that side. The bald eagle is sensitive to disturbance around its nest tree and is a protected species. Bald eagles are highly selective in choosing nest sites and usually return to the same nest site year after year. They also depend upon the food available in the wetland. Would you:

- Ask your parents to select a different site on the property to build your home?
- Suggest they sell the property?
- Let your family chop down the tree and build your home?
- Do something else? What?

Fishing

You are fishing at a secluded lake and have caught your limit for the day. But, you caught your limit so quickly that you're not ready to leave yet. You really want to keep fishing but to keep more fish would be illegal. Would you:

- Put back some of the fish you already caught even though they don't appear to be very healthy anymore and will probably die anyway?
- Keep catching and keeping fish - who's going to know what you did?
- Keep fishing, but practice catch and release, and only bring home your legal limit of fish?
- Do something else? What?

Sandy Beach

Your family bought a cottage on a lake with wetlands at the edge. You, and your siblings would like to have a sandy beach to make it easier to swim in the lake. The real estate agent who sold your parents the property told your family that although it is illegal to use chemicals to get rid of plants or put in a sand layer, some of your neighbors have done it and have never been caught. You also like to fish, and realize that aquatic plants are necessary for reproduction and shelter for many fish. Do you:

- Leave your property the way it is, and go swim at a public beach entry?
- Wait until late fall after most of the lake residents have left and apply chemicals and lay down a sand beach?
- Clear a narrow strip of beach and leave the rest in its natural state?
- Do something else? What?

Highway

You are a county board member. You must vote on a proposed local highway renovation needed to support increasing traffic. If the current road was expanded many homes and businesses would be displaced. If a new highway was built it would redirect traffic through a large marsh, and would destroy 20 acres of wetlands. Local biologists are afraid of the effect this would have on birds, amphibians, and other wildlife. Do you:

- Support construction of the highway through the marsh because you don't think its fair to uproot local residents from their homes?
- Vote against construction of the highway through the marsh because of the jeopardy it poses for wetland wildlife?
- Vote against construction of the highway through the marsh because of the long term financial costs of wetland destruction?
- Do something else? What?

Suburbs

You are an older person who has no children but has acquired a lot of land over the years. Among your real estate holdings is a 100 acre marsh. Your land lies in the expansion path of a growing suburb. A major development firm has made numerous offers to purchase the 100 acres and develop the marsh into a housing subdivision. You would be rich! But, you know that although the development firm would have to build another wetland elsewhere, it probably wouldn't be the same as your natural wetland. A local group has been looking for a place to construct a small nature center and begin environmental education programs, but they don't have much money. Do you:

- Have no reason to be concerned about the distant future, so you sell your land to the developer and live a long, happy, rich life?
- Donate the entire parcel to the nature group, asking only to serve on its board of directors?
- Keep your land and not sell it at all?
- Do something else? What?

Farmer

You are a farmer who recently purchased 175 acres of land with a small wetland that borders a stream flowing along the edge of your property. State and local guidelines allow you to graze your cattle in the wetland or allow them to wade into and drink from the stream. However, you read an article about maintaining stream water quality. Cattle can cause stream bank erosion, muddy water, and pollution (from manure), and also disturb nesting birds. The farmer down the way has a cattle crossing through the stream. Do you:

- Fence off the wetland and stream to prevent your cattle from disrupting these ecosystems?
- Allow your cattle to roam freely into the wetland and stream because fencing is expensive and your cattle need water on hot summer days? Besides, the guy downstream does it.
- Fence off the wetland and stream and put pressure on the local township to prohibit farmers from practicing destructive activities in all wetland areas?
- Do something else? What?

Coyotes and Plovers

Summary	This running game will not only give your students exercise, but also will help them remember what they have learned in their wetlands unit.
Objectives	Students will be able to: <ul style="list-style-type: none">• Practice listening and critical thinking skills• Discuss various items they have learned about in their wetlands unit
Materials	<ul style="list-style-type: none">• Large area for students to be able to run• List of true and false statements about wetlands
Time Involved	15 to 25 minutes
Utah Core	Physical education: Standard I, Objective 1
Preparation	Prepare true/false statements about wetlands.
Activity	<p>Divide the class into 2 equal teams, the coyotes and the plovers. Line up the 2 teams, facing each other, about 8 feet apart. About 25 feet behind each team, draw another line (or set up cones) for their home bases.</p> <p>The teacher makes a statement about wetlands aloud, and if the statement is <u>true</u>, the Coyotes chase the Plovers. If the statement is <u>false</u>, the Plovers chase the Coyotes. Anyone tagged by a member of the opposite team must join that team.</p> <p>If the answer is not obvious to the players, you will get some confusion where the Coyotes and Plovers might both be running toward each other, and others will be running towards their home bases. While this is occurring, the leader should remain silent and neutral. When the action has calmed down, the leader can reveal the correct answer.</p>
Extensions	Have your students come up with their own true/false statements to quiz the class with.
Assessment	To see if your students were paying attention during the game (and not just following the crowd), you can turn these true/false statements into a short quiz afterwards, or the next day.

Adapted from Owls and Crows, Sharing Nature with Children, by Joseph Cornell, DAWN Publications, 20th Anniversary Edition (1998).

Davis Lake Dilemma

Summary	Students will evaluate potential positive and negative effects of making a fresh water lake from one section of the Great Salt Lake.
Objectives	Students will be able to: <ul style="list-style-type: none">• Take on various roles within a pretend, but plausible, scenario;• Explain the general roles and reasons for a County Commissioners meeting;• Make their own decisions on a dilemma after contemplating various views.
Materials	<ul style="list-style-type: none">• Heavy paper or cardstock for nametags• Podium and microphone (if possible)• 5 classroom desks arranged as described• Map of the Great Salt Lake• "Davis Lake Proposal" handouts (1 per student)
Background	Davis County is located along the eastern shore of the Great Salt Lake. In this fictional scenario, a proposal has been made to use the North and South causeways to Antelope Island as dikes to separate Farmington Bay from the rest of the lake. This would capture the freshwater inflow from the 7 local drainages, and the lake's own freshwater springs, to form a freshwater lake. An estimated 5 million birds, of 250 different species, visit or live here permanently. Sixty-four species of small mammals live along the shores of the Great Salt Lake. A significant portion of wildlife would be disturbed if this proposal were to become a reality. Similar proposals have come up in the past.
Time Involved	1-2 hours
Utah Core	Social Studies Standard & Objective: 6040-0101, -0203; Language Arts: Standard I, Objectives 1a-d, 2a; Standard V, Objectives 2a, 2b; Standard VIII, Objectives 1a, 1b.
Preparation	Make nametags and arrange classroom appropriately. This includes placing 5 chairs in the front of the room. Make copies of the "Davis Lake Proposal" (1 per student).
Activity	<p>Give each student a copy of the "Davis Lake Proposal" handout. After they have had time to read the information, use the map of the Great Salt Lake to point out the area affected by the proposal. Briefly discuss the pros and cons of the proposal.</p> <p>Tell the students that they are going to consider the issue in more detail by assuming the roles of Davis County residents. Five students will be chosen to represent the County Commissioners. The rest will each be assigned a citizen role. You may assign the roles, or you may have the students choose one.</p>

Davis Lake Dilemma, cont'd

Have each student prepare for his or her role by developing a brief position paper. Provide in-class time or arrange library time for research. Tell them that they should be prepared to explain to the County Commissioners whether they agree with the proposal or not, and why. Express to them that they are to take on the role of the citizen that they are assigned to, regardless of their own personal beliefs. They will have a chance to express their own beliefs in the Assessment section.

Give each participant a large name tag to wear during the activity so everyone can remember what viewpoint he or she represents. Then give each person 1 to 2 minutes to introduce himself or herself, and explain why Davis Lake should or should not be developed.

Have the County Commissioners vote aloud, giving the reason for their votes, as to whether or not they should appropriate funds to develop Davis Lake.

After the council decision, have a brief discussion to summarize the pros and cons that emerged from the students' presentations. Identify and list the benefits, as well as the costs or liabilities that would result from development of the lake.

Extensions

Have the students write to the Davis County Commissioners to express their opinions on developing the lake.

Have the students do the activity *To Dam or Not to Dam* from Project WILD Aquatic K-12 Activity Guide.

Assessment

After the role play and class discussion, ask each of the students to write a short essay describing his or her personal opinion about developing Davis Lake. The students should explain why they hold the opinions they do. Base your evaluation of the essay on how well the reasons are explained, not on whether or not the student's opinion is a popular one.

Adapted from Davis Lake Dilemma, The Great Salt Lake Story Curriculum, 1997.

Davis County is located along the eastern shore of the Great Salt Lake. Approximately 2/3 of the county is covered by the Great Salt Lake. The fresh water in the county is currently being used for drinking and washing, crop irrigation, industry, and other activities such as lawn watering. Davis County also has a rapidly expanding human population, which is putting more stress on the limited water supplies.

A proposal has been made to use the North and South causeways to Antelope Island as dikes to separate Farmington Bay from the rest of the lake. This would capture the freshwater inflow from the 7 local drainages, and the lake's own freshwater springs, to form a freshwater lake. The new lake would be called Davis Lake. Davis County officials feel that this would increase the supplies of water available for irrigation and industry. They would also like to use the new lake for recreation, such as boating and water-skiing.

An estimated 5 million birds, of 250 different species, presently visit or live in the area. Sixty-four species of small mammals live along the shores of the Great Salt Lake. All of the plants and animals of the region are specially adapted to the present ecosystem. The creation of a freshwater lake would change much of the habitat. A significant portion of wildlife would be disturbed if this proposal were to become a reality.

Numerous other concerns have been expressed by researchers. The sediments on the lake bottom in this area contain high concentrations of toxic metals and organic wastes, which could make it dangerous to eat fish from the new lake. Because of its shallow depth, the proposed lake is also likely to be good breeding ground for mosquitoes, as well as for the production of odor-causing blue-green algae.

The lake water would be too saline for drinking purposes. During dry periods, the salinity would be marginal for irrigation and industrial purposes. To protect aquatic life, a 40 million dollar wastewater treatment plant would need to be built to remove pollutants before the water enters the freshwater lake.

COUNTY COMMISSIONERS: 5 students

A.G. "RICK" CULTURE: A representative of the local farmers who are very interested in the plentiful, cheap freshwater that Davis Lake would provide. They could grow more crops for less money, which would make it easier to compete with imported produce.

DAN D. LION: President of "Save Our Native Plants and Wild Animals". He believes that all native animals and plants have value.

B. "BLANKET" BINGO: Beach volleyball and party addict who is excited about getting rid of "those awful swamps around Farmington Bay," and installing some "real" trees and plants that will improve his view and the quality of his parties.

U.NION CRUISE: President of the local AFL-CIO, who insists that this project must be built, and built by union workers, regardless of anything else.

BRIAN SHRIMP: Owner of a brine shrimp harvesting company with annual profits of \$9.9 million, who is concerned that there will be no shrimp in Davis Lake. This would affect his profits.

MINNIE RAL: Representative of a consortium of mineral producers on the lake, who could be put out of business if a freshwater lake is developed.

GOLDEN R. TRIEVER: President of a local duck hunting club, whose preserve would be destroyed by Davis Lake.

ROD N. REEL: Owner of a fishing supply shop and tour guide who makes a lot of money teaching people where and how to catch the "Big Ones."

"SKY" SOARER: President of the local birding club that has been organizing bird watch excursions along the lake shore for the past 75 years.

SAM SLALOM: Power boat owner and speed freak who sees the new lake as a real boon to racing and skiing interests.

CY N. TIST: Respected biologist who is prepared to testify about the potential effects on wildlife if the lake is developed.

O.L. SLICK: Salesman of motor boats, water skis, and other recreational equipment.

BITTER WATERS: Tribal leader who is concerned about the loss of native heritage from the flooding of traditional tribal lands.

E. CONOMY: Local businessperson who is concerned about improving the long-term business potential of the area.

C.D. MINIMUM: Wealthy land developer who has architects working on designs for lakeside homes, condominiums, and resorts.

PAT POTTERY-BRUSHER: Archaeology professor from the University who has done extensive research on the archaeological sites of hunter-gatherer camps along the shore of Farmington Bay.

LYNN DRIPPER: Director of the municipal water department, which is responsible for providing quality drinking water to the growing population of Davis County, even during times of extreme drought.

H.M. OWNER: Representative for all homeowners who have property along the shore of the proposed lake. They are concerned that their property taxes will be raised to pay for the development, and then increase again as property values rise on prime homesites bordering the lake.

BOATER CARTOP: Retired angler who enjoys throwing the boat on top of the car and putting in at the closest body of water.

AND SO ON! Create other roles to illustrate a variety of perspectives and the interests of the students. Encourage the students to dress-up for their roles. If possible, provide a microphone and podium from which the people can address their elected representatives. Even if the microphone is phony, it helps students get into their roles.

What do You Know about Wetlands?

- Summary** Armed with their knowledge about wetlands, students will survey other students and adults about wetlands.
- Objectives** Students will:
- Ask questions of the general public about wetlands to determine their knowledge about wetlands;
 - Develop confidence and public speaking skills by talking to people they would not normally speak with.
- Materials** Each student should have:
- Copies of survey
 - 1 clipboard
 - pencils
- Time Involved** Give your students 1 week to complete this assignment. The wrap up should take about 30 minutes.
- Utah Core** Standard V, Objectives 1a, 1b, 2a, 2b;
Standard VIII, Objectives 1a, 1b, 1c, 6c, 6e;
Language Arts: Standard I, Objectives 1a, 1b, 1c, 1d.
- Literature Connections**
- Cone, Molly. Come Back Salmon. Sierra Club Books for Children. 1994. In this story for elementary students, enterprising children and their teachers clean up a creek and reintroduce salmon to its waters. This true story demonstrates a way classrooms can become involved with their surrounding environments.
- Lewis, Peyton, and Rory Chalcraft. Willa in Wetlands. Washington, DC: Wetlands Division, U.S. Environmental Protection Agency. 1991. (800) 832-7828. A play with songs where Willa goes to a wetland to find treasures. At first she finds nothing of value, but eventually discovers that everything is priceless. She also notices encroaching development into the wetland.
- Turner, Ann Warren. Heron Street. Harper & Row. 1989. Over the centuries as people settle near the marsh by the sea, herons and other animals are displaced.
- Preparation** None
- Activity** Tell your students that they will be completing a survey where they will interview all kinds of different people, asking them questions about wetlands. First, they all need to come up with the survey questions.

What do You Know about Wetlands?, cont'd

Start out by brainstorming questions the students think they should ask people about wetlands. With a brainstorming session, no suggestion is dumb or put down, even if it seems out of the ordinary. It is important that the students feel this is a safe place to offer suggestions. As they throw out ideas to the class, write them down as quickly as possible on a board that everyone can see. Questions can be about wetland facts or people's feelings about wetlands.

After they have exhausted their ideas, and you have guided them a bit by offering suggestions of your own, look at the list, and see if the questions can be categorized or grouped in some way. For example, one category might be wetland values or functions, and a question related to this category might be, "Can you tell me one way that wetlands are important to people?" See if the students can come up with the categories. If they have difficulty, you may need to assist them with this task.

After choosing categories, choose appropriate questions to categorize. When about 10 questions have been chosen, create a survey sheet with spaces between questions so that your students will be able to ask a question, and then put the answer underneath the question. Make copies of the survey sheet, and give each student at least 8 copies.

Tell them they need to interview at least 5 people. They must include both children and adults. They also cannot survey people that have already been interviewed. Give your students about 1 week to complete this assignment. When they have completed it, and turned it in to you, create a summary of people's responses to questions. You can put their answers into general categories so it is easier to read and understand.

Talk to your students about some of the general results. What did they find out? Did this meet their expectations, or did they expect people to know more or less about wetlands? If people knew less than they thought they would, what can they do to better educate people about wetlands?

Extensions

After answering the last question above, "What can your students do to better educate people about wetlands?", have your students work on carrying out some of these ideas!

Introduce the concept of statistics to your class. Tell them that scientists use statistics to validate answers to questions. Statistics used in this activity would be very simple, such as: "Five people responded 'no' to the question 'Do you think wetlands are important?'"

Assessment

Ask your students how many of them spoke to people they did not know very well. Was it more difficult to speak to those people than to people they knew better? Try to come up with a list of things they could do to make this challenge a little easier.

Appendices

Activity Guide Correlations with Utah Elementary Core Curriculum for 4th Grade

STANDARDS	Science		Language Arts					Social Studies	Visual Arts	Phys. Ed.		
	III	V	I	II	IV	V	VI			VII	VIII	1
Activity									4			
Pre-Field Trip Activities												
Mystery Topic		1b, 2a										
Wetlands: Whetting Your Imagination			1b									
Ecosystem Experts		1a, 1b										
Wetlands: Worth a Thousand Words		1b										
What Kind of Wetland is it?		1b, 3a										
Where are the Wetlands?		1c, 1d										
Do you Dig Wetland Soil?	2d 3b	1a, 1b										
What's this Plant?		2a, 3a, 3b										
Plants and their Watery World		2a, 3a, 3b										
Wetland Who's Who		2c										
Migration Views		2a, 2c, 4a										
The Great Traveler		2a-c, 4b	1a, 1b									
Heap O' Hazards		2a, 2c, 4a										
Wetland Web		2a, 2c										
Wetland Metaphors		1a, 1b, 2a										
How Did They Live?		2a			3	1a, 1b, 2a, 2b						
Cattail Ducks												1, 2, 3

Activity Guide Correlations, cont'd

	Science		Language Arts					Social Studies	Visual Arts		Phys. Ed.			
	III	V	I	II	IV	V	VI		VII	VIII	6040	4	1	2
Field Trip Activities														
Sensing a Wetland: There's Nothing Like the Real Thing		1b												
What went on at the Wetland?		2a, 2b, 2c, 4a-c												
I see a Bird!		2a, 2b, 2c, 4a												
Macroinvertebrate Messages		2a, 2b, 2c, 4e												
Flatten Your Plant!		2a, 2b, 3a, 3b												
Treasure Hunt!		2a, 2b, 2c												
Post-Field Trip Activities														
Designing a Wetland Habitat		1a, 1b, 1e, 2a-c												
Our Wonderful Wetland Guide		1a, 1b, 2a-c, 4d-e												
The Choice is Yours			1b											
Coyotes & Players												1		
Davis Lake Dilemma			1a-d, 2a			2a-b								
What do you know about Wetlands?	1a-c, 6c, 6e		1a, 1b, 2a, 2b											

GLOSSARY

Adaptation - an alteration in structure or behavior of an animal or plant that improves its condition in relation to its environment.

Adventitious roots - roots that extend above the water in woody wetland plants, and allow the plants to obtain and keep oxygen. They usually originate from the stem. They are also called "prop roots" because they look like they are propping up the plant. Adventitious roots have "lenticels" (see definition below).

Aerenchyma - air spaces found in the roots and stems of some submergent aquatic plants that allow them to obtain and keep oxygen.

Aerobic - with oxygen.

Anaerobic - without oxygen.

Aquatic - something that is in or near water.

Behavior - what an animal does.

Benthic - bottom-dwelling.

Binomial nomenclature - a system of naming organisms where the organism receives two names - a genus name, and a species name. The genus groups it along with similar organisms. The species part is unique to that particular organism.

Biome - a major ecological community type, such as a desert or tropical rain forest.

Carnivore - an animal that eats only other animals.

Classification - the systematic arrangement in groups according to specific criteria.

Community - group of organisms living and interacting with each other in a region under similar environmental conditions.

Competition - the demand by two or more organisms for limited environmental resources, such as nutrients, living space or light.

Complete Metamorphosis - a kind of life cycle where the stages include: egg, larva, pupa, adult. Each stage looks distinctly different from the other.

Coniferous - a kind of tree that does not lose its leaves during a specific season, but may lose them periodically throughout the year.

Conservation - the protection and wise-use of natural resources.

Consumer - an organism that eats other organisms for energy.

Deciduous - a kind of tree that loses its leaves every year.

Decomposer - an organism that converts dead, organic organisms into inorganic materials, such as detritus.

Delineation - as in wetland delineation, deciding where wetlands are, and where they are not present.

Desert - a type of ecosystem that receives less than 10 inches of rain per year, and has organisms that are specially adapted for this harsh environment.

Detritus - decomposing organisms create detritus, which eventually turns into soil.

Glossary, cont'd

Dichotomous key - a system of classification used by scientists. It asks a series of yes or no questions that at each step allow you to determine what it is you are trying to identify.

Discharge - the outflow of water from a stream or aquifer.

Dissolved oxygen - oxygen found in water. Chemical tests can be done to determine amount of dissolved oxygen in the water. More oxygen is created in moving water.

Ecology - the study of living things and their interaction with their environment.

Ecosystem - an interacting system of plants and animals and non-living elements of a distinct natural environment such as a forest or wetland.

Ecosystem service - services that are valued by humans, and are provided naturally through ecosystems. An example is wetlands providing floodwater retention.

Emergent - an aquatic plant that partly extends out of the water. It usually gets oxygen from above the water with tubes that go above and below the surface of the water.

Endangered - a species is in danger of extinction throughout part or all of its range. It is protected by the federal and/or state government.

Environment - the surroundings of an organism that influences its existence, including other organisms, climate, and other physical or chemical factors.

Environmental education - the study of our environment, and ecology. Additionally takes into account the social science, economics, politics, culture, technology and aesthetic issues of the environment. It involves the process of dealing with environmental issues using critical thinking and problem-solving skills, with the outcome of a more environmentally literate citizenry.

Ephemeral - temporary. In terms of wetlands, some wetlands are ephemeral, lasting only a short period of time.

Exotic species - a species that is not historically found in an area. Exotic species often disrupt the new ecosystem they are introduced to.

Field marks - marks an animal has to help distinguish it from other, similar animals.

Filtration - the process of removing different particles. Wetlands are excellent at filtering out unwanted contaminants.

Floater - a kind of aquatic plant that floats on top of the water. It will usually obtain oxygen through spaces on the upper part of the leaves that float on the water.

Flood water retention - wetlands provide this service by keeping flood waters, and slowly releasing them into the environment. This, in turn, prevents flooding to other areas.

Flow chart - similar to a dichotomous key, a flow chart can be used for classification.

Food web/chain - a food web is a series of interactions between organisms that eat each other, and transfer energy from one organism to another. A food chain is the transfer of energy from one living organism to another.

Forest - a kind of ecosystem consisting of trees (deciduous and/or coniferous) and underbrush.

Freshwater - water that does not contain salt.

Glossary, cont'd

Hydrogeomorphology - a way of classifying wetlands that looks at the hydrologic regime (or hydroperiod) and geomorphic setting of an area. It does not look at the soil and plant life of the wetland to classify it. The geomorphic setting is the topographic location of the wetland within the surrounding landscape.

Gill - a body structure that fish, and some other aquatic organisms have, that allows them to breathe oxygen underwater.

Gleyed - this is what soil can become when it is saturated for long periods of time, and changes to a gray, greenish, or bluish gray color.

Ground water - water that is found underneath the ground surface.

Groundwater recharge - the addition of water by natural infiltration, such as rain.

Habitat - the arrangement of food, water, shelter and space suitable to an animal's needs.

Herbaceous - a kind of plant that is not woody.

Herbivore - an animal that eats only plants.

Hydric soil - soil that is saturated with water most of the time. This soil is also called anaerobic because there is very little oxygen present in the soil.

Hydroperiod - the amount of time a wetland, or other area, is covered with water.

Hydrophyte - a wetland plant is called a hydrophyte because it is adapted to living in conditions where water is present almost constantly.

Impervious - unable to be entered or passed through.

Incomplete Metamorphosis - a kind of life cycle where the stages include: egg, nymph, adult. The nymph stage looks somewhat similar to the adult stage, unlike complete metamorphosis.

Infiltration - the movement of water through soil.

Inorganic - not containing matter that is living or used to be living.

Invasive species - a species that has the ability to significantly displace desirable, usually native, species.

Invertebrate - an organism that does not have a backbone. Examples include insects, snails and clams.

Lacustrine - part of wetland classification, it means "lake-like."

Larvae - the second stage of complete metamorphosis when the organism has hatched from the egg, and is now feeding on its own..

Learning styles - the different ways that people learn. People may be visual, auditory, or kinesthetic learners.

Lenticel - cells that are found on the surface of adventitious roots (see definition above) that allow the exchange of oxygen to the plant.

Macroinvertebrate - an invertebrate that can be seen with the naked eye; no microscope is needed to observe this animal.

Metamorphosis - the process of life changes that all invertebrates, and some vertebrates (amphibians), go through. There are two main kinds of metamorphosis: complete and incomplete. See these terms for definitions.

Glossary, cont'd

Metaphor - a figure of speech in which one object is stated to represent another object. An example is "wetlands are sponges."

Migration - the movement of organisms from one area to another.

Mineral soil - soil that is not made up of organic materials.

Mitigation - to compensate for an impact. Mitigated wetlands are usually created because a wetland in one area was disturbed, therefore another one needs to be created elsewhere.

Naiad - an aquatic nymph.

Niche - an organism's occupation - where it fits into the ecosystem, including what it eats, what eats it, where it lives, etc.

Nymph - the second stage in incomplete metamorphosis, after the organism has left the egg.

Omnivore - an animal that eats both plants and animals.

Organic - something that is made up of organisms that are, or used to be alive.

Osmosis - the movement of water from an area of higher concentration to an area of lower concentration, until it is equal on either side.

Palustrine - a wetland that is "pond-like."

Photosynthesis - a chemical process where plants use energy obtained from the sun to create their own "food", or "energy" in the form of glucose.

Pneumatophore - also called "air roots," these are a kind of adventitious root (see definition) found in mangrove trees. These are found above the main roots, and are exposed during low tides.

Predator - an organism that eats other organisms (prey).

Prey - an organism that is eaten by other organisms (predators).

Producer - an organism (usually a plant), that must produce its own food using energy from the sun.

Productivity - the rate that an organism (usually a plant) uses solar energy to produce more mass.

Pupa - the third life stage in complete metamorphosis. This stage is often inactive, such as during the cocoon stage of a moth's life.

Reduced/reduction - the chemical process of gaining an electron, losing oxygen, or gaining hydrogen.

Rubric - a way of scoring students on their performance in any number of tasks, including tests, interviews, journals, etc.

Scat - animal droppings.

Submergent - an aquatic plant that lives completely underwater.

Terrestrial - of the earth. A terrestrial organism is a land-based organism, versus an aquatic-based organism.

Wetland - Wetlands are ecosystems identified by the presence of water at some point during the year, which creates a unique environment with hydric soils and specially adapted plants and animals.

Common Plants and Animals of Utah's Wetlands

The wetlands of Utah offer a diversity of wildlife. Listed below are some of the more common wetland plants and animals. Exotic species are denoted with an asterisk.

Plants

alkali sacaton
 American vetch
 baltic rush
 blue vervain
 box elder tree
 bulrushes
 buttercups
 cattails
 common spikerush
 cottonwoods
 duckweeds
 elephant's head lousewort
 lesser bladderwort
 manna grass
 marsh marigold
 marsh milkweed
 mint
 Northern arrowhead
 olney threesquare
 pickleweed
 reed canarygrass
 river birch
 sago pondweed
 saltmarsh bird's-beak
 salt grass
 sea blight
 sedges
 streamside bluebell
 tall centaury
 tamarisk*
 tufted hairgrass
 twinberry
 water sedge
 wild iris
 willows

Insects and Spiders

damselfly
 dragonfly
 horse fly
 mayfly
 mosquito
 phantom midge
 vinegar fly
 waterlily leaf beetle
 water boatman
 Western tiger swallowtail

Fish

carp*
 least chub
 plains killifish*
 speckled dace
 Utah chub
 Western mosquito fish*

Amphibians

boreal chorus frog
 boreal toad
 canyon tree frog
 northern leopard frog
 tiger salamander
 Western spotted frog
 Western toad
 Woodhouse's toad

Reptiles

ringneck snake
 smooth green snake
 western terrestrial garter snake

Mammals

beaver
 coyote
 little brown bat
 masked shrew
 meadow vole
 mink
 moose
 muskrat
 raccoon
 red fox
 river otter
 long-tailed weasel
 striped skunk
 water shrew

Birds

American avocet
 American bittern
 American coot
 American dipper
 American white pelican
 American wigeon
 bald eagle
 black-crowned night heron
 black-necked stilt
 blue-winged teal
 broad-tailed hummingbird
 California gull
 Canada goose
 canvasback
 cinnamon teal
 cliff swallow
 common goldeneye
 common merganser
 common snipe
 common yellowthroat
 gadwall
 great blue heron
 greater yellowlegs
 green-winged teal
 killdeer
 least sandpiper
 mallard
 marsh wren
 northern harrier
 northern oriole
 northern pintail
 northern shoveler
 pied-billed grebe
 peregrine falcon
 red-winged blackbird
 sanderling
 sandhill crane
 short-eared owl
 snowy egret
 sora
 violet-green swallow
 virginia rail
 western grebe
 western wood pewee
 white-faced ibis
 Wilson's phalarope
 wood duck
 yellow-headed blackbird
 yellow warbler

* exotic species

Coyote
Canis latrans

Description: Length of head & body 32-37 inches, tail 11-16 inches. Weight 20-50 pounds. Looks like medium-sized dog, and is usually gray.

Habitat: Coyotes are generalists, and can be found in all kinds of habitats, including wetlands, deserts, prairies and forests.

Food: Most common foods are rodents and rabbits, but will also eat vegetation such as berries and grass.

Gee Whiz!: Once only found in the western U.S., coyotes can now be found throughout the continental U.S.



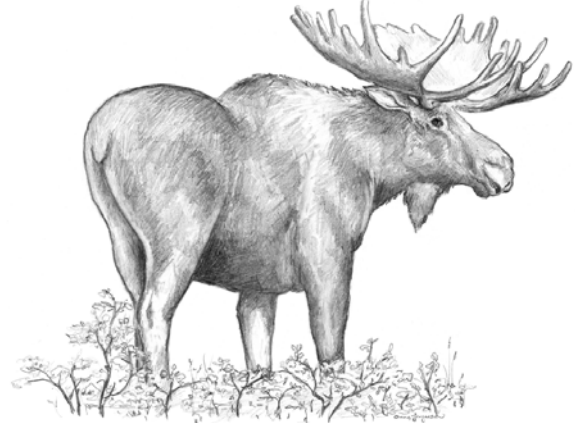
Moose
Alces alces

Description: Height 5 1/2-6 feet. Weight of males 850-1180 pounds, females 600-800 pounds. Large antlers, overhanging snout, 'bell' on throat. Males have antlers.

Habitat: Forests with lakes and swamps, especially alpine wetlands.

Food: In winter, eats twigs, bark, and tree saplings. In summer, eats aquatic vegetation.

Gee Whiz!: Can swim as fast as 2 men can paddle a canoe - up to 35 miles per hour.



Raccoon
Procyon lotor

Description: Length of head & body 18-28 inches, tail 8-12 inches. Weight 12-35 pounds. Grayish body, black face mask, striped gray & black tail.

Habitat: Raccoons can be found in forests and wetlands, as well as urban areas, but they are never far from water.

Food: They eat both plants and animals (omnivores), such as berries, insects, eggs, nuts, crayfish.

Gee Whiz!: Although scientists don't know exactly why, raccoons will often dunk their food in water before eating.



Red Bat

Lasiurus blossevillii

Description: Length of forearm 1 1/2 - 1 2/3 inches. Weight 1/4 - 1/2 ounce. Reddish colored bat, with white-tipped hairs.

Habitat: Red bats usually roost (sleep) in trees, but also sometimes in caves near rivers.

Food: As all bats in North America do, the red bat eats insects.

Gee Whiz!: Bats are not blind, but they do use echolocation to find and catch flying insects. This type of bat is very rare in Utah, and is on Utah's Sensitive Species list.



Beaver

Castor canadensis

Description: Length of head & body 25-30 inches, tail 9-10 inches. Weight 30-60 pounds. The beaver is a very large rodent with a naked, flat tail (6 inches wide). Large front teeth are colored brown.

Habitat: Beavers are found near streams and lakes where trees are next to the bank or shoreline.

Food: Bark, twigs, and leaves of a number of trees, but especially willow, aspen, alder, maple, and birch.

Gee Whiz!: Beavers make lodges and dams out of fallen trees, often across a stream or at the edge of a lake.



Long-tailed Weasel

Mustela frenata

Description: Length of head & body: males 9-10 1/2 inches, females 8-9 inches; tail, males 4-6 inches, females, 3-5 inches. Weight: males 7-12 ounces, females 3-7 ounces. This weasel has a long neck and body, black tip on tail, and yellowish-white underparts.

Habitat: Longtail weasels will usually be found in habitats near water.

Food: Small mammals and sometimes birds.

Gee Whiz!: Weasels kill by biting the heads of their prey and piercing the skull with their canine teeth.



Muskrat

Ondatra zibethicus

Description: Length of head & body 10-14 inches, tail 8-11 inches. Weight 2-4 pounds. Dense, brown fur. Tail is long, thin, naked, and flattened

Habitat: Muskrats live at the edges of ponds, lakes, and streams, as well as in open water, where they make their homes.

Food: Mainly aquatic vegetation, but will also sometimes eat clams, frogs, and fish.

Gee Whiz!: Muskrats build homes, often out of cattails and other wetland vegetation, that are 2-3 feet above the water. People will often mistake them for beaver dams.



River Otter

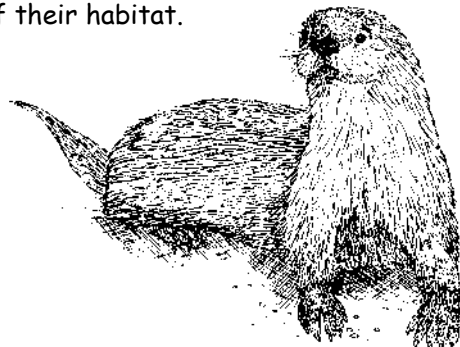
Lontra canadensis

Description: Length of head & body 26-30 inches, tail 12-17 inches. Weight 10-25 pounds. Large mammal, brown above, silvery below, webbed feet, and a tail that is thick at base and tapers towards tip.

Habitat: River otters live near streams, rivers, or the borders of lakes.

Food: Fish, crayfish, frogs and sometimes birds or mammals.

Gee Whiz!: The river otter is on Utah's Sensitive Species List, which means its populations are small, and are declining. This is probably due to alteration of their habitat.



American Avocet
Recurvirostra americana

Description: Length 16-20 inches. A large shorebird with a slightly upturned bill. Black and white pattern on the body.

Habitat: Avocets in Utah breed in mudflats, ponds and alkaline wetlands.

Food: Invertebrates, including water boatmen, beetle larvae, fly larvae, brine shrimp, brine flies and midge larvae in the water. They may also eat other land invertebrates.

Gee Whiz!: During the winter, avocets will travel south, even sometimes to northeastern Guatemala.



Black-necked Stilt
Himantopus mexicanus

Description: Length 13-17 inches. Large, thin shorebird with extremely long, red legs. Wings are entirely black.

Habitat: Black-necked stilts live in alkaline wetlands, ponds and mudflats.

Food: Invertebrates, both in the water and flying in the air, are the main sources of food. They also eat small fish, crayfish and seeds.

Gee Whiz!: The parents of young black-necked stilts will take them to a safe place to feed and hide from predators, then leave them - before the young can even fly!



Bald Eagle
Haliaeetus leucocephalus

Description: Length 30-43 inches; wing spread 7-8 feet. Mature bird has a white head and tail, with large, yellow bill.

Habitat: In Utah, can be found near lakes and rivers.

Food: Eagles are predators, and will often eat fish and waterfowl. But they will also eat carrion (dead animals), rabbits and other small mammals.

Gee Whiz!: Although eagles are a threatened species in the U.S. and Utah, their numbers are increasing throughout the United States. It is also our national symbol.



American Dipper
Cinclus mexicanus

Description: Length 7-8 1/2 inches. Short, squat dark-gray colored bird.

Habitat: Dippers can be found near lakes, streams and rivers in Utah.

Food: Invertebrates, insects, and fish.

Gee Whiz!: Dippers can dive and swim under water, and walk on the bottom!



American Bittern

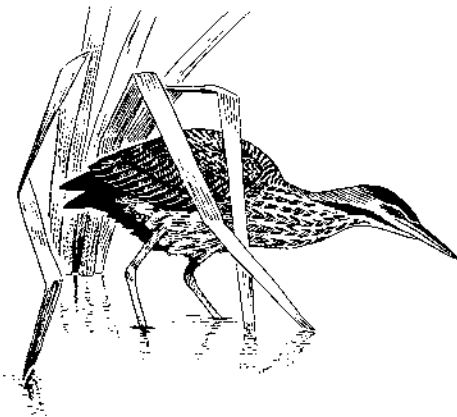
Botaurus lentiginosus

Description: Length 23 inches. Black stripe on neck distinguishes it from the least bittern.

Habitat: Found in marshes where cattails and/or rushes are thick.

Food: Fish and sometimes invertebrates.

Gee Whiz!: When at rest or when frightened, bitterns lift their heads so the bill is pointed up. Their coloration of brown and white stripes on their neck allow them to blend in well with the marsh.



American Coot

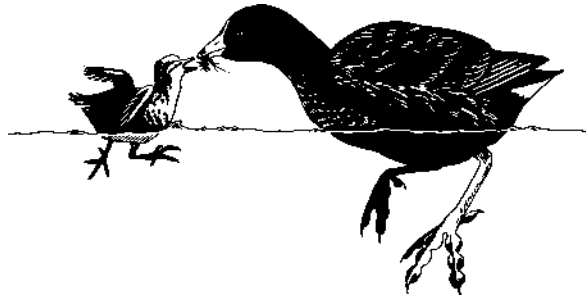
Fulica americana

Description: Length 13-16 inches. Dark gray, almost black color, white bill. Large feet are 'lobed' - with 'scallops' on toes.

Habitat: Ponds, lakes and marshes.

Food: Mostly vegetation, but also mollusks, seeds, insects, worms, berries, fruits.

Gee Whiz!: Female coots sometimes lay their eggs in the nests of other species and allow those females to take care of their young. They are therefore sometimes parasitic birds.



Wood Duck

Aix sponsa

Description: Length 17-20 1/2 inches. Males are very colorful, with green and white head, red eye, bright orange bill, and green, brown, yellow and white body. Females are more brown in color.

Habitat: Wood ducks prefer marshes and ponds near woods. Females nest in holes in trees.

Food: During the winter wood ducks eat plants, and in spring and summer their diet changes to insects.

Gee Whiz!: Ever seen a duck in a tree? If you have, it was probably a wood duck. When young hatch out of eggs, within 24 hours they hop out of the nest (which can often be 20 feet off the ground), fall onto the ground, then follow their mother to the nearest body of water, never again to return to their nest.



Yellow-headed Blackbird

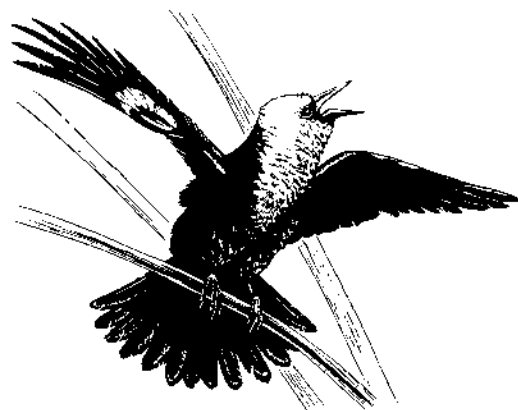
Xanthocephalus xanthocephalus

Description: Length 8-11 inches. Male has orange-yellow head and breast; female is more brown.

Habitat: Various wetlands, including wet meadows, marshes and wet lake margins.

Food: During breeding season they eat insects. The rest of year they eat seeds and grains.

Gee Whiz!: The nests of yellow-headed blackbirds are cup-shaped and are built in vegetation above the water in a wetland.



Northern Harrier (Marsh Hawk)

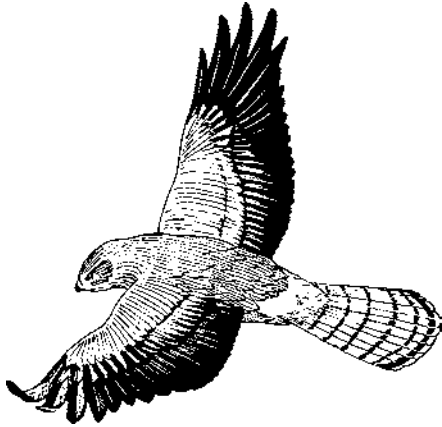
Circus cyaneus

Description: Length 17 1/2 -24 inches. Slim, has long wings and long tail and white rump patch. Males are pale gray, females are brown.

Habitat: Found near marshes, fields and prairies.

Food: Mostly small mammals and small birds and sometimes invertebrates.

Gee Whiz!: Northern harriers build their nests on the ground.



Virginia Rail

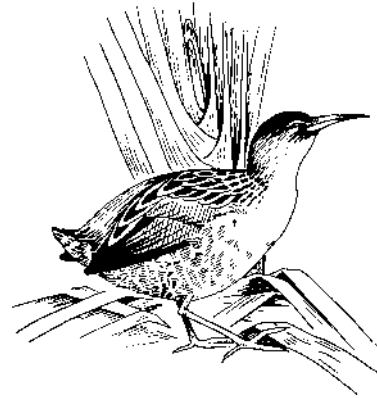
Rallus limicola

Description: Length 9 inches. Rusty in color, with gray cheeks and a long, reddish bill.

Habitat: Freshwater wetlands (for breeding) and fresh or saltwater wetlands for the rest of the year.

Food: Invertebrates, aquatic plants and the seeds of emergent plants.

Gee Whiz!: The virginia rail breeds in the U.S., as well as in Mexico, Guatemala and South America.



Western Toad

Bufo boreas

Description: Length 2 1/2 -5 inches. Have a white or cream colored stripe down the middle of the back. Are gray or greenish above with rust colored warts.

Habitat: Found in desert streams and springs, ponds, lakes, reservoirs and rivers. Can also be found in non-wet areas such as grasslands and woodlands.

Food: Adults will eat invertebrates, such as ants or grasshoppers. Tadpoles eat algae or detritus.

Gee Whiz!: These toads will sometimes find shelter in burrows of gophers, ground squirrels and other animals. They usually walk instead of hop.



Northern Leopard Frog

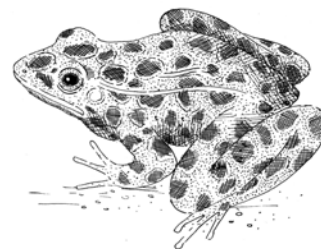
Rana pipiens

Description: Length 2-4 3/8 inches. Green or brownish with dark spots on its back.

Habitat: Streams, marshes, ponds, reservoirs, but may look for food far from water.

Food: Adults eat invertebrates. Tadpoles eat algae, detritus or smaller invertebrates.

Gee Whiz!: Numbers of Northern leopard frogs in the wild may be declining.



Woodhouse's Toad
Bufo woodhousii

Description: Length 1 3/4-5 inches. Gray, yellowish brown or blackish above and cream colored below.

Habitat: Usually sandy areas near desert streams, marshes, lakes and pools.

Food: Adults eat insects, and tadpoles eat algae, detritus, and plants.

Gee Whiz!: The sound of Woodhouse's toad has been compared to a snore or an infant's cry "w-a-a-a-ah!"



Tiger Salamander
Ambystoma tigrinum

Description: Length 3-6 1/2 inches. Large, with small eyes. Black background color with pale yellow/cream stripes or spots.

Habitat: Ponds, lakes, reservoirs and vernal (temporary) ponds.

Food: Insects and larvae of other amphibians.

Gee Whiz!: Tiger salamanders are the only salamanders found in Utah. These salamanders migrate, but not as far as birds do! They will migrate a short distance between breeding and resting sites.



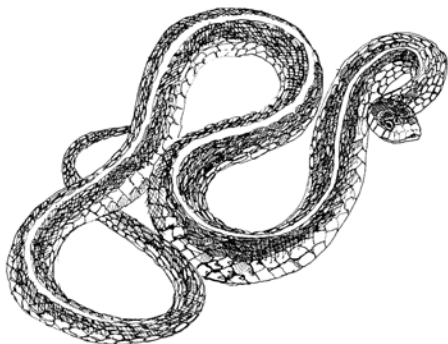
Common Garter Snake
Thamnophis sirtalis

Description: Body length 18-26 inches. Has yellow stripes on black or brown background.

Habitat: Found in northern, central, and eastern areas of Utah. Can usually be found near water, such as wet meadows, marshes, or even wet farmlands and drainage ditches.

Food: Eats primarily earthworms, fish, insects and amphibians, but will also eat spiders, small mammals and small birds.

Gee Whiz!: Females give birth to between 13 to 26 young per year during mid-summer.



Dragonfly

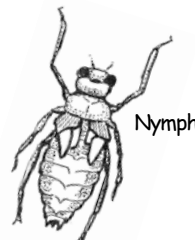
Order Odonata, Suborder Anisoptera

Description: Nymph body is either long and stout or oval and flattened. Has 3 pairs of segmented legs. Wings of adults are held outstretched away from body.

Habitat: Nymphs are born and live in still-water habitats, including ponds, lakes, small streams, larger rivers, seeps and bogs. Adults may stay near water but can also venture farther away.

Food: All are predators and catch their prey with a unique long lower lip that has a hinge allowing it to bend. They extend the lip to capture their prey and bring it to their mouth.

Gee Whiz!: Most dragonflies stay in the nymph stage an average of 10 months. Some, though, stay as nymphs from 5-6 weeks to 5-6 years!



Nymph



Adult

Water Flea *Daphnia*

Description: Most are less than 3mm (approximately $\frac{1}{8}$ inches) in size -- you could fit dozens on one fingernail. Not really fleas, they are crustaceans, related to shrimp and crabs.

Habitat: Found in almost any wetland habitat.

Food: Eat tiny algae found throughout the water.

Gee Whiz!: Other wetland animals, especially fish, love to eat *Daphnia*. Therefore they are extremely important to a wetland ecosystem.



Water Scorpion Family Nepidae

Description: Body length usually. Has long, slender body usually measuring 15-35mm (approximately $\frac{1}{2}$ - $\frac{3}{8}$ inches). Front legs have "elbows" for grabbing and holding prey.

Habitat: Ponds, swamps and streams, usually among vegetation or debris in shallow areas.

Food: They capture swimming crustaceans (like *Daphnia*) and insects with their long front legs. They especially like to eat water boatmen.

Gee Whiz!: They spend most of their time on vegetation and debris, waiting for their prey. Although they live in water, they are very poor swimmers. They breathe by tubes on their abdomen, and so must spend a lot of time hanging upside down.



Water Boatman Family Corixidae

Description: Elongated, oval, flat body that is 3-11mm (approximately $\frac{1}{8}$ - $\frac{7}{16}$ inches). Usually dark gray or brown with narrow wavy, yellowish lines across top of body.

Habitat: Shallow water of ponds and lakes and pools of streams and rivers. Usually found in or around aquatic plants.

Food: Stir up fine debris on the bottom of the water, eating whatever living material is in the sediment, such as diatoms, algae, protozoa, nematodes and small insects.

Gee Whiz!: Water boatmen breathe from an air bubble they hold under their wings and across their abdomen. When oxygen in the bubble is used up, dissolved oxygen in the water enters the bubble. Eventually though, they need to go to the surface of the water to grab another air bubble.



Mayfly Order Ephemeroptera

Description: Larvae have elongated bodies with gills on the sides of the abdomen, and 2 or 3 long, thin tails on the end of the abdomen. On adults, wings are usually held together and extended above the body when not flying. Adults also have 2 or 3 long, thin tails on end of abdomen.

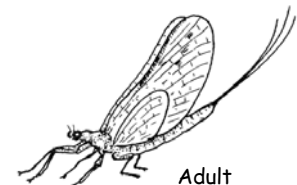
Habitat: Nymphs found in small streams to large rivers, and ponds to lakes. Often found on the undersides of small rocks.

Food: Nymphs eat small plants and animals found in the water. Adults never eat.

Gee Whiz!: Mayfly larvae shed their exoskeleton more times than any other aquatic insect - between 12-27 times. Also, their name, *ephemero*, means "lasting a day", which is how long the adults live. During that 24 hours they do not eat at all. All they do is mate.



Nymph



Adult

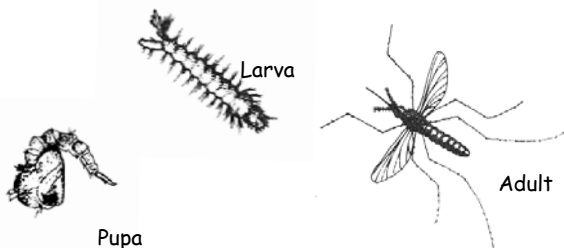
Mosquito
Family Culicidae

Description: Larvae and pupae are found in water. They are very active, and are called wrigglers and tumblers, respectively. Adults live out of water and can fly.

Habitat: Larvae are born in still-water habitats, including pools, marshes, ponds, swamps, lakes and backwaters and pools of streams and rivers.

Food: Larvae & pupae have brush-like mouth-parts to eat plankton in the water. Adult females eat blood so their eggs can develop. Adult males eat nectar

Gee Whiz!: Some mosquito eggs can remain dormant for months to years, then hatch when they become wet.



Pond Snail
Family Lymnaeidae

Description: Snails in this family are commonly found throughout Utah. Their coiled shells are usually 10-50 mm (approximately 3/8 - 2 inches) long. The shells of snails twist either clockwise or counter-clockwise and can have openings on either the right or left sides. Those in this family open on the right side. They breathe in the water.

Habitat: Pond snails can be found in various wetland habitats.

Food: Algae and plants. Pond snails use their tongue, or radula to scrape food off of the bottom of a wetland such as rocks and plants for their food.

Gee Whiz!: There are 57 species of snails in North America. It is unknown how many are found in Utah.



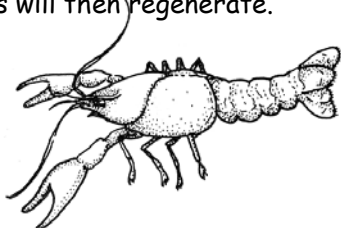
Crayfish
Families Astacidae & Cambaridae

Description: Body length 10-150mm (approximately 3/8 - 6 inches) (not including antennae). Have 5 pairs of walking legs, with hinged claws on ends of first 3 pairs of walking legs. Broad flipper found on end of body.

Habitat: Shallow water in springs, rivers, lakes, ponds, sloughs, marshes, swamps, wet meadows. They hide among rocks, woody debris or vegetation.

Food: Are omnivores, eating whatever food is available, but usually eat decaying vegetation. When this is not available, they eat insects, small fish, live snails, and fish eggs.

Gee Whiz!: When attacked, crayfish can let their legs break off so the animal can escape. These legs will then regenerate.



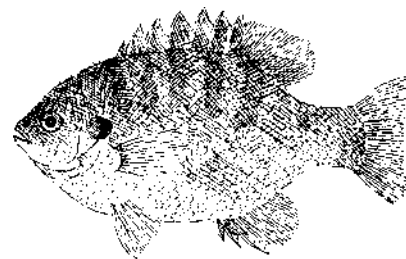
Bluegill
Lepomis macrochirus

Description: A round-shaped that fits well in a frying pan with faint, verticle stripes. Outer edge of gill cover has large black spot and blue border.

Habitat: Bluegill are not native to Utah, but were introduced as a sport fish. They can be found in almost any warm water habitat in the state, usually in shallow water with sufficient vegetation cover.

Food: Small fish, zooplankton, insect adults and larvae and other invertebrates.

Gee Whiz!: A male bluegill build nests on the bottom of the lake or pond before spawning, then guards eggs and baby fish (called fry).



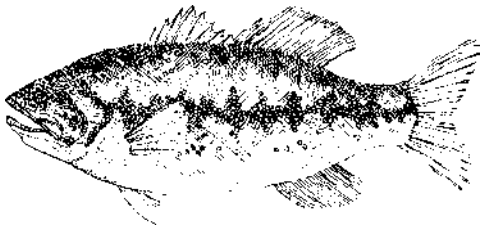
Largemouth Bass *Micropterus salmoides*

Description: "Football-shaped" fish with brownish back, greenish sides and white belly. Mouth of largemouth bass extends behind the eye, unlike the smallmouth bass, in which it does not.

Habitat: Not native to Utah, but were introduced as sport fish. Can be found in most of Utah's warmer waters, but usually not at depths greater than 18 feet.

Food: Eat fish most often, but also eat amphibians, rodents, birds and large invertebrates.

Gee Whiz!: Female largemouth bass can deposit up to 25,000 eggs in nests. Males guard nests until just after fry are born. Then young are left on their own.



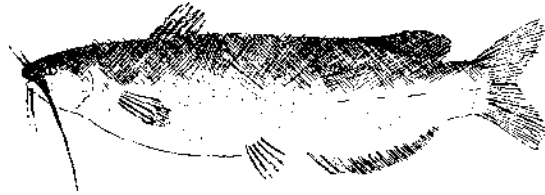
Channel Catfish *Ictalurus punctatus*

Description: Barbels, or whiskers, on face that have tastebuds on them, as well as a deeply forked tail. Young fish also have black spots. All catfish have smooth skin with no scales.

Habitat: Not native to Utah, but is native to many areas east of the Rockies. They are bottom-dwelling, and can live in water that is cool to very warm.

Food: Plants, detritus and invertebrates, although adults mainly eat other fish.

Gee Whiz!: Catfish use their barbels to look for food on the bottom of the water. They are most active from sundown to midnight.



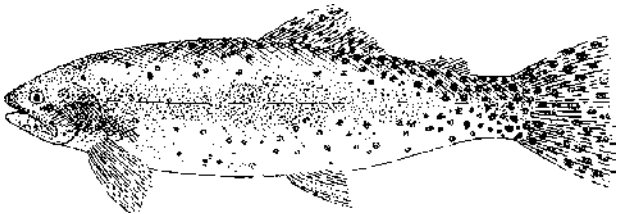
Bonneville Cutthroat Trout *Oncorhynchus clarki*

Description: Long-shaped fish (12-16 inches in length) with a patch of orange or red on the throat, and longer heads and jaws than rainbow trout.

Habitat: Native to Utah - in fact, is Utah's state fish! Requires a riparian zone within a river or stream, or even a lake at low or high elevations. Riparian zone must provide structure, cover, shade and bank stability.

Food: Eats mainly insects, but adults will also eat other fish.

Gee Whiz!: This species is on Utah's Sensitive Species list due to habitat loss/alteration, predation and competition with other, non-native fish, and hybridizing with non-native fish.



Redside Shiner *Richardsonius balteatus*

Description: Usually 5-6 inches in length. Has thick, red line going along side of body.

Habitat: Native to Bonneville Basin of Utah, and has been introduced to Colorado River drainage. Lives in heavily vegetated areas of slow-moving water with sand or mud on the bottom.

Food: Insects, mollusks, zooplankton, small fishes, fish eggs and algae.

Gee Whiz!: Eggs are sent into water, fertilized, then stick to plants, rocks, detritus or the bottom. The parents do not care for young at all.



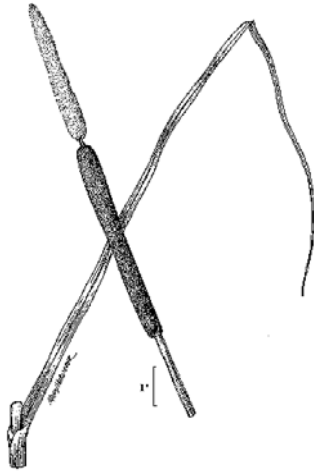
Narrow-leaf Cattail

Typha angustifolia

Description: Tall, narrow plant; can have up to 8 leaves per stem that are usually 1/2 inch wide.

Habitat: Edges of ponds, lakes; in marshes; along streams.

Gee Whiz!: Native Americans used to use cattail pollen in making bread, almost like flour.



Reed Canarygrass

Phalaris arundinacea

Description: Can grow as tall as 2 to 9 feet! Fluffy-looking flowers are found at the top, and are initially green to purple, eventually changing to beige. This plant is one of the first in the spring to sprout.

Habitat: Various kinds of wetlands. Can grow on dry soil, but does best in wet, organic soil.

Gee Whiz!: Is often used to control erosion, especially in created wetlands. There is both a species native to North America and a Eurasian species. The Eurasian species is the one most commonly used for erosion control, but unfortunately it can be very invasive in some areas.



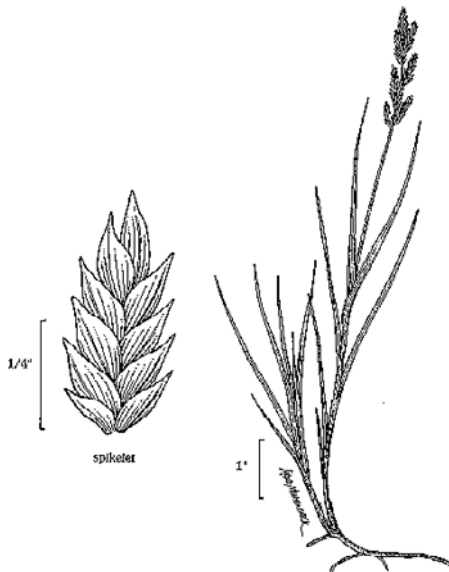
Inland Saltgrass

Distichlis stricta

Description: Leaves are narrow and elongated; smooth stems can be up to 15 inches tall.

Habitat: Salt marshes, saline ponds, alkaline flats, playas, and saline wet meadows

Gee Whiz!: Forms sod.



Alkali Sacaton

Sporobolus airoides

Description: Stems are hollow and up to 4 feet tall. Spikelets have one flower each.

Habitat: Saline ponds, alkaline wet meadows

Gee Whiz!: An important grass for domestic livestock.



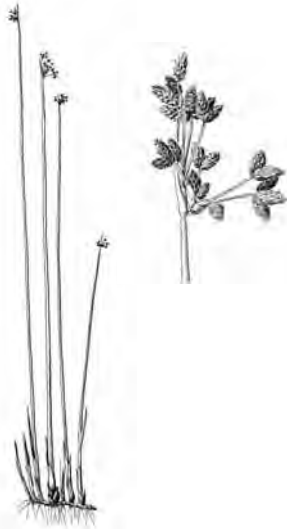
Hardstem Bulrush

Scirpus acutus

Description: Bulrushes are really in the sedge family, so this plant's stem has edges (as do all sedges). Long, narrow leaves with a flower almost at the top of the stem.

Habitat: Various wetlands, lakes and ponds.

Gee Whiz!: Good food source for wildlife and helps prevent erosion.



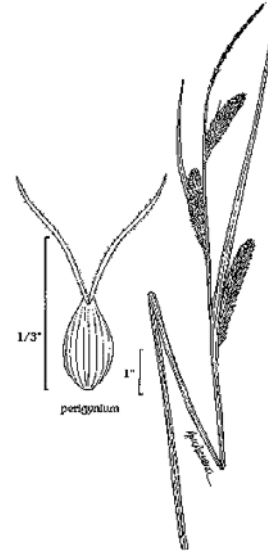
Nebraska Sedge

Carex nebrascensis

Description: This plant has bluish-green leaves that are alternate on the stem. The stem is triangular and can be up to 3 feet tall.

Habitat: Wet meadows, around lakes and ponds.

Gee Whiz!: Waterfowl enjoy eating parts of the plant.



Common Spikerush

Eleocharis palustris

Description: Stem is round (as with all rushes), and as an adult, this plant has no leaves. Dense flowerhead found at the end of the stem.

Habitat: Vernal pools, wetlands

Gee Whiz!: Stems are hollow when the plant is in water and solid when the plant is on dry ground.



Baltic Rush

Juncus balticus

Description: Tall rush; flower appears along the stem, near the top, but not at the top.

Habitat: low wetlands, from valleys to mid elevations, marsh, wet meadows, riparian areas.

Gee Whiz!: Baltic rush is both drought tolerant and flood tolerant.



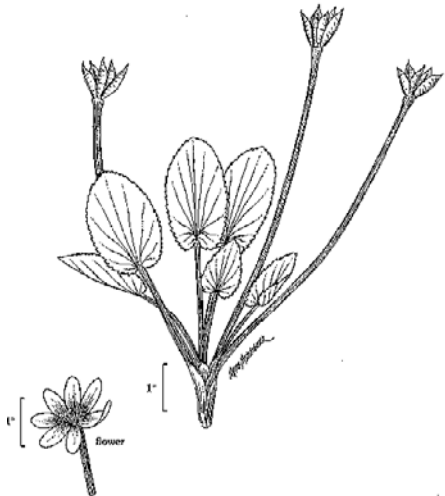
Slender-Sepal Marsh Marigold

Caltha leptosepala

Description: Herbaceous perennial plant with oval leaves, each on its own stem. One white flower per plant.

Habitat: High elevation wet meadows, alpine wetlands, bogs, seeps, springs.

Gee Whiz!: Sap of marsh marigold may irritate sensitive skin.



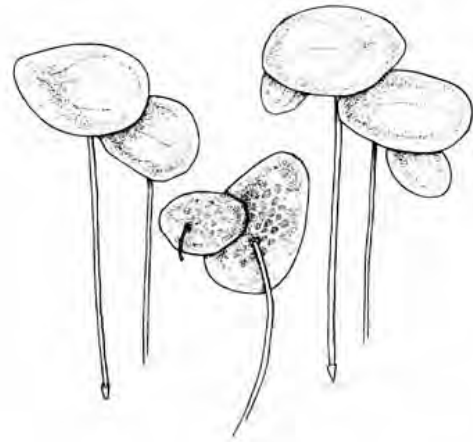
Lesser Duckweed

Lemna minor

Description: A floating plant that gets some of its oxygen from pores on top of the leaf. It has only one root.

Habitat: Ponds, marshes, lakes and streams.

Gee Whiz!: Duckweed is the smallest flowering plant in the world. Ducks enjoy eating it, perhaps because of its high nutritional value.



Lesser Bladderwort

Utricularia minor

Description: Slender, flat, smooth-edged leaves; small, yellow flowers with 5 petals. Bladders are small, deflated pouches in leaves.

Habitat: Fens, open bogs, sedge meadows, marshes.

Gee Whiz!: Bladders are not used for floatation, but for capturing small invertebrates. When trigger hairs are disturbed, the bladders suck in water and the creature at the same time. Digestive enzymes in the bladder digest the animal, taking 15 minutes to 2 hours. Once digested, the nutrients left are sucked into the stem. The only predatory aquatic plant in the U.S.



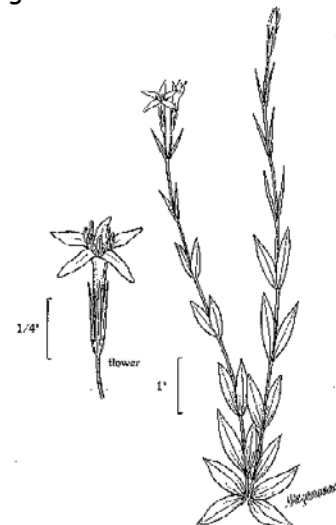
Tall Centaury

Centaurium exaltatum

Description: Flowers are pink or rose-colored with 4 or 5 petals, and are yellow inside. Leaves are opposite, slender and up to 2 inches long.

Habitat: Along streams, in marshes, sometimes in alkali soil.

Gee Whiz!: This plant can sometimes be found near hot springs.



Northern Arrowhead

Sagittaria cuneata

Description: Also called "duck potato". Leaves are emergent and are in the shape of an arrow. Flowers are yellow with 3 petals.

Habitat: Shallow water of marshes, lakes, ponds, streams and ditches.

Gee Whiz!: The root of this plant has been used historically to help digestion. It is endangered or threatened in many eastern states.



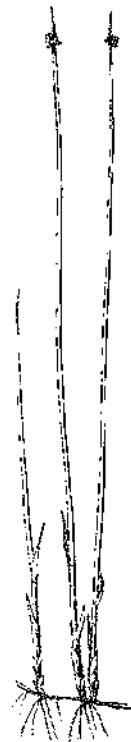
Olney Threesquare

Scirpus americanus

Description: A sedge that grows up to 5 feet tall, but has only a few leaves that are 4" long. The flower, or inflorescence, is a collection of small spikelets.

Habitat: Marshes, saline wet meadows, and playas, sometimes in alkali soil, as well as fresh water.

Gee Whiz!: Muskrat, Canada geese, and snow geese enjoy eating this plant.



Saltmarsh Bird's-beak

Cordylanthus maritimus

Description: Plant is 8-16 inches tall; leaves are alternate and oblong and 1/4-1 inch long. Inflorescence is a spike with many flowers that are cream to yellow colored,

Habitat: Saline wet meadows, coastal marshes of California.

Gee Whiz!: This is an endangered plant species, so if you see it, don't step on it! It is sometimes called a hemi-parasite because it gets some of its energy from the underground parts of other plants. The rest of the energy comes from photosynthesis.



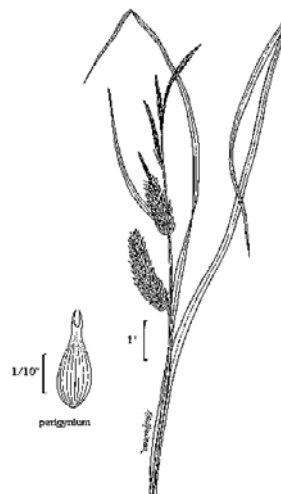
Beaked Sedge

Carex rostrata

Description: Leaves are flat and long; stem is triangular and spongy at the base; flowers are in spikes.

Habitat: Wet meadows, marshes, wet lake margins, ponds, riparian areas. Water level can be very low or very high for this plant to live.

Gee Whiz!: Waterfowl love to eat this plant. A beaked sedge plant may live up to 6 years.



Water Sedge

Carex aquatalis

Description: Has 3-7 spikes. Leaves are flat and long.

Habitat: High elevation wet meadows, ponds, wet lake margins.

Gee Whiz!: Cows like to eat water sedge. This may not be good for the wetland where it is found.



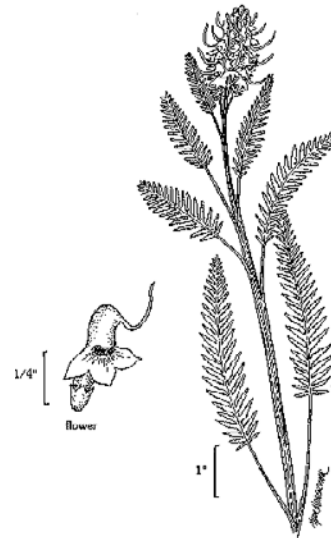
Elephant's-head Lousewort

Pedicularis groenlandica

Description: Several flowers are crowded together on a spike. Deeply divided leaves are 12 inches long, and 3 inches wide.

Habitat: High elevation wet meadows, along streams in mountains.

Gee Whiz!: When this plant is in bloom the upper lip of the purple flowers look like an elephant's trunk.



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Animal drawings by the following artists:

Anne Ferguson: American avocet, black-necked stilt, moose

Cindy Brunner: bald eagle, beaver, coyote, American dipper, leopard frog, western toad, long-tailed weasel, muskrat, river otter, woodhouse's toad, tiger salamander, common garter snake, bluegill, largemouth bass, channel catfish, bonnevillie cutthroat trout

Zachary Zdinak (2001-02): American bittern, American coot, Northern harrier, Virginia rail, wood duck, yellow-headed blackbird, raccoon, red bat, canvasback, wigeon, (cottonwood tree)

Buller, Dave. 1980. OBS pond guide. Delta Education, Inc, Nashua, NH. Artists, Lonnie Kennedy and Lisa Haderlie Baker: dragonfly, waterflea, water scorpion, water boatman, mayfly, mosquito, pond snail, crayfish

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Supplemental Resources
for
Utah's Wonderful Wetlands
Educator's Activity Guide

Wetlands Pictures

8.5 inches x 11 inches size

for use with Activity: What Kind of Wetland is it?



These wetlands occur in solid rock. These small basins have been ground out of the rock by stones swirling in the water. The water in them is freshwater from precipitation or surface runoff. They do not have water all of the time, usually only during the spring or during rainy season. There is often no vegetation, but you might find fairy shrimp in the water. They have no outlet and dry out through evaporation. These wetlands are also called tanks or tinajas. They are found in the Colorado Plateau.

Potholes



These wetlands usually have little or no standing water, and have almost no vegetation. They also may have an outlet to another water body. The environment, especially in the salt flats, poses a huge challenge to any plants trying to adapt to these conditions, therefore few plants are found in this type of wetland. Most of these type of wetlands in Utah are located around the Great Salt Lake.

(Mud flats/Salt flats)



These types of wetlands are found along rivers and streams. They usually have moving water associated with them and often connect 2 larger bodies of water. These areas are considered some of the most productive areas for plants and animals, especially in Utah where there is little precipitation. These areas often seem to be a ribbon of green in a sea of brown, unvegetated areas. Cutthroat trout are often found in these areas of Utah.

(Riverine/Riparian)



These wetlands may not always have water that is obvious, because they often have lots of vegetation associated with them. In fact, sometimes the vegetation is so thick that the wetland may look dry, but if you dig just beneath the surface of the ground you will find water. They are often found near riverine systems at middle or high elevations throughout the state. These wetlands are important to a diverse group of wildlife including raptors, songbirds, moose, mule deer, elk and red fox.

(Wet Meadows)



These wetlands have little to no vegetation, and no outlets to other water bodies. They are depressions in the earth that fill with water in spring rainy seasons, then slowly dry up, often leaving behind a salt flat. This type of wetland always has both wet and dry seasons. Salt grass is the most common vegetation found in this kind of wetland. They can be found around the Great Salt Lake, as well as throughout the southern and western parts of Utah.

(Playas)



These wetlands are often found at low elevations, but can really be found at any elevation. They usually dry up during a drought period. They will have some vegetation cover, especially cattails, but not as much vegetation as a Wet Meadow.

(Wet Lake Margins)



These wetlands occur below waterfalls. They may have groundwater seeping into them through the rock faces. They are also called hanging gardens and often have perennial water. Hanging gardens have many rare plants that only grow in these locations, such as *Alcove death camas*, *Alcove bog orchid* and *Cave primrose*. They have outlets to other water bodies via stream channels. These wetlands are found in the Colorado Plateau.

Plunge pools



These wetlands can include several different types, including marshes, ponds, fens and glacial lakes. The common characteristic linking them together is that they are found at high elevations. They are also only covered with water now and then, and will have some vegetation, such as marsh marigold, associated with them. Moose are commonly found in these wetlands.

(Subalpine/Montane Wetlands)



These are a kind of depressional wetland, and are always covered with shallow water. These wetlands are very important to wildlife, including migrating birds, as well as many other species. Most wetlands found at lower elevations in Utah are of this type.

(Ponds)



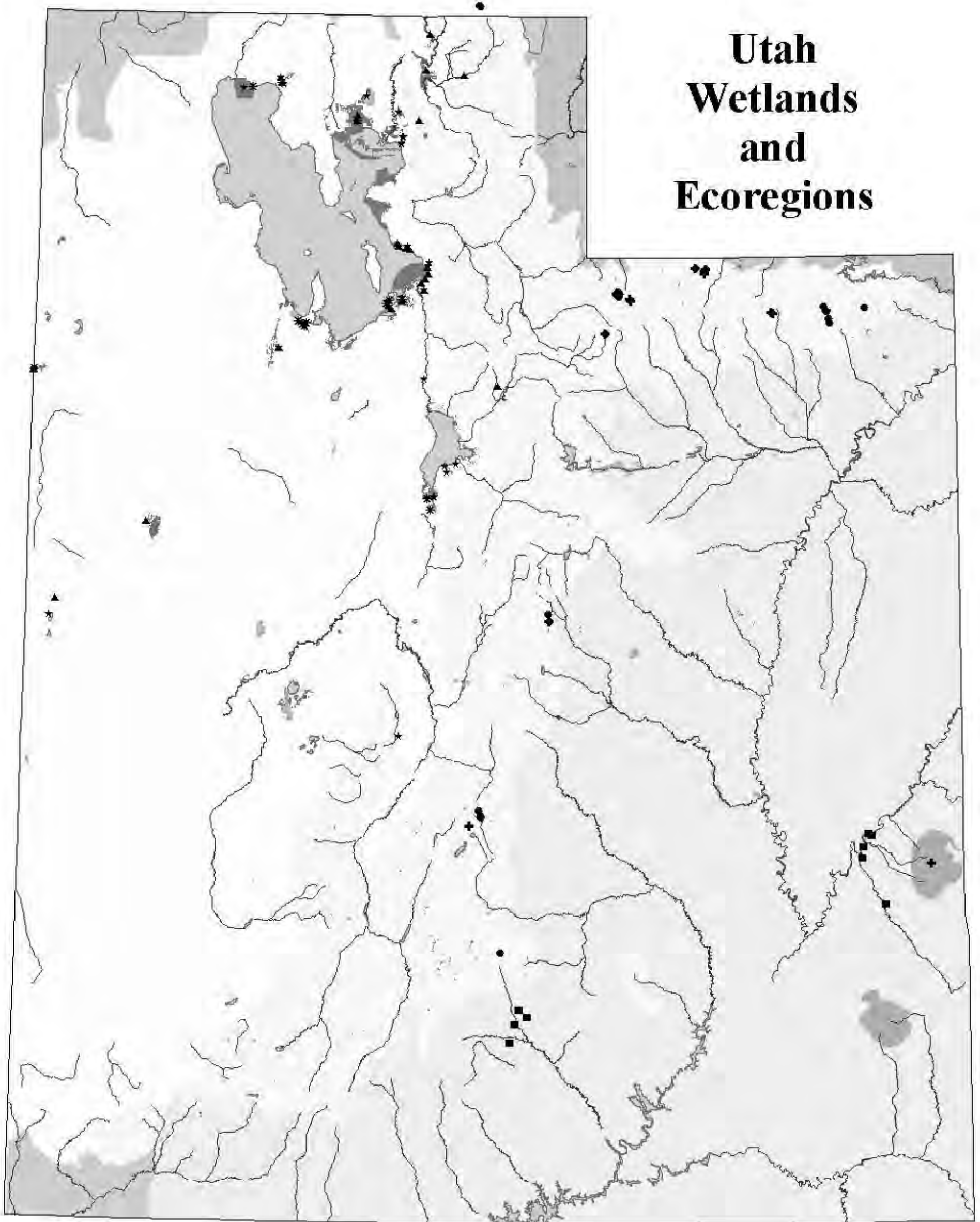
These areas are similar to ponds, but have much deeper water. Because of this deeper water, they are sometimes not considered *wetlands*, but are more of a *deep-water habitat*. As stated previously, defining wetlands is not always straightforward.

(Lakes & Reservoirs)

Utah Wetlands Color Map

for use with Activity: Where are the Wetlands?

Utah Wetlands and Ecoregions



LEGEND

Wetlands

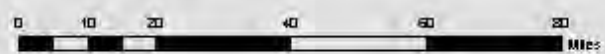
- Subalpine - Montane Wetlands
- Ponds, Ponds, Plugpools
- ▲ Ponds
- * Ponds
- ★ Low Elevation Wet Meadows
- ⊕ High Elevation Wet Meadows

Wetlands Continued

- Riparian - Riparian Lands
- ▨ Wildlife Management Areas
- ▩ Wet Lake Margins
- ▩ Arid/Arctic Wetlands
- Open Water

Ecoregions

- Snake River High Desert
- Southern Rockies
- Colorado Plateau
- Wyoming Basin
- Wasatch - Uinta Mountains
- Northern Basin & Range
- Mojave Basin & Range



Note: Utah Educators may request the following on a CD

e-mail dianavos@utah.gov

Key to Life in the Pond

&

Key to Life in the River

Identification Key #1 *

Identification Key #2 *

Identification Key #3 *













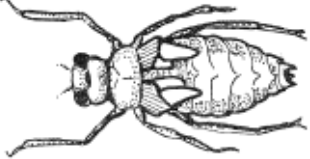





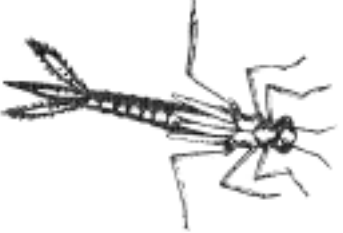






Identification Key #4 *

Microscopic Organisms *

for use with Activity: Macroinvertebrate Messages?

*** From "MinnAqua" Leader' <http://www.dnr.state.mn.us/minnaqua/index.html#Contactss> Guide, Minnesota DNR 2007**

Wetland Treasure Hunt Bingo Board
for use with Activity: Treasure Hunt?

<p>Plant growing out of the water</p> 	<p>Tracks</p> 	<p>3 wetland sounds, such as frogs calling, birds singing, or water moving</p> 	<p>Plant seeds</p> 	<p>Wind</p> 
<p>Tree or branch a beaver chewed</p> 	<p>Dragonfly</p> 	<p>Snail shell</p> 	<p>Describe the way the wetland smells</p> 	<p>A plant or animal that is already dead</p> 
<p>Mud!</p> 	<p>2 different animal homes</p> 	<p>An insect that grew up in the wetland</p> 	<p>A predator, or evidence (such as tracks or scat) of a predator</p> 	<p>Plant growing totally underwater</p> 
<p>Bird eating insects or fish</p> 	<p>Animal scat!</p> 	<p>Plant floating on the water surface</p> 	<p>An animal with gills</p> 	<p>Eggs - can be fish, snail, frog, bird, etc.</p> 
<p>Water strider</p> 	<p>Fish</p> 	<p>A water boatman, water beetle, or back-swimmer</p> 	<p>A leaf that has been chewed</p> 	<p>A bird flying overhead</p> 

Davis Lake Dilemma Activity Cards
for use with Activity: Davis Lake Dilemma

A.G. "RICK" CULTURE: A representative of the local farmers who are very interested in the plentiful, cheap freshwater that Davis Lake would provide. They could grow more crops for less money, which would make it easier to compete with imported produce.

DAN D. LION: President of "Save Our Native Plants and Wild Animals". He believes that all native animals and plants have value.

B. "BLANKET" BINGO: Beach volleyball and party addict who is excited about getting rid of "those awful swamps around Farmington Bay," and installing some "real" trees and plants that will improve his view and the quality of his parties.

U.NION CRUISE: President of the local AFL-CIO, who insists that this project must be built, and built by union workers, regardless of anything else.

BRIAN SHRIMP: Owner of a brine shrimp harvesting company with annual profits of \$9.9 million, who is concerned that there will be no shrimp in Davis Lake. This would affect his profits.

MINNIE RAL: Representative of a consortium of mineral producers on the lake, who could be put out of business if a freshwater lake is developed.

GOLDEN R. TRIEVER: President of a local duck hunting club, whose preserve would be destroyed by Davis Lake.

ROD N. REEL: Owner of a fishing supply shop and tour guide who makes a lot of money teaching people where and how to catch the "Big Ones."

"SKY" SOARER: President of the local birding club that has been organizing bird watch excursions along the lake shore for the past 75 years.

SAM SLALOM: Power boat owner and speed freak who sees the new lake as a real boon to racing and skiing interests.

CY N. TIST: Respected biologist who is prepared to testify about the potential effects on wildlife if the lake is developed.

O.L. SLICK: Salesman of motor boats, water skis, and other recreational equipment.

BITTER WATERS: Tribal leader who is concerned about the loss of native heritage from the flooding of traditional tribal lands.

E. CONOMY: Local businessperson who is concerned about improving the long-term business potential of the area.

C.D. MINIMUM: Wealthy land developer who has architects working on designs for lakeside homes, condominiums, and resorts.

PAT POTTERY-BRUSHER: Archaeology professor from the University who has done extensive research on the archaeological sites of hunter-gatherer camps along the shore of Farmington Bay.

LYNN DRIPPER: Director of the municipal water department, which is responsible for providing quality drinking water to the growing population of Davis County, even during times of extreme drought.

H.M. OWNER: Representative for all homeowners who have property along the shore of the proposed lake. They are concerned that their property taxes will be raised to pay for the development, and then increase again as property values rise on prime homesites bordering the lake.

BOATER CARTOP: Retired angler who enjoys throwing the boat on top of the car and putting in at the closest body of water.

Golden R. Trierer

Dan D. Lion

Cy N. Tist

Brian Shrimp

A.G. "Rick" Culture

Rod N. Reel

E. Conomy

C.D. Minimum

Boater Cartop

U. Nion Cruise

Minnie Ral

"Sky" Soarer

Sam Slalom

O.L. Slick

Bitter Waters

**Pat Pottery-
Brusher**

H.M Owner

Lynn Dripper

B. "Blanket" Bingo

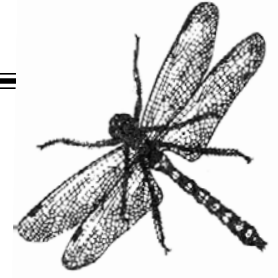
How Did They Live? Comparison Worksheet
for use with Activity: How Did They Live?

How Did They Live? Comparison Worksheet

	<u>Naatse'e</u>	<u>You</u>
Roles of Family Members:		
Mother -		
Father -		
Brother -		
Sister -		
Your Typical Weekday: What do you eat?		
How do you get what you eat?		
Do you work/ have chores?		
What do you play with? How do you entertain yourself?		
Do you spend more time outside or inside?		
What kind of house or shelter do you live in?		
What do you sleep on?		
How do you learn information and skills you need to survive?		

Macroinvertebrate Diversity Activity
for use with Activity: Macroinvertebrate Messages

Macro-diversity!



If you don't have the chance to get out to a wetland, or just if you want your students to learn more about macroinvertebrates and biodiversity before they go to a wetland, this is a good activity to do. It can be done in conjunction with *Macroinvertebrate Messages*. Biodiversity is essentially the "variety of life" in an area. This can be an ecosystem, habitat, or even a larger area, such as a biome! The easiest way of thinking about biodiversity is looking at species diversity. This is not only the number of different species in an area, but also the number of different individuals of each species in an area, for example, the number of dragonflies, number of mayflies, etc. To measure biodiversity, it isn't necessary to count every single individual in an area which would most likely be impossible - most scientists take a sample of species, and use a biodiversity index to determine the biodiversity in an area. When using an index, it is important to remember that this is not an actual number of species, but an index number between 0 and 1 that represents species diversity. When using an index, scientists usually look at a minimum of 2 different areas so they can compare the diversity index between these 2 areas. With the diversity index being between 0 and 1, the lower the number, the less diverse an area is. Therefore scientists often compare healthy versus disturbed habitats - a disturbed habitat will often have a lower diversity index than a healthy area.

For example: A wetland has 5 different species of macroinvertebrates (see Glossary for definition of macroinvertebrate). A scientist scooped for macroinvertebrates with a sampling net, then picked out one invertebrate at a time from the net. Assuming that each invertebrate has an equal chance of being chosen, the results of the sample and identification on the scientist's data sheet looked like this (with each letter representing a different species):

ACEEDDDBBBBCCEAAAAADDDDBB

The scientist picked out 35 invertebrates from the sampling net. To determine the number of changes, or runs in the list, the scientist drew a line above or below each identical letter or letters:

ACEEDDDDBBBBCCEAAAAAADDDDBB

There were 10 changes, or runs, in this sample. To figure out the diversity index (DI), use the following formula:

$$DI = \frac{\text{\#runs}}{\text{Total \# organisms}} \quad \text{Example: } \frac{10}{35} = 0.29$$

At the next wetland, the scientist picked 35 invertebrates out of another sampling net. This time there were 22 changes, or runs. 22 divided by 35 = 0.63, which is a higher diversity index than the first sample. The scientist might then conclude that the second wetland is more diverse, and possibly therefore a healthier habitat than the first wetland.

To be more scientifically accurate, however, the scientist would probably take 3 samples from each wetland, and average the diversity indices for each wetland. This would be necessary because the scientist probably would not get the same diversity index every time.

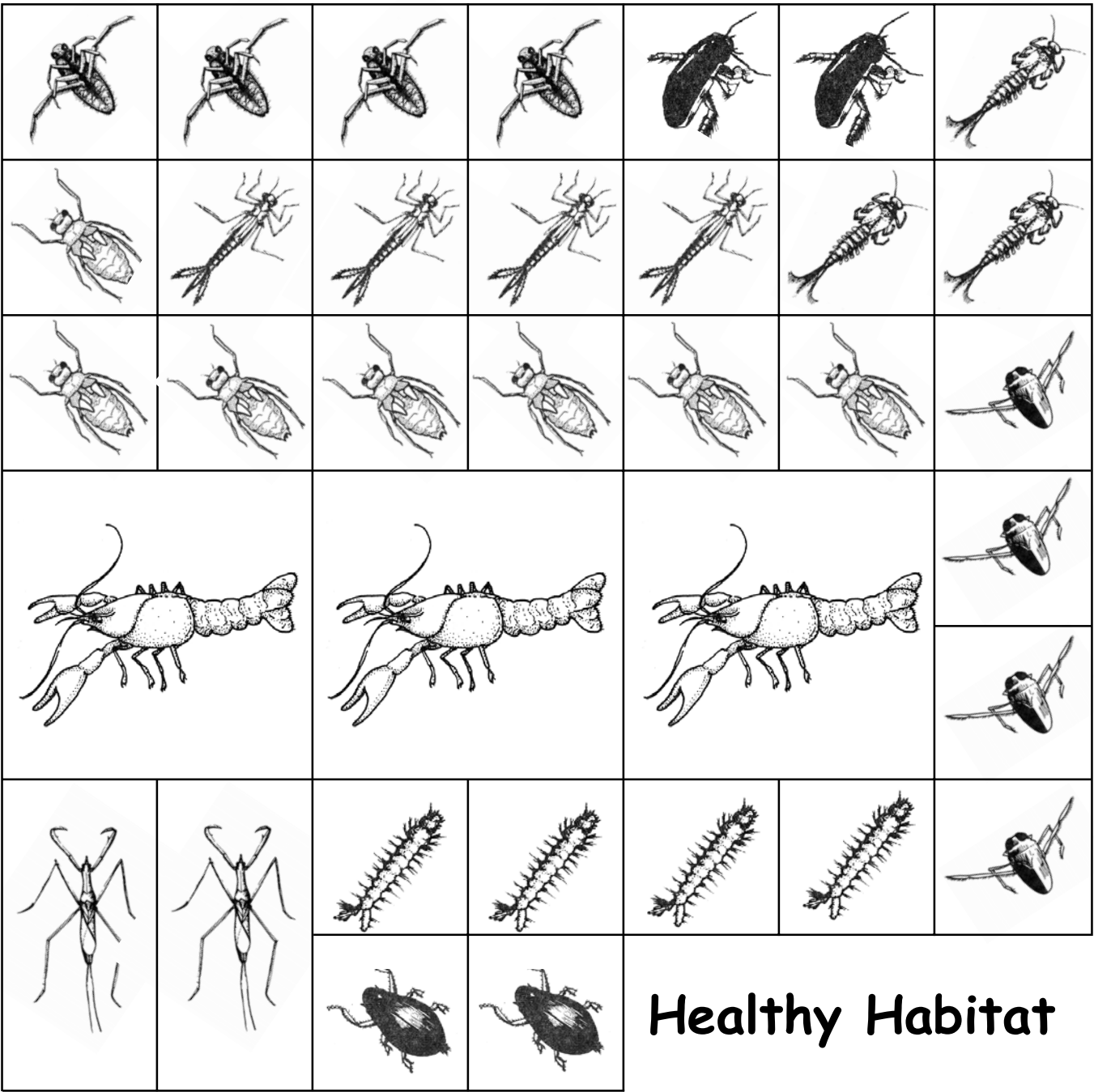


Materials:

- 1 paper bag per group of 2 students
 - Copies of pictures of macroinvertebrates, cut apart and placed into a paper bag as follows:
 - healthy habitat - 4 backswimmers, 2 predaceous diving beetles, 3 mayfly nymphs, 4 damselfly nymphs, 7 dragonfly nymphs, 4 water boatmen, 3 crayfish, 4 mosquito larvae, 2 water scorpions and 2 whirligig beetles
 - disturbed habitat - 10 pond snails, 4 mosquito larvae, 8 scuds, 5 leeches, 5 dobson fly larvae, 3 midgefly larvae
 - Blank paper to use as data sheet (1 per group)
 - Pencils
-

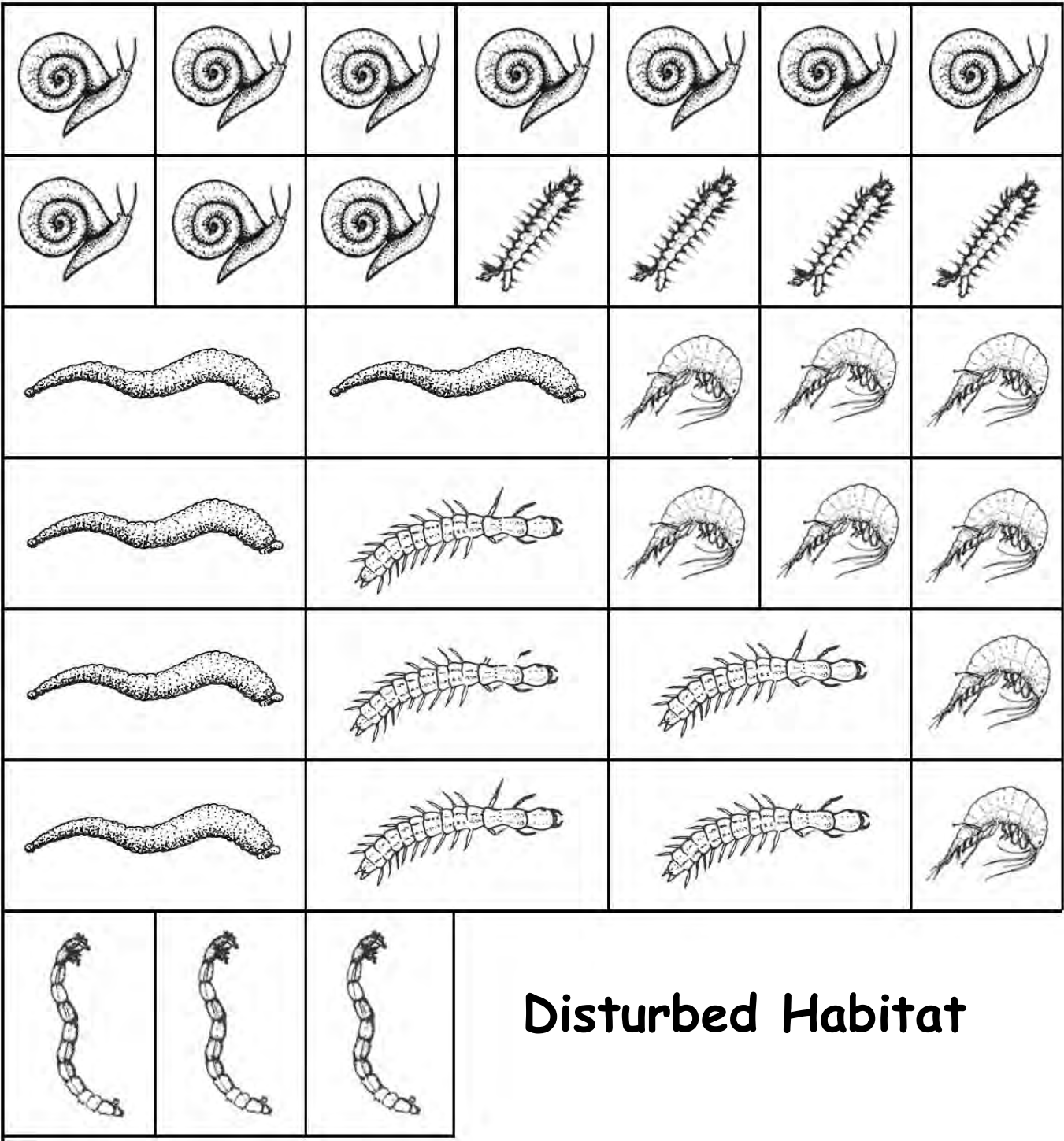
Procedure:

- 1) Teacher: prepare one bag of invertebrates for each group of 2 or 3 students in your class. Make an even number of healthy and disturbed wetland bags. Write either H or D on the outside of the bag, depending on whether it contains invertebrate pictures from a healthy or disturbed wetland.
 - 2) Explain the background information to your students and do a related demonstration. Put your students into groups of 2 or 3 and hand out one wetland invertebrate bag per group. Make sure that approximately half the class has a disturbed wetland bag and half has a healthy wetland bag. Instruct your students to assign one person as a recorder and another person as a chooser.
 - 3) Ask the choosers to pull out one invertebrate picture at a time from the bag without looking in the bag. The recorders should then record the invertebrates in the correct order that they were chosen, as shown in the example. The names for the invertebrates are on the back of each picture. They may use letter representations such as WB for whirligig beetle if they wish.
 - 4) After choosing every invertebrate in the bag (there should be a total of 35 in each bag), have your students follow the procedure in the example to determine the diversity index (DI) for their bag of invertebrates - determine the number of changes, or runs, then use the DI formula of dividing # runs by the total # organisms. Have them do this entire procedure (steps 2-4) 2 more times, switching between recorders and choosers. They will probably calculate a different DI each time. Then have them add up each DI and divide by 3 to average the indices, finally getting the most accurate DI.
 - 5) Make a list of each averaged DI on the board in front of the class. Ask the class what they think happened - why are there different numbers? What do these different numbers mean? Guide them in answering these questions by using the initial example given. Explain that healthier habitats usually will have higher species diversity than disturbed habitats.
-



Healthy Habitat

Mayfly Nymph	Predaceous Diving Beetle	Predaceous Diving Beetle	Backswimmer	Backswimmer	Backswimmer	Backswimmer
Mayfly Nymph	Mayfly Nymph	Damselfly Nymph	Damselfly Nymph	Damselfly Nymph	Damselfly Nymph	Dragonfly Nymph
Water Boatman	Dragonfly Nymph	Dragonfly Nymph	Dragonfly Nymph	Dragonfly Nymph	Dragonfly Nymph	Dragonfly Nymph
Water Boatman	Crayfish		Crayfish		Crayfish	
Water Boatman						
Water Boatman	Mosquito Larva	Mosquito Larva	Mosquito Larva	Mosquito Larva	Water Scorpion	Water Scorpion
			Whirligig Beetle	Whirligig Beetle		



Pond Snail	Pond Snail	Pond Snail	Pond Snail	Pond Snail	Pond Snail	Pond Snail
Mosquito Larva	Mosquito Larva	Mosquito Larva	Mosquito Larva	Pond Snail	Pond Snail	Pond Snail
Scud	Scud	Scud	Leech		Leech	
Scud	Scud	Scud	Dobsonfly Larva		Leech	
Scud	Dobsonfly Larva		Dobsonfly Larva		Leech	
Scud	Dobsonfly Larva		Dobsonfly Larva		Leech	
				Midgefly Larva	Midgefly Larva	Midgefly Larva

Wetland Plant Adaptations Information Sheet

Plant Environment Cards

Criteria for Drawing and Presentation

Prefixes and Suffixes List for Naming Purposes

Plant Identification Terms

Some Wetland Plants Color Pictures

for use with Activity: Plants and Their Watery World

Wetland Plant Adaptations

Adaptation	Advantage	Examples
submerged plants:		
thin skin	to absorb nutrients from water	milfoil, pondweed
flexible stems	will bend. not break	most wetland plants
finely cut leaves	to increase surface area for absorbing sunlight to photosynthesize	milfoil, elodea
floating plants:		
air bladders	for floating (no roots)	bladderwort
digestive juices	to eat insects for nutrients	bladderwort
hanging roots	to absorb nutrients	duckweed
rooted plants:		
large, floating leaves	to reach sunlight to photosynthesize	lilies
stomata on leaf's upper surface	to allow gas exchange	lilies
flowers smell,	to attract insects to pollinate	yellow water lily
emergent plants:		
spongy stem	to transport gases	cattails
large breathing pores	to exchange gases	willows
air filled roots	get gases from upper plant	willows
roots in air	to get oxygen	mangroves ¹
buttress roots	to get oxygen	cypress
gas-transporting tissues	to transport oxygen and carbon dioxide	cordgrass
rot-resistant wood	to prevent decay	cedar, cypress
tall, narrow plants with no branches, long leaves	to reduce resistance to water so leaves won't break in water	cattails, reeds, rushes, bulrushes, sedges
flowers small, up high	keep out of water	sedges, reeds, rushes
long, creeping rhizomes	to anchor plant in soft soil	reeds, rushes, bulrushes
buds on rhizomes,	to reproduce quickly and form dense colonies	reeds, rushes, sedges bulrushes

1. Not necessarily a wetland adaptation

2. Found in subtropical area such as in the Florida Everglades, Belize, and Mexico

Adaptation	Advantage	Examples
salt-tolerant plants:		
gummy, hairy, waxy skin	to prevent salt absorption	gunweed, pickleweed, cinquefoil, sea thrift
holds water in cells	to maintain water supply	pickleweed
oxygen-rich layer around roots	to obtain oxygen	cordgrass (tiny organisms live there!)
exudes salt crystals	to rid of excess salt	saltgrass
salt drops on tips of leaves	to rid of excess salt	pickleweed
large, hardy seeds	to maintain salt balance in cells; to keep salt water from flowing in	pickleweed
low, sprawling form	to reduce water loss from wind exposure	pickleweed, jaumea
small flowers, parasitic,	uses little energy to obtain nutrients from other plants	sedges, rushes, bulrushes salt marsh dodder
bog plants:		
sticky, sweet smelling	to attract insects for nutrients	sundew, pitcher plant
leaves upright,	to reduce surface area for drying out from exposure to the sun	Labrador tea, cranberry
thick, fuzzy, rolled leaves,	to prevent water loss from evapotranspiration	Labrador tea
live symbiotically with fungi,	to obtain nutrients	orchids, heath plants

1. Not necessarily a wetland adaptation

Lives underwater in
a pond.

Lives along a
swiftly moving
stream.

Lives along edge of
a freshwater
marsh.

Floats on the
surface of a pond.

Lives along the
edge of the Great
Salt Lake (in water
that is salty).

Lives in high
elevation
mountain bog.

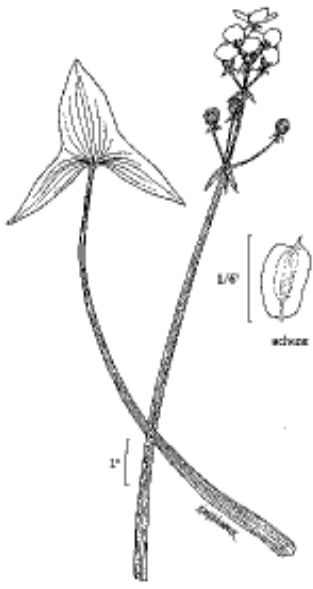
Criteria to include in Plant Drawing and Presentation:

1. Where specifically does your plant live in its environment?
2. Describe its physical features that aid in survival e.g. coloration, shape, size, defense structures.
3. How does your plant obtain oxygen?
4. How does your plant reproduce? What is the appearance of its seeds and how do they disperse?
5. Does your plant stand upright in soil? If so, what physical features allow your plant to do this in soft wetland soil?
6. If your plant lives in a salty environment, how does it get rid of salt, or prevent itself from taking up salt in the first place?
7. If your plant floats, what physical features allow it to float on top of water?
8. Give your plant a scientific (Genus and species) and common name, and write them on your paper.
9. Be creative, but be sure that your plant's adaptations actually provide a survival benefit.

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Latin Plant Roots, Prefixes & Suffixes



Binomial Nomenclature Rules:

1. Both terms are always underlined or written in italics
Genus (capitalized) species (lower case)
2. The pair of terms used in a scientific name is unique.
Genus - is common to all members of the genus
species - can be used with many genus names
3. Word parts are often used to write names which help describe the organism

aer- referring to the air (aeranthos = air flower)

aestiv- referring to summer (aestivus)

alpin- referring to alpine regions (alpinus)

anemo- referring to wind (*Anemone* = wind flower)

antiqu- ancient (antiquorus / antiquus)

apert- open, uncovered, bare (apertus)

aqu- referring to water (habitat) (aquatica / aquatilis / aqueus)

archont- majestic, noble (*Archontophoenix* = majestic (date) palm)

arist- referring to a beard (hairy, bristly) (aristatus / aristosus)

arom- referring to odor (aromatica)

arund- referring to a reed (*Arundinaria*, the giant native reed) (arundinaceus)

asper- rough (aspera / asperata / asper / aspericaulis = rough-stemmed)

astr- referring to a star (*Astrocaryum*, star-nut)

avi- referring to a bird, birdlike (avium / aviculare)

azur- referring to the color blue (azureum)

bombyc- referring to silk (bombycina)

bon- good (bonus / bona-nox = good/beautiful night)

brachy- short, squat (brachypodium = short foot)

brun- brown (brunneus)

calam- referring to a reed (calamifolia / calamus)

calceol- referring to slipper (shape) (calceolatus)

canal- referring to lines, grooves (canaliculatus)

-card(...) referring to a heart (*Anacardium*, the cashew genus-heart-shaped fruit)

caud- referring to a tail (caudatus)

caul- referring to a stem (cauliflorus = bearing flowers on the stem / caulescens)

cernu- bending, drooping (cernuus)

chit- referring to a covering, a cloak (*Rhodochiton* = rosy covering)

-cid(...) referring to the act (or art) of killing (*Piscidea* = fish + kill, the Fish Poison Tree)

coron- referring to a crown (coronata coronaria)

-cotyl(...) referring to a cup

crypt- hidden, not obvious (cryptanthus = hidden flower)

cyn- referring to a dog (*Cynoglossum* = dog's tongue)

dactyl- referring to a finger (*Phoenix dactylifera*, the date palm, = finger-bearing,

decip- drooping, deceptive, falling (decipiens)

delect- chosen, desirable, tasty (delectus)

denud- naked (denudatus)

-derm(...) referring to skin, therefore bark (leucodermis = white- bark)

diurn- referring to daytime (diurnum)

-dor(...) referring to a gift (*Haemodorum* = blood gift)

echin- referring to a bristle, prickle, spine (hedgehog) (Echino- cereus, a cactus genus)

edul- edible (edulis)

elepha- referring to an elephant (*Phytelephas* = Elephant Plant)

-ensis native to (canadensis)

entom- referring to insects (entomophilus = insect-loving)

eros- jagged (erosus)

fero- ferocious (Ferocactus = ferociously-spined cactus) (ferox is the Lat. adjective)

fistul- hollow tubelike (fistularis / fistulosa)

flabell- fan-like (flabelliformis = formed like a fan)

flagell- referring to a whip (flagelliforma)

-frag(...) referring to a break or rupture (rupifragum = rock- breaker)

frigid- referring to cold regions (frigida)

geo- referring to the earth, the ground (geoides)

gig- referring to giants or immensity (gigantea)

glut- referring to glue (glutinosa)

glyc- sweet (in taste) (*Glycyrrhiza*, the licorice plant, = sweet root)











gracil- graceful, slender (*gracilis* / *gracilipes* = slender + foot / stalk)
hal- referring to salt (*halodendron* = salt + tree)
haplo- referring to the number one (*haplophylla* = one-leaved)
heli- referring to the sun (*Helianthus* = sun flower)
hibern- referring to winter (*hibernalis*) OR Ireland (*hibernicus*)
hydr- referring to water (*Hydrocotyle* = water cup)
ign- referring to fire (color) (*igneus*)
illic- referring to fragrance/seduction (*Illicium*)
infest- unsafe (*infesta*)
junc- referring to a reed
lact- referring to milk (*lactiflorus* = milk-colored flowers)
lacun- referring to a hole or pit (*lacunosa*)
lacustr- referring to a lake (*lacustris*)
lept- thin, slender (*Leptocodon* = slender bell)
limn- / lim- referring to mud or marshes (*Limodorum* = marsh gift) **luna-** referring to the moon (usually in crescent shape)
lyc- referring to a wolf (*Lycopersicum* = wolf-peach - the tomato; the derivation is probably due to the fact that the fruit was once considered poisonous)
mel- / mell- referring to honey (*melliodora* = honey-scented) (*Melianthus* = honey flower)
merid- referring to noon (*meridionalis* = mid-day bloomer)
mirab- wonderful (*Mirabilis*, the Four-O'Clock genus)
mont- referring to a mountain (*montanus*)
mosch- referring to musk (odor) (*Moschosma* = musk-like odor / *moschata*)
nat- floating, swimming (*natans*)
neva- referring to mts., Nevada, Sierra Nevada (*nevadensis*)
noct- referring to the night (*nocturnum*)
nub- referring to a cloud (*nubicola*)
obes- fat (*obesus*)
ole- referring to oil (olive) (*oleifera* = oil-bearing)
ornith- referring to a bird (*Ornithocephalus* = bird's head) (*ornithorhyncum* = bird + snout/beak)
ovi- referring to an egg (shape) (*ovifera* = egg-bearing)
palm- referring to a hand, a palm (usually leaf-shape) (*palmata*)
palustr- referring to a swamp, marsh (*palustris*)

papil- referring to a butterfly (*papilionaceus* = like the pea-family whose individual flowers are somewhat similar in form to a butterfly)
-phil(...) loving, desirous of (*anemophilus* = wind-loving)
-potam(...) referring to a river (*megapotamicum* = large river)
praten- referring to a meadow (*pratensis*)
probosc- referring to a nose (*proboscidea*)
ran- referring to a frog (*Ranunculus* = little frog, because most of the species grow where frogs live, i.e., marshes, ponds)
rep- creeping (*repens reptans repanda*)
ripa- referring to the banks of a river (*riparia*)
rivu- / riva- referring to rivers, streams (*rivularis* / *rivale* / *rivalis*)
sal- referring to salt (*salinus* / *salicolus*)
sapid- tasty (*sapidus*)
semper- always (*sempervirens* = evergreen / *Sempervivum* = living for ever)
silic- referring to sand (*siliceus*)
solar- referring to the sun (*solaris*)
-steph(...) referring to a crown (*macrostephana* = large crown)
-stom(...) referring to a mouth
tard- late (*tardiflora* = late-flowering)
terr- referring to (the) earth (*terrestris*)
toxi- referring to a poison (*Toxicodendron* = poison tree)
tremul- trembling, (*tremuloides*)
umbrac- referring to an umbrella (shade) (*umbraculifera* = umbrella-bearing)
-ur(...) referring to a tail (*Leonurus* = lion's tail)
vagans- wandering, erratic
velut- velvety (*velutina*)
visc- sticky (*Malvaviscus* = sticky mallow) (*viscaria*)
xer- dry (*xerocarpa* = dry-fruited) (*Xeranthemum* = dry flower)
xiph- referring to a sword (*xiphioides*)
xyl- referring to wood (*Xylobium* = wood + life, referring to the epiphytic habit of these orchids)
zona- referring to a zone, a band (color/shape) (*zonatus* / *zonale*)
zyg- united (*Zygopetalum* = united petals, an orchid) (*Zygadenus* = united (paired) glands)

Plant Identification Terms

In order to identify plants, there are some terms you should know to help describe characteristics of plants:

Leaves can be arranged on the stem in different ways:

 Opposite	 Alternate	 Whorled	 Simple	 Lanced-Shaped
 Round	 Oval	 Toothed	 Compound	 Hairy

Native and non-native(*) plants found in Utah wetlands

Woody plants (trees and shrubs)

alder
 aspen
 box elder
 cottonwoods
 dogwood
 river birch
 Russian olive*
 tamarisk*
 willows

Non-woody plants

alkali grass	monkshood
arrowgrass, bistort	pickleweed
bluebells	pondweed
blue vervain	reeds
bog orchid	rushes
bulrush	salt grass
buttercup	sea blight
cattail	sedges
common reed (<i>Phragmites</i>)	skunk cabbage
duckweed	small burreed
elephanthead lousewort	tufted hairgrass
hornwort	twinberry
manna grass	vetch
marsh marigold	watercress*
milkweed	wild iris
mint	

Wetland Plant Life Identification

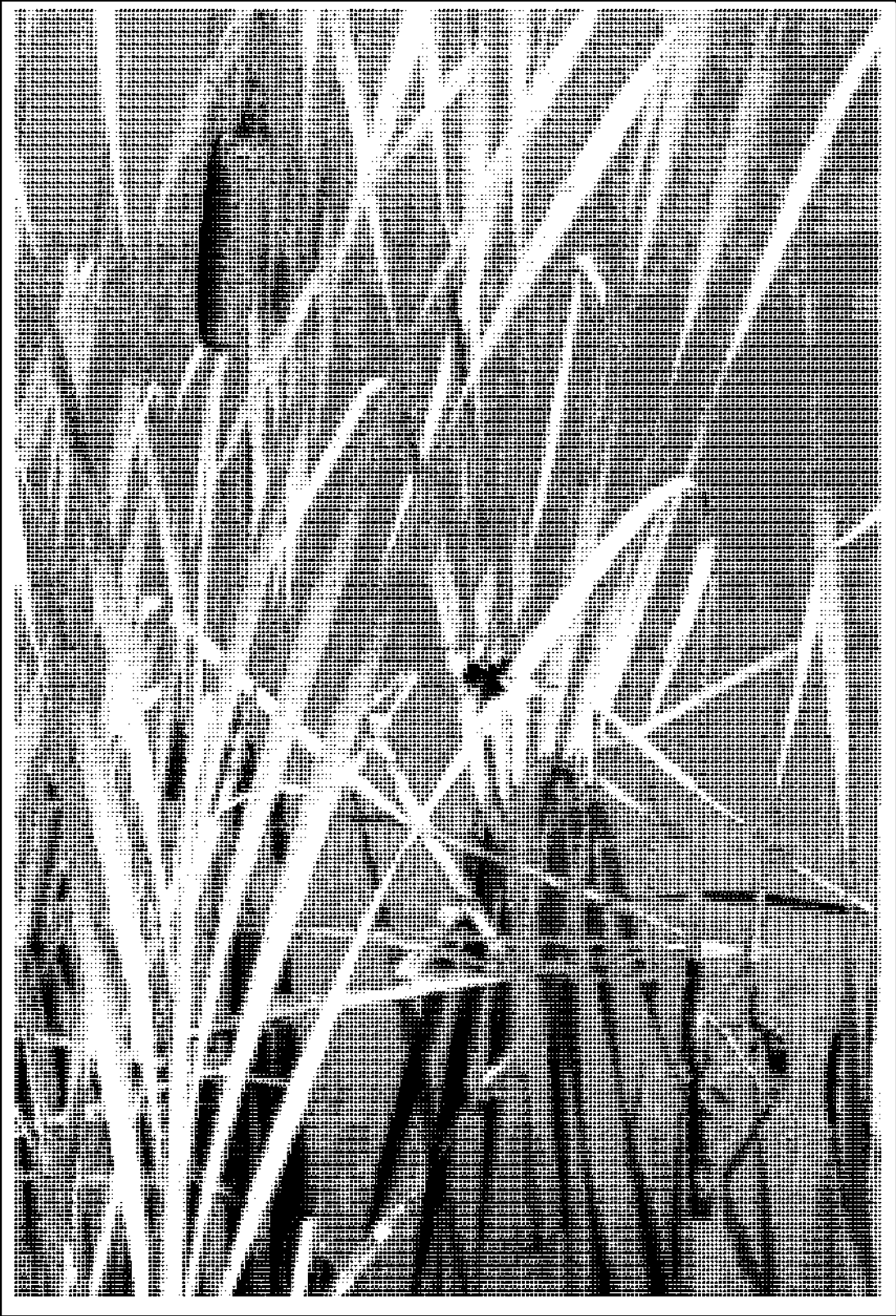
Part A: Identifying your plant

1. Go to <http://www.npwrc.usgs.gov/resource/plants/florawe/index.htm> and use the online wetland plant identification key at the bottom of the page to identify your plant.
2. The key works just like any other classification key, where you are asked a question, and then your answer determines where you should go next.
3. The key may use difficult vocabulary, so use the illustrated "plant identification terms" on the next page to understand words you don't know. If the word you are looking for is not pictured, **keep reading until the end of the sentence**, it may become obvious what they are looking for. Some of the questions refer to flowers or reproductive parts that you may not have collected. If this is the case, you will have to follow both branches of the key just to make sure.
4. You will eventually end up in a plant group (1-8), where you will have to click on each of the links for a picture of the plant. Look through the links in that group until you find one that looks very similar to your plant.
5. Once you find a plant species that looks just like your sample, check to make sure it is on the list of "Native and non-native plants found in Utah wetlands" (next page). Once you have done this you can move on to Part B. If you can't find your plant on the key, go to step 6.
6. Go to <http://www.earth.utah.edu/west/k12/Biology/Slide1.jpg/>. Use this key just like the last one to identify your plant. If you find the name of your plant go to Part B so you can look at a picture and make sure. If you still can't find your plant, go to step 7.
7. Try going to <http://www.earth.utah.edu/west/k12/Biology/plants/> . This page contains pictures of some common Utah wetland plants that you can browse through. If you find your plant this way, go to Part B. If not, move on to step 8.
8. If none of this works for you, try using a plant reference book such as Audubon's "Trees" or "Wildflower" books to identify your sample. However, if you have reached this point it's possible your sample is not a wetland plant and it may need to be removed. Whether or not you find your plant in a reference book, you should take a digital photo of it and include this photo with your wetland proposal so that an expert can identify it and determine if it needs to be removed.

Part B: Making sure your plant is a wetland native

1. After you have identified your plant, go to <http://plants.usda.gov/> so you can look at a photo of it and make sure it is not a weed or non-native plant. To do this, enter the common or scientific name in the "Search" section of the web page (upper left corner). **Make sure the option directly below your entry matches!** For example, if you entered a common name, you must change this entry to "common name."
2. After you click "Search", scroll down until you see your plant species name, and click on it. This page will have pictures that you can compare to your plant. If you have the right species, scroll down towards the bottom of the page and look for the headings "noxious weed information" or "invasive information". If you have these sections, your plant may need to be removed from the wetland.

CATTAIL, Emergent Plant



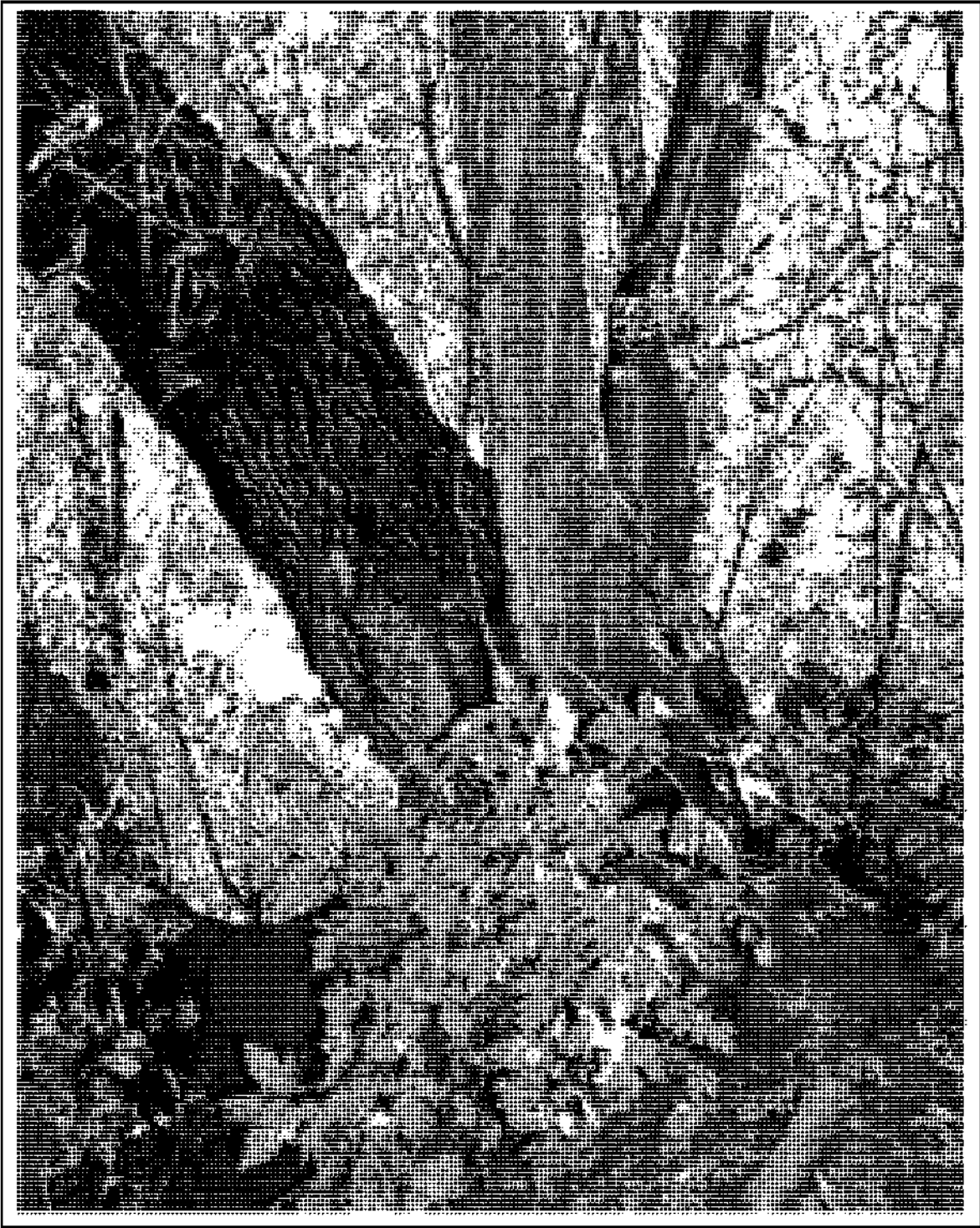
NORTHERN ARROWHEAD, Emergent Plant



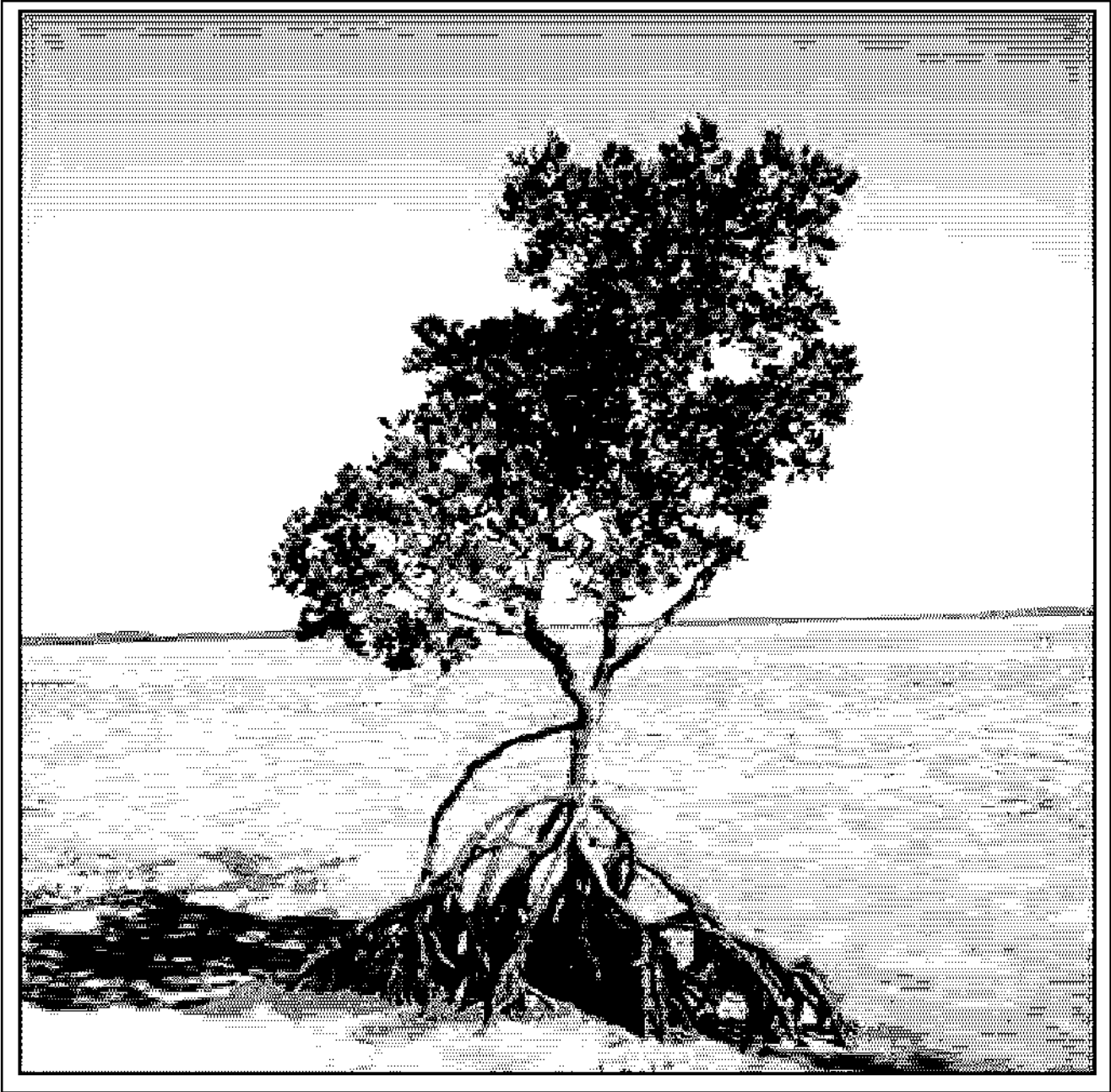
SALT GRASS, Salt-tolerant Plant



BOX ELDER TREE, Maple Family, Riverine Tree



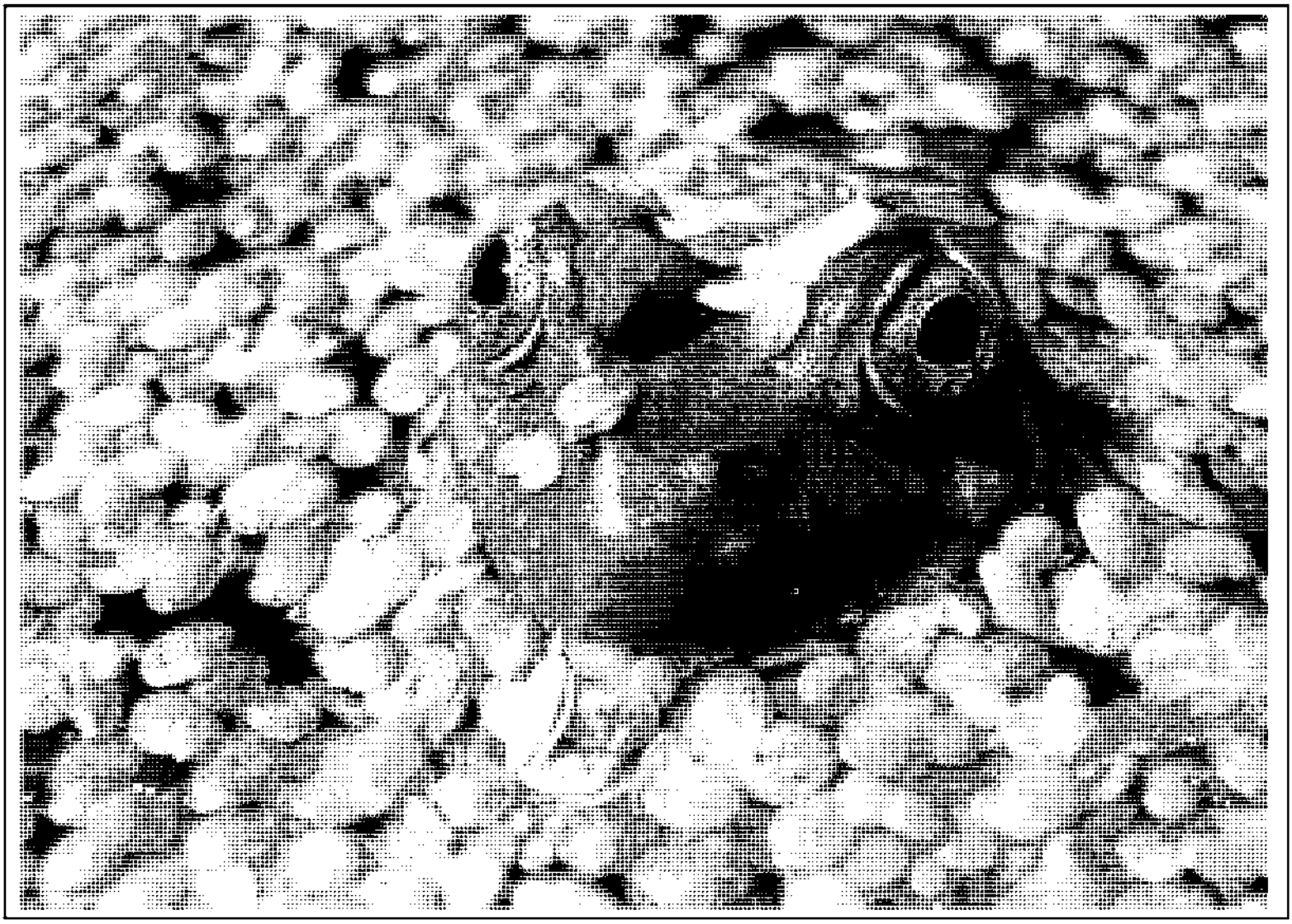
MANGROVE, Emergent, Tree



SAGO PONDWEED, Submerged Plant



DUCKWEED, Floating Plant, and Columbia Spotted Frog



WATER LILIES, Rooted Plant



CRANBERRY, Bog Plant

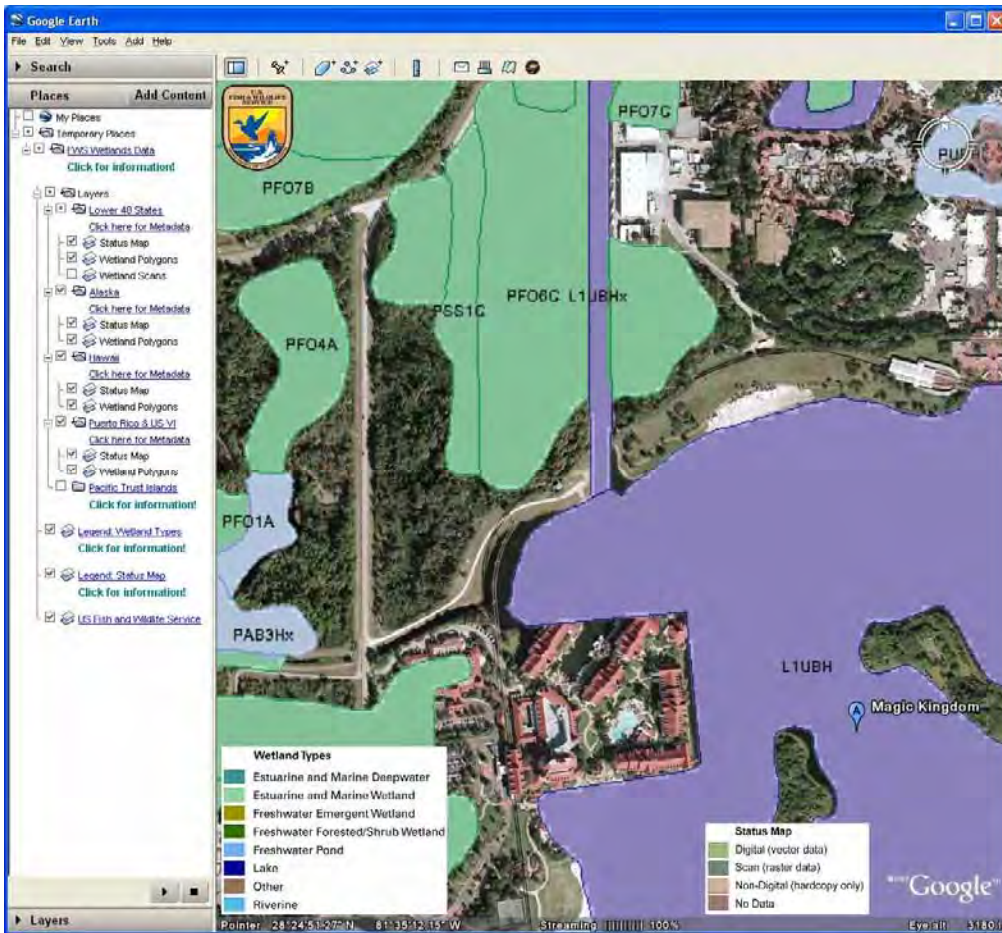


Viewing Wetlands with Google Earth

for use with Activity: Where are the Wetlands?



U.S. Fish And Wildlife Service Viewing Wetlands with Google™ Earth¹



A Keyhole Markup Language file has been created to view Wetlands Data with Google Earth². To ensure that you use the latest version, it is recommended that you load the file and open Google Earth by starting your internet browser and navigating to the following HTML link:

<http://www.fws.gov/wetlands/data/GoogleEarth.html>

Once you navigate to the previously mentioned web page, select the link:

WetlandsData.KMZ

Google Earth maps the surface of the Earth by superimposing images from satellites and aerial photography. Most land areas, except for islands, are shown using satellite imagery with a resolution of about 15 meters per pixel or better. In this application, Google Earth imagery can be used as a backdrop for viewing the wetlands digital data.

If Google Earth fails to launch automatically, the file can also be used by first launching the Google Earth application. Select the menu option File, Open, and then locate the previously downloaded file (WetlandsData.KMZ); then click the Open button.

Notes:

- Double click any layer title to zoom into its area.
- Click on any layer or legend checkbox to view or hide it.
- The Lower 48 States Wetland Scans layer is hidden by default. To view the image layer, first zoom into an area that has Wetland Scans information, then turn on the layer.
- Important: Do not leave the Wetland Scans layer on (checked) while viewing areas that do not have scanned data. A large red X will appear if you do so.
- To remove the Wetlands KMZ file from Google Earth, right-click on the FWS Wetlands Data folder located under Places (Google Earth left panel), then select **Delete**.
- Please visit our Map Creation and Mapper Display web page (<http://www.fws.gov/wetlands/data/MapperTips.html>) for more tips and technical information.



- This data is available through an OGC compliant Web Map Service³.



Digital data available on this source represent the latest, most accurate information available from the U.S. Fish and Wildlife Service. These data are also available on The National Map (<http://nationalmap.gov/>).

U.S. Fish and Wildlife Service

800/344-WILD

<http://www.fws.gov>

November 2008



¹ The use of trade, product, industry or firm names or products is for informative purposes only and does not constitute an endorsement by the U.S. Government or the Fish and Wildlife Service. Links to non-Service Web sites do not imply any official U.S. Fish and Wildlife Service endorsement of the opinions or ideas expressed therein or guarantee the validity of the information provided. Base cartographic information used as part of the Wetlands Mapper has been provided through a collaborative effort with the U.S. Geological Survey and The National Map.

² Please note that Google Earth version 4.2, or higher, is required to run this script.

³ Follow this link for more information about Web Map Service:

<http://www.fws.gov/wetlands/data/WebMapServices.html>

EPA Wetlands Fact Sheets



Wetlands Overview

What Is a Wetland?

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—making these areas very important features of a watershed. Using a watershed-based approach to wetland protection ensures that the whole system, including land, air, and water resources, is protected.



Wetlands found in the United States fall into four general categories—marshes, swamps, bogs, and fens. Marshes are wetlands dominated by soft-stemmed vegetation, while swamps have mostly woody plants. 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. Fens are freshwater peat-forming wetlands covered mostly by grasses, sedges, reeds, and wildflowers.

Good News

Often called “nurseries of life,” wetlands provide habitat for thousands of species of both aquatic and terrestrial plants and animals.

These nurseries support the critical developmental stages for many plants and animals. Although wetlands are best known for being home to water lilies, turtles, frogs, snakes, alligators, and crocodiles, they also provide important habitat for waterfowl, fish, and mammals. Migrating birds use wetlands to rest and feed during their cross-continental journeys and as nesting sites when they are at home. As a result, wetland loss has a serious impact on these species. Habitat degradation since the 1970s has been a leading cause of species extinction.

Two-thirds of the 10 million to 12 million waterfowl of the continental United States

reproduce in the prairie pothole wetlands of the Midwest, and in the winter millions of ducks like these can be found in the wetlands of the south-central United States.



Dave Davis

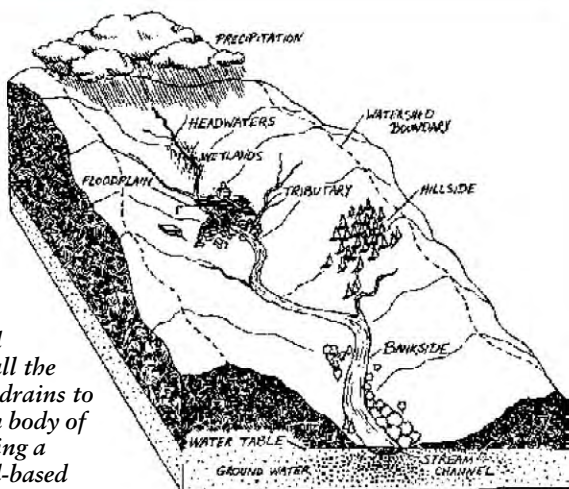
This forested wetland on the Chincoteague National Wildlife Refuge on Virginia’s Eastern Shore is part of the Atlantic flyway, where shorebirds and waterfowl rest before they migrate south for the winter.

Dave Davis



Is there a wetland in your neighborhood?

The best way to find out if there’s a wetland in your watershed or neighborhood is to contact your Natural Resources Conservation Service office or local public works or planning department. Most have specialists trained in identifying and delineating wetlands. The U.S. Fish and Wildlife Service’s National Wetland Inventory maps can also help. The maps indicate open water and likely wetland areas. For copies, call 1-888-ASK-USGS or visit the National Wetlands Inventory web site at www.nwi.fws.gov.



A watershed includes all the land that drains to a common body of water. Using a watershed-based approach to wetland protection ensures that the whole ecosystem is protected.



A freshwater pool at Assateague National Seashore in Virginia.

Living systems cleanse water and make it fit, among other things, for human consumption.

Elliot A. Norse, in R.J. Hoage, ed., *Animal Extinctions*, 1985

The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased, and not impaired, in value.

—Theodore Roosevelt, 1907

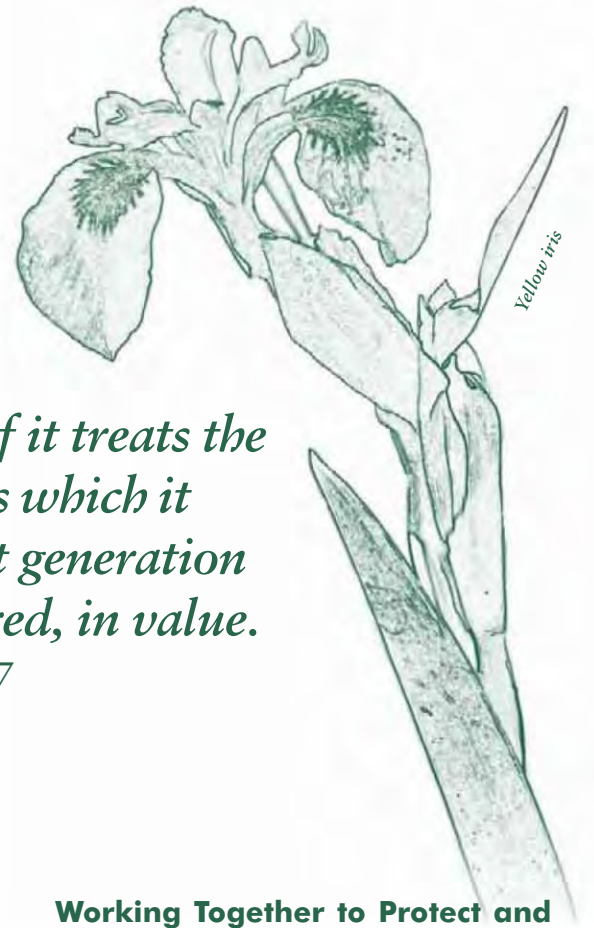
Wetlands do more than provide habitat for plants and animals in the watershed. When rivers overflow, wetlands help to absorb and slow floodwaters. This ability to control floods can significantly prevent property damage and loss and can even save lives. Wetlands also absorb excess nutrients, sediment, and other pollutants before they reach rivers, lakes, and other waterbodies. They are great spots for fishing, canoeing, hiking, and bird-watching, and they make wonderful outdoor classrooms for people of all ages.

Bad News

Despite all the benefits provided by wetlands, the United States loses about 60,000 acres of wetlands each year. The very runoff that wetlands help to clean can overload and contaminate these fragile ecosystems. In addition, nonnative species of plants and animals and global warming contribute to wetland loss and degradation.

What Is EPA Doing to Protect Wetlands?

EPA has a number of programs for wetland conservation, restoration, and monitoring. EPA, along with the U.S. Army Corps of Engineers (Corps), establishes environmental standards for reviewing permits for discharges that affect wetlands, such as residential development, roads, and levees. Under Section 404 of the Clean Water Act, the Corps issues permits that meet environmental standards (after allowing the public to comment).



Working Together to Protect and Restore Wetlands

In addition to providing regulatory protection for wetlands, EPA works in partnership with states, tribes, and local governments, the private sector, and citizen organizations to monitor, protect, and restore these valuable habitats. EPA is helping states and tribes incorporate wetland monitoring, protection, and restoration into their watershed plans. EPA is also working to develop national guidance on wetland restoration, as well as constructed wetlands used to treat storm water and sewage. Nationally, EPA's Five-Star Restoration Program provides grants and promotes information exchange through community-based education and restoration projects.

EPA works with a variety of other federal agencies to protect and restore wetlands, including the U.S. Fish and Wildlife Service, the U.S. Department of Agriculture, and the National Marine Fisheries Service. EPA is working with these agencies and others to achieve a net increase of 100,000 acres of wetlands each year by 2005. EPA also partners with private interests and public organizations like the Association of State Wetland Managers, the National Association of Counties, the Izaak Walton League, local watershed associations, schools, and universities to advance conservation and restoration programs.

How Can I Help?

You can do many things to help protect wetlands in your area. First, identify your watershed and find the wetlands in your neighborhood. Learn more about them and share what you learn with someone you know! Encourage neighbors, developers, and state and local governments to protect the functions and values of wetlands in your watershed.

To prevent wetland loss or degradation, follow these simple guidelines:

- Invest in wetlands by buying duck stamps. Proceeds from these \$15 migratory bird hunting stamps support wetland acquisition and restoration. The stamps are available on-line at the U.S. Fish and Wildlife Service's web site (www.fws.gov) or at your local post office.
- Rather than draining or filling wetlands, find more compatible uses that would not damage the wetlands, such as waterfowl and wildlife habitat.
- When developing your landscaping plan, keep wetlands in mind. Plant native grasses or forested buffer strips along wetlands on your property to protect water quality.
- "Get into" your wetland by participating in a volunteer monitoring program.
- Plan to avoid wetlands when developing or improving a site. Get technical assistance from your state environmental agency before you alter a wetland.
- Maintain wetlands and adjacent buffer strips as open space.
- Support your local watershed association.
- Plan a wetland program or invite a wetland expert to speak at your school, club, youth group, or professional organization.
- Build a wetland in your backyard. Learn how by visiting the U.S. Department of Agriculture's web site at www.nrcs.usda.gov/feature/backyard.



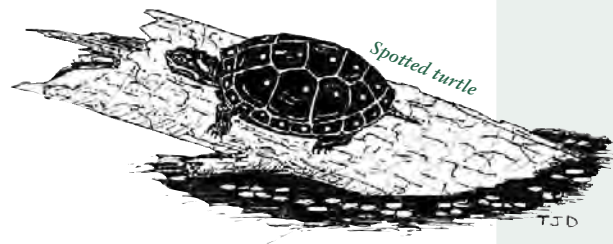
Dave Davis

Wetland habitat along this Idaho riparian corridor provides food and shelter for many different wildlife species.



Dave Davis

If bottomland hardwood swamps are protected, Bald Cypress trees like these can grow for more than 2000 years.



Wetlands can be found in every county and climatic zone in the United States.

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American Avocet



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For more information, visit www.epa.gov/owow/wetlands.

Wetland Resources

On the Internet

EPA's Wetland Home Page	www.epa.gov/owow/wetlands
USDA's Wetland Reserve Program	www.nrcs.usda.gov/programs/wrp
The Association of State Wetland Managers	www.aswm.org
National Marine Fisheries Service Restoration Center	www.nmfs.noaa.gov/habitat/restoration
USDA NRCS's Wetland Science Institute	www.pwrc.usgs.gov/WLI
National Wetlands Inventory Center	www.nwi.fws.gov
Izaak Walton League.....	www.iwla.org

In Print

America's Wetlands: Our vital link between land and water. Available or on the Internet at www.epa.gov/owow/wetlands/vital/toc.html.

Our National Wetland Heritage: A Protection Guide, Jon Kusler and Teresa Opheim. Available from the Association of State Wetland Managers. Call (518) 872-1804 or visit www.aswm.org.

Wetlands, 3rd edition, William J. Mitsch and James G. Gosselink. Available from the Association of State Wetland Managers. Call (518) 872-1804 or visit www.aswm.org.

History of Wetlands in the Conterminous United States: National Water Summary on Wetland Resources, U.S. Geological Survey Water Supply Paper 2425. Available from the U.S. Fish and Wildlife Service at wetlands.fws.gov/bha or from the U.S. Geological Survey at water.usgs.gov/nwsum/WSP2425/history.html.

National Wetlands Status and Trends Study and Report for the Year 2000. Available from the U.S. Fish and Wildlife Service at wetlands.fws.gov/bha.

Recognizing Wetlands. Available from the U.S. Army Corps of Engineers at www.wes.army.mil/el/wetlands.

The Wetlands Assistance Guide for Landowners. Available from the Texas Parks and Wildlife Department at www.tpwd.state.tx.us/conserves/wetlands/wetintro.htm. For a printed copy, contact Julie Anderson, State Wetlands Planner, Resource Protection Division, Texas Parks and Wildlife Department, 4200 Smith School Road, Austin, TX 78744; call (512) 389-4328, fax (512) 389-8059, or e-mail julie.anderson@tpwd.state.tx.us.



Functions and Values of Wetlands

Dave Davis



Wetlands are considered valuable because they clean the water, recharge water supplies, reduce flood risks, and provide fish and wildlife habitat. In addition, wetlands provide recreational opportunities, aesthetic benefits, sites for research and education, and commercial fishery benefits.



Long regarded as wastelands, wetlands are now recognized as important features in the landscape that provide numerous beneficial services for people and for fish and wildlife. Some of these services, or functions, include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during dry periods. These beneficial services, considered valuable to societies worldwide, are the result of the inherent and unique natural characteristics of wetlands.



Functions Versus Values

Wetland functions include water quality improvement, floodwater storage, fish and wildlife habitat, aesthetics, and biological productivity. The value of a wetland is an estimate of the importance or worth of one or more of its functions to society. For example, a value can be determined by the revenue generated from the sale of fish that depend on the wetland, by the tourist dollars associated with the wetland, or by public support for protecting fish and wildlife.

Although large-scale benefits of functions can be valued, determining the value of individual wetlands is difficult because they differ widely and do not all perform the same functions or perform functions equally well. Decision-makers must understand that impacts on wetland functions can eliminate or diminish the values of wetlands.

Water storage. Wetlands function like natural tubs or sponges, storing water and slowly releasing it. This process slows the water's momentum and erosive potential, reduces flood heights, and allows for ground water recharge, which contributes to base flow to surface water systems during dry periods.

Although a small wetland might not store much water, a network of many small wetlands can store an enormous amount of water. The ability of wetlands to store floodwaters reduces the risk of costly

property damage and loss of life—benefits that have economic value to us. For example, the U.S. Army Corps of Engineers found that protecting wetlands along the Charles River in Boston, Massachusetts, saved \$17 million in potential flood damage.

Water filtration. After being slowed by a wetland, water moves around plants, allowing the suspended sediment to drop out and settle to the wetland floor. Nutrients from fertilizer application, manure, leaking septic tanks, and municipal sewage that are dissolved in the water are often absorbed by plant roots and microorganisms in the soil. Other pollutants stick to soil particles. In many cases, this filtration process removes much of the water's nutrient and pollutant load by the time it leaves a wetland. Some types of wetlands are so good at this filtration function that environmental managers construct similar artificial wetlands to treat storm water and wastewater.



Red-osier dogwood

Biological productivity. Wetlands are some of the most biologically productive natural ecosystems in the world, comparable to tropical rain forests and coral reefs in their productivity and the diversity of species they support. Abundant vegetation and shallow water provide diverse habitats for fish and wildlife. Aquatic plant life flourishes in the nutrient-rich environment, and energy converted by the plants is passed up the food chain to fish, waterfowl, and other wildlife and to us as well. This function supports valuable commercial fish and shellfish industries.



The Great Flood of 1993 in the upper Mississippi River Basin caused billions of dollars in property damage and resulted in 38 deaths. Historically, 20 million acres of wetlands in this area had been drained or filled, mostly for agricultural purposes. If the wetlands had been preserved rather than drained, much property damage and crop loss could have been avoided.

DID YOU KNOW?

- In 1991 wetland-related ecotourism activities such as hunting, fishing, bird-watching, and photography added approximately \$59 billion to the national economy.
- According to the Pacific Coast Federation of Fishermen's Associations, almost \$79 billion per year is generated from wetland-dependent species, or about 71 percent of the nation's entire \$111 billion commercial and recreational fishing industry in 1997.
- An acre of wetland can store 1–1.5 million gallons of floodwater.
- Up to one-half of North American bird species nest or feed in wetlands.
- Although wetlands keep only about 5 percent of the land surface in the conterminous United States, they are home to 31 percent of our plant species.



Steve Delaney

Seventy-five percent of commercially harvested fish are wetland-dependent. Add shellfish species and that number jumps to 95 percent.

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For more information, visit www.epa.gov/owow/wetlands.

Wetland Resources

On the Internet

Ecosystem Valuation www.ecosystemvaluation.org
Economic Valuation of Wetlands www.ramsar.org/lib_val_e_index.htm

In Print

Restoration, Creation, and Recovery of Wetlands: Wetland Functions, Values, and Assessment, R.P. Novitzki, R.D. Smith, and J.D. Fretwell. United States Geological Survey Water Supply Paper 2425. Available on-line at <http://water.usgs.gov/nwsum/WSP2425/functions.html>.

Technical Aspects of Wetlands: Wetland Hydrology, Water Quality, and Associated Functions, Virginia Carter. United States Geological Survey Water Supply Paper 2425. Available on-line at <http://water.usgs.gov/nwsum/WSP2425/hydrology.html>.

Wetlands Functions and Values. Visit the North Carolina State University Water Quality Group's on-line informational database, WATERSHEDSS, at <http://h2osparc.wq.ncsu.edu/info/wetlands/funval.html>.



Types of Wetlands



Reddish egret

Do you think all wetlands are the same? Think again. Each wetland differs due to variations in soils, landscape, climate, water regime and chemistry, vegetation, and human disturbance. Below are brief descriptions of the major types of wetlands found in the United States organized 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 are further characterized as tidal marshes and non-tidal marshes.

Tidal (coastal) marshes occur along coastlines and are influenced by tides and often by freshwater from runoff, rivers, or ground water. Salt marshes are the most prevalent types of tidal marshes and are characterized by salt-tolerant plants such as smooth cordgrass, saltgrass, and glasswort. Salt marshes have one of the highest rates of primary productivity associated with wetland ecosystems because of the inflow of nutrients and organics from surface and/or tidal water. Tidal freshwater marshes are located upstream of estuaries. Tides influence water levels but the water is fresh. The lack of salt stress allows a greater diversity of plants to thrive. Cattail, wild rice, pickerelweed, and arrowhead are common and help support a large and diverse range of bird and fish species, among other wildlife.

Nontidal (inland) marshes are dominated by herbaceous plants and frequently occur in poorly drained depressions, floodplains, and shallow water areas along the edges of lakes and rivers. Major regions of the United States that support inland marshes include the Great Lakes coastal marshes, the prairie pothole region, and the Florida Everglades.

- **Freshwater marshes** are characterized by periodic or permanent shallow water, little or no peat deposition, and mineral soils. They typically derive most of their water from surface waters, including floodwater and runoff, but do receive ground water inputs.
- **Wet meadows** commonly occur in poorly drained areas such as shallow lake basins, low-lying depressions, and the land between shallow marshes and upland areas. Precipitation serves as their primary water supply, so they are often dry in the summer.
- **Wet prairies** are similar to wet meadows but remain saturated longer. Wet prairies may receive water from intermittent streams as well as ground water and precipitation.
- **Prairie potholes** develop when snowmelt and rain fill the pockmarks left on the landscape by glaciers. Ground water input is also important.
- **Playas** are small basins that collect rainfall and runoff from the surrounding land. These low-lying areas are found in the Southern High Plains of the United States.
- **Vernal pools** have either bedrock or a hard clay layer in the soil that helps keep water in the pool. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall.



The Vernal Pool Association

Many vernal pools fill with water in fall or spring.



Leigh Dunkelberger

Freshwater marshes, like this one in Sequoia National Park, are dependent on rainfall, runoff, and seasonal flooding for their water supplies.



Dave Davis

Farmland surrounds these prairie potholes in Nebraska.



Trees found in swamps are sometimes buttressed at the base, which helps anchor them in the saturated soils.

SWAMPS are fed primarily by surface water inputs and are dominated by trees and 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. Well-known swamps include Georgia's Okefenokee Swamp and Virginia's Great Dismal Swamp. Swamps are classified as forested, shrub, or mangrove.

Forested swamps are found in broad floodplains of the northeast, southeast, and south-central United States and receive floodwater from nearby rivers and streams. Common deciduous trees found in these areas include bald cypress, water tupelo, swamp white oak, and red maple.

Shrub swamps are similar to forested swamps except that shrubby species like buttonbush and swamp rose dominate.

Mangrove swamps are coastal wetlands characterized by salt-tolerant trees, shrubs, and other plants growing in brackish to saline tidal waters.

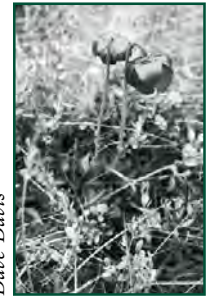


Forested swamps serve a critical role in the watershed by reducing the risk and severity of flooding to downstream areas.

These tropical and subtropical systems have a North American range that extends from the southern tip of Florida along the Gulf Coast to Texas.

BOGS are freshwater wetlands characterized by spongy peat deposits, a growth of evergreen trees and shrubs, and a floor covered by a thick carpet of sphagnum moss. These systems, whose only water source is rainwater, are usually found in glaciated areas of the northern United States. One type of bog, called a pocosin, is found only in the Southeastern Coastal Plain.

FENS are ground water-fed peat-forming wetlands covered by grasses, sedges, reeds, and wildflowers. Willow and birch are also common. Fens, like bogs, tend to occur in glaciated areas of the northern United States.



Date Davis

Bog ecosystems support cranberries, blueberries, and carnivorous plants like the pitcher plant.

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- Teaching about Wetlands

For more information, visit www.epa.gov/owow/wetlands.

Wetland Resources

On the Internet

- EPA's Wetland Home Page contains information and pictures on several types of wetlands www.epa.gov/owow/wetlands/types
- Types of Wetlands and Their Roles in the Watershed, part of North Carolina State University's WATERSHEDSS h2osparc.wq.ncsu.edu/info/wetlands/types3.html
- Wetlands of the United States from the USGS Northern Prairie Wildlife Research Center www.npwrc.usgs.gov/resource/1998/uswetlan/types.htm
- Prairie Potholes www.greatplains.org/resource/1999/ppjv/ppjv.htm

In Print

- Wetlands*. 3rd Edition. W.J. Mitsch, and J.G. Gosselink. 2000. John Wiley & Sons, Inc. New York, NY.
- In Search of Swampland: A Wetland Sourcebook and Field Guide*. R.W. Tiner, 1998. Rutgers University Press, Piscataway, NJ.
- Adopting a Wetland—A Northwest Guide*. S. Yates. 1989.



Threats to Wetlands

Destroying or degrading wetlands can lead to serious consequences, such as increased flooding, extinction of species, and decline in water quality. We can avoid these consequences by maintaining the valuable wetlands we still have and restoring lost or impaired wetlands where possible.

What Is the Status of Our Nation's Wetlands?

More than 220 million acres of wetlands are thought to have existed in the lower 48 states in the 1600s. Since then extensive losses have occurred, and more than half of our original wetlands have been drained and converted to other uses. The mid-1950s to the mid-1970s were a time of major national wetland loss. Since then the rate of loss has slowed.



The National Audubon Society notes that bird populations continue to decrease as wetlands are destroyed. In the past 15 years alone, the continental duck breeding population fell from 45 million to 31 million birds, a decline of 31 percent. The number of birds migrating over the Gulf of Mexico, which rely on coastal wetlands as staging areas (especially in Louisiana and Mississippi), has decreased by one-half since the mid-1960s. Approximately 100 million wetland acres remain in the 48 contiguous states, but they

continue to be lost at a rate of about 60,000 acres annually. Draining wetlands for agricultural purposes is significant, but declining, while development pressure is emerging as the largest cause of wetland loss.

Unfortunately, many remaining wetlands are in poor condition and many created wetlands fail to replace the diverse plant and animal communities of those destroyed.

When a wetland functions properly, it provides water quality protection, fish and wildlife habitat, natural floodwater storage, and reduction in the erosive potential of surface water. A degraded wetland is less able to effectively perform these functions. For this reason, wetland degradation is as big a problem as outright wetland loss, though often more difficult to identify and quantify.

What Is Adversely Affecting Our Wetlands?

Human activities cause wetland degradation and loss by changing water quality, quantity, and flow rates; increasing pollutant inputs; and changing species composition as a result of disturbance and the introduction of nonnative species. Common human activities that cause degradation include the following:

Hydrologic Alterations. A wetland's characteristics evolve when hydrologic conditions cause the water table to saturate or inundate the soil for a certain amount of time each year. Any change in hydrology can significantly alter the soil chemistry and plant and animal communities. Common hydrologic alterations in wetland areas include:

- Deposition of fill material for development.
- Drainage for development, farming, and mosquito control.
- Dredging and stream channelization for navigation, development, and flood control.
- Diking and damming to form ponds and lakes.
- Diversion of flow to or from wetlands.
- Addition of impervious surfaces in the watershed, thereby increasing water and pollutant runoff into wetlands.

Pollution Inputs. Although wetlands are capable of absorbing pollutants from the surface water, there is a limit to their capacity to do so. The primary pollutants causing wetland degradation are sediment, fertilizer, human sewage, animal waste, road salts, pesticides, heavy metals, and

Percentage of Wetlands
Acreage Lost, 1780s–1980s



Twenty-two states have lost at least 50 percent of their original wetlands. Since the 1970s, the most extensive losses have been in Louisiana, Mississippi, Arkansas, Florida, South Carolina, and North Carolina.

Source: *Wetlands*,
2nd edition,
Van Nostrand and
Reinholdt, 1993.

selenium. Pollutants can originate from many sources, including:

- Runoff from urban, agricultural, silvicultural, and mining areas.
- Air pollution from cars, factories, and power plants.
- Old landfills and dumps that leak toxic substances.
- Marinas, where boats increase turbidity and release pollutants.



Pollutants such as sediment, nutrients, pesticides, and heavy metals degrade wetlands and water quality across the country.

Vegetation Damage. Wetland plants are susceptible to degradation if subjected to hydrological changes and pollution inputs. Other activities that can impair wetland vegetation include:

- Grazing by domestic animals.
- Introduction of nonnative plants that compete with natives.
- Removal of vegetation for peat mining.

What Can You Do?

Nearly 75 percent of all wetlands are privately owned, making it imperative that the public participate in wetland management and protection. Here are some things you can do:

- Conserve and restore wetlands on your property.
- Support local wetlands and watershed protection initiatives by donating materials, time, or money.

- Work with your local municipalities and state to develop laws and ordinances that protect and restore wetlands.
- Purchase federal duck stamps from your local post office to support wetland acquisition.
- Participate in the Clean Water Act Section 404 program and state regulatory programs by reviewing public notices and commenting on applications.
- Encourage neighbors and developers to protect the function and value of wetlands in your watershed.
- Avoid wetland alteration or degradation during project construction.
- Maintain wetlands and adjacent buffer strips as open space.
- Reduce the amount of fertilizers, herbicides, and pesticides applied to lawns and gardens.



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For more information, visit www.epa.gov/owow/wetlands.

Wetland Resources

A Global Overview of Wetland Loss and Degradation. Available on The Ramsar Convention on Wetlands' web site at www.ramsar.org/about_wetland_loss.htm.

Wetland Issues. Available on-line at www.nceonline.org/NLE/CRSreports/Wetlands/wet-5.cfm.

Wetlands Loss and Degradation. Visit the North Carolina State University Water Quality Group's on-line informational database, WATERSHEDSS, at h2osparc.wq.ncsu.edu/info/wetlands/wetloss.html.

Wetlands and Agriculture: Private Interests and Public Benefits, Ralph E. Heimlich et al. USDA-ERS Report No. 765. Available on-line at www.ers.usda.gov/publications/aer765.



Wetland Restoration



Wetlands are one of the most valuable and fragile components of a watershed, but for many years they were filled and drained for agriculture and development. Now we are learning that wetlands are crucial to the health of our waters and wildlife. Wetland restoration, the renewal of natural and historical wetlands that have been lost or degraded, is a growing activity. It can improve water quality and wildlife habitat across the nation.



Wetland restoration involves renewing natural and historical wetlands that have been lost or degraded.

What Is Restoration?

Restoration is the return of a degraded wetland or former wetland to its preexisting naturally functioning condition, or a condition as close to that as possible. It is a complex process that requires expertise, resources, and commitment from many different stakeholders. Ideally, a successfully restored wetland will mimic the functions of a healthy natural wetland.

All restoration projects require planning, implementation, monitoring, and management. Many projects require a team with expertise in ecology, hydrology, engineering, and environmental planning. Getting local experts and the community involved gives the project local ownership, which is important for restoration success.

Why Restore Wetlands?

Restoring our lost and degraded wetlands to their natural state is essential to ensure the health of America's watersheds. Unless we reverse the tide of wetland loss, the quality of our waters will continue to be threatened and a part of our natural heritage will be lost. The quality of America's waters is closely linked to the integrity of America's wetlands. Over the past 200 years, wetlands have vanished at an alarming rate. More than half of our nation's original natural wetlands in the contiguous

states have been lost to agriculture and development. Many of the wetlands that remain today continue to be degraded. Such losses and damage hamper wetland functions, such as water quality protection, habitat for fish and other wildlife, and flood prevention. Read more about wetland and watershed restoration at EPA's web site at www.epa.gov/owow/wetlands/restore.

Community-based Wetland Restoration

EPA is working with its partners on community-based wetland restoration projects in 500 watersheds across the nation. EPA's Five-Star Restoration Program (www.epa.gov/owow/wetlands/restore/5star), provides wetlands challenge grants, facilitates technology/information transfer and partnership collaboration, and supports peer-to-peer communication programs.

If you want to restore a wetland on your property or in your community, many different organizations and agencies can help. Many land-owners are eligible to enroll in federal programs that provide restoration expertise and funding, such as the USDA's Conservation Reserve Program or the Fish and Wildlife Service's Partners for Fish and Wildlife Program. If your project doesn't qualify for such a program or it is a community project involving many different stakeholders, you might want to hire a professional to draft a plan and put together a team to do the work. You can obtain more information through the web sites and resources listed on the reverse.



Through its Five-Star Restoration Program, EPA is working with multiple partners to reach a goal of 500 community-based wetland restoration projects across the nation.

LOCAL YOUTH RESTORE NEW YORK MARSH

Youth organizations are working hard to restore and protect an urban wetland in Utica, New York. The marsh is home to more than 190 bird species and 250 plant species. The Sustainable Utica Project, headed by Utica Community Action, Inc. (UCAI), recently became one of eight youth corps organizations nationwide to receive a \$20,000 grant from EPA's Five-Star Restoration Grant Program. Over the next few months, project organizers will improve existing nature trails to make the entire trail network accessible to the public. They'll also develop a nature interpretation trail system for marsh visitors that will enhance public understanding of the wetland's value. UCAI will also remove invasive plants, trash, and other debris from the marsh to enhance its wildlife habitat value. So far, they have removed 6 tons of garbage from the marsh. In addition to promoting conservation education and tourism, the project will generate economic development opportunities for the local community. For more information, contact John Furman, Program Planner, Utica Community Action, Inc., 253 Genesee Street, Utica, NY 13501. Phone: (315) 797-7364; fax: (315) 792-1983; e-mail: JFurman835@aol.com.

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Teaching about Wetlands

For more information, visit www.epa.gov/owow/wetlands.

Wetland Resources

On the Internet

EPA's River Corridor and Wetland Restoration home page	www.epa.gov/owow/wetlands/restore
USDA's Conservation Reserve Program	www.nrcs.usda.gov/programs/crp/
USDA's Wetland Reserve Program	www.nrcs.usda.gov/programs/wrp/
Partners for Fish and Wildlife Program	partners.fws.gov
The Association of State Wetland Managers	www.aswm.org
Society for Ecological Restoration	www.ser.org
National Wetlands Conservation Alliance	users.erols.com/wetlandg
National Marine Fisheries Service Restoration Center	www.nmfs.noaa.gov/habitat/restoration
Chesapeake Bay Program	www.chesapeakebay.net
Society of Wetland Scientists	www.sws.org
Izaak Walton League of America	www.iwla.org

In Print and On Video

A Citizen's Guide to Wetland Restoration (EPA910-R-94-006). Available from EPA Region 10. Call (206) 553-1200.

Wetland Creation and Restoration: The Status of the Science, Jon Kusler and Mary Kentula, 1990. Available from Island Press. Call 1-800-828-1302.

Wetlands: An Approach to Improving Decision-Making in Wetland Restoration and Creation, Mary Kentula et al., 1992. Available from Island Press. Call 1-800-828-1302.

Wetland Restoration: Steps to Success. This 21-minute video from The Wetlands Conservancy discusses techniques for wetland restoration, including using native plants and when and where to plant. For copies, call The Wetlands Conservancy at (503) 691-1394 or log onto their website at www.wetlandsconservancy.org.

Restoration, Creation, and Recovery of Wetlands: National Water Summary on Wetland Resources, Mary Kentula, 1999. United States Geological Survey Water Supply Paper 2425. Available on-line at water.usgs.gov/nwsum/WSP2425/restoration.html.



Teaching About Wetlands

Why Is a Wetland Important?

Unfortunately, many people can't answer this question with confidence. Although the public's appreciation of wetlands is increasing, wetland studies have often been omitted from school curricula in the past. Once young people learn about the value of wetlands, they have the tools to become active citizens working to protect this critical feature of the environment for future generations.



Pickeretweed flower

ACTIVITY

To help in planning what to teach, find out what the students already know.

Ask each student to write down
(1) a type of wetland,
(2) a type of animal associated with a wetland,
(3) a plant associated with a wetland, and
(4) two adjectives that describe a wetland.
After the students have answered the questions, poll the class on the answers for each item. The answers should help you identify the general level of knowledge, along with any preconceptions about wetlands (negative or positive).

What Should I Teach?

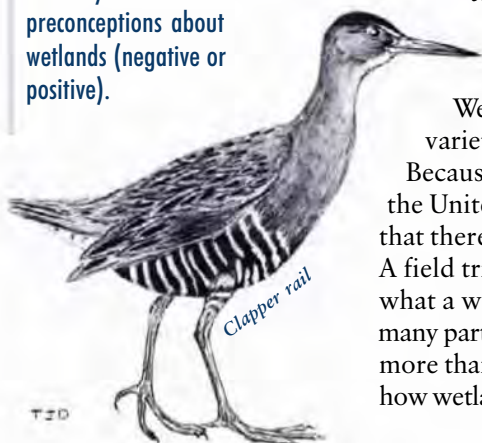
Many children and adults do not know what a wetland really is, so that's the place to start. Although wetlands are often wet, a wetland might not be wet year-round. In fact, many wetlands are only seasonally wet. Many wetlands serve as transition zones between land and water where the flow of water, the cycling of nutrients, and the energy of the sun produce a rich variety of plant and animal life. Because of their wet nature, wetlands are home to specially adapted water-loving plants and promote the development of characteristic wetland soils.

Students also need to know that wetlands help us in many ways. They protect water quality, provide fish and wildlife habitat, and store floodwater. Once we realize how helpful wetlands are, we can understand why we should conserve and protect them. Although laws protect some wetlands, threats to wetlands from development, agriculture, and pollution are still very real. Simply helping students to understand and care about wetlands can go a long way toward wetland preservation.

Wetlands can also be incorporated into classroom work in the context of many subjects. As a natural feature of the environment, wetlands can be studied in physical science, biology, or even water chemistry units. Many wetlands are restored or protected by community cooperation and hard work, leading to studies in civics and sociology. The beauty and serenity of wetlands provide the perfect setting to practice art or to discuss and enjoy literature.

How Should I Teach About Wetlands?

Wetland science lends itself to a variety of exciting learning methods. Because wetlands can be found all over the United States, there is a good chance that there are wetlands near your school. A field trip to a wetland shows students what a wetland looks like and how its many parts function together. Trips to more than one wetland can demonstrate how wetlands differ from each other.



Clapper rail



Classroom projects and field trips get young people excited about studying and protecting wetlands.



Where Can I Find Information?

Wetland education materials are becoming increasingly available as we see the benefit of teaching people of all ages about the wonders of wetlands. Many different materials are available on the internet at www.epa.gov/owow/wetlands.

In addition, many state natural resource and environmental agencies are developing classroom materials on wetlands. Local conservation commissions, libraries, and community environmental groups are often good sources. A wide variety of eye-catching posters, brochures, and even true-to-life scale models of wetlands are available to enhance study. Some wetland programs offer videos and TV downlinks. The U.S. Fish and Wildlife Service's *Wild Things* program, for example, offers a live electronic field trip to a wildlife refuge.

Marsh fern



Georgia has developed an Adopt-a-Wetland Program, based on its Adopt-a-Stream Program. A manual that explains how to find a wetland to adopt and how to conduct a wetland walk, perform surveys, and maintain the beauty of a wetland is available on the program's web site. Programs like Georgia's provide an opportunity for hands-on learning for all ages. For more information, call (404) 656-1639 or visit www.riversalive.org/aas.htm.

Tiger swallowtail



Dave Davis

The Wetland Fact Sheet Series

American Avocet



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Wetland Resources

On the Internet

EPA's Wetlands Science, Education, and Information Resources ... www.epa.gov/owow/wetlands/resources/information.html

Izaak Walton League of America www.iwla.org

Terrene Institute's Wetlands: Educational Resources and Products www.terrene.org/education.htm

The Cattail Company's Wetlands Curriculum Resources www.cattailcompany.com/habitats/second_wetland.html

Project WILD www.projectwild.org

Schoolyard Habitats Program www.nwf.org/schoolyardhabitats

In Print

WOW! The Wonders of Wetlands: An Educator's Guide. Grades K–12. Order from The Watercourse, 201 Culbertson Hall, P.O. Box 170575, Montana State University, Bozeman, MT 59717-0575; call (406) 994-5392 or visit www.montana.edu/wwwater. \$15.95 plus \$4.50 shipping and handling.

Discover Wetlands. Grades 4–8. Order from the Washington State Department of Ecology, P.O. Box 47600, Olympia, WA 98504-7600; call (206) 438-7538 or visit www.ecy.wa.gov/biblio/88016.html.

Project WET: Curriculum and Activity Guide. Order from Project WET, National and International Headquarters, 201 Culbertson Hall, P.O. Box 170570, Montana State University, Bozeman, MT 59717-0570; call (406) 994-5392 or visit www.projectwet.org.



Volunteering for Wetlands

Bossier Parish Wetland Reserve Project

The USDA's Natural Resources Conservation Service and the Bodcau Soil and Water Conservation District in Louisiana worked with five landowners to help them enroll four contiguous tracts of land, a total of about 2,500 acres, in the Wetlands Reserve Program. The land had been in cropland, pasture, and woodland but was not very productive from an agricultural standpoint because of flooding problems. Once this land was set aside and protected, volunteers from schools, community organizations, and a local Air Force base came together to help protect and restore the wetland areas.

J. Larry Newton School Wetland Restoration Project

EPA Supported Five STAR Project

In Fairhope, Alabama, the Mobile Bay National Estuary Program, in partnership with EPA, local businesses, schools, nonprofit groups, conservation agencies, and a youth conservation corps, are restoring wetlands adjacent to the newly constructed J. Larry Newton School. The restored wetlands will be a living laboratory for the students and a demonstration project for landowners interested in wetland restoration.

Can Volunteers Protect Wetlands?

Government regulations and zoning restrictions are not enough to protect wetlands. Citizens must also become involved. Volunteers that demonstrate concern and devote time to protecting wetlands can make a big difference. In fact, volunteers have already halted wetland degradation and reduced the number of threatened wetlands in communities around the country. We all have a responsibility to protect and restore wetlands, and by working together we can make a difference.



How Do Volunteers Make a Difference?

Local citizens not only provide the extra workforce necessary to assess the health of and threats to our wetlands but also serve as some of the most powerful advocates for protecting wetland habitat. Volunteer efforts to improve our environment have been gaining momentum over the past 20 years. Volunteer groups are growing in strength and number in many states across the country. These groups would certainly welcome your assistance, or you could even start a group in your own community. Whether you work on your own or with a group, you can help wetlands by working to preserve and protect them, monitoring and assessing their health, and restoring them. There are ways to help.

Wetland Preservation and Protection

When volunteers work to protect local wetlands, they greatly improve the chances that those wetlands will be valued by the community. You can help local conservation and restoration efforts by influencing local and regional environmental policy. By educating others about the functions and values of wetlands, you can empower them to become involved in wetland protection. For example, many landowners have voluntarily enrolled wetland areas on their property in the USDA's Wetland Reserve Program, which provides technical and financial support to landowners. You could also join the Izaak Walton League of America in its American Wetlands Month celebration every May. The League offers

American Wetlands Month kits on the Internet to help local groups initiate on-the-ground projects. The kits include fact sheets on wetlands, project ideas, contact information, case studies of projects from across the country, and links to many informative wetland sites. For more information on American Wetlands Month, visit the web site at www.iwla.org/SOS/awm.

Wetland Assessment and Monitoring

Volunteer monitors often make critical observations and measurements that help assess the health of a wetland. Monitoring wetland characteristics such as plants, soils, hydrology, and wildlife helps us better understand wetland functions and track changes in wetland ecosystems. To become involved in wetland



Anna Hicks

These volunteers are learning how to assess wetland habitat.

monitoring and assessment, contact your local extension service or join a local citizens group involved in wetland monitoring. Working with these groups, you can address data gaps that exist in the current monitoring system in your area. If no local organizations are involved in wetland monitoring, you can help to educate local officials about the importance of wetlands and encourage them to set aside funding to support wetland monitoring.

Wetland Restoration

Through their dedication, volunteers increase awareness of the importance of wetlands and create a foundation for active restoration of previously degraded wetlands. By staying involved in local issues and serving as a source of information for others, you can reinforce the importance of wetland restoration and ensure that restoration projects get local support. To

further your efforts, you can join citizen groups that sponsor restoration projects and help with hands-on restoration work like planting native wetland plants. You can also make a difference by raising funds or recruiting additional volunteers from youth groups, church groups, schools, and other sources.

Massachusetts North Shore Salt Marsh Assessment

In the summer of 1999, a volunteer-staffed pilot monitoring program began along the Massachusetts coast, with the support of local organizations, the state, and EPA. Using a curriculum written by the University of Massachusetts Cooperative Extension, the program developed a series of citizen monitoring workshops that focused on using six wetland parameters—birds, plants, water chemistry, land use, tidal influence, and benthic macroinvertebrates—to assess a wetland's health. Their outreach and education efforts drew 50 new volunteers. The training program is being revised, using feedback from the volunteers, and will eventually be used throughout New England to train other citizen groups to monitor wetlands. For more information, visit the web site at www.mvpc.org/services_sec/mass_bays/8T&B_volunteers.htm.

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For more information, visit www.epa.gov/owow/wetlands.

Wetland Resources

On the Internet:

- Volunteer Monitor Newsletter Site* www.epa.gov/owow/monitoring/volunteer/vm_index.html
- Izaak Walton League of America* www.iwla.org
- USDA's Backyard Conservation Guide* www.nrcs.usda.gov/feature/backyard
- National Audubon Society* www.audubon.org
- Frog Watch* www.frogwatch.org

In Print:

- Handbook for Wetlands Conservation and Sustainability*, 1998. Available from the Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878. Call (800) BUG-IWLA or e-mail sos@iwla.org.
- Monitoring Wetlands: A Manual for Training Volunteers*, T. Miller, C. Bertolotto, J. Martin, and L. Storm, 1996. Available from Adopt-a-Beach, 4649 Sunnyside Ave., N, Rm 305, Seattle, WA 98103. Call (888) 57-BEACH.
- National Directory of Volunteer Environmental Monitoring Programs* (EPA 841-B-98-009), U.S. Environmental Protection Agency, 1998. Available on-line at yosemite.epa.gov/water/volmon.nsf.
- Volunteer Wetland Monitoring: An Introduction and Resource Guide* (EPA 843-B-00-001), U.S. Environmental Protection Agency, 2000. Available on-line at www.epa.gov/owow/wetlands.
- Wetland Walk Manual: A Guidebook for Citizen Participation* (Manual and Worksheets), U.S. Environmental Protection Agency, 1996. Available on-line at www.epa.gov/owow/wetlands/wetwalk.pdf (Wetland Walk Manual) and www.epa.gov/owow/wetlands/wetwork.pdf (Wetland Walk Supplement: Worksheets).

What are Wetlands?

Mini Wetlands Activity Guide

What are Wetlands?

A wetlands activity guide for educators and kids from the Utah Division of Wildlife Resources -- 2003

May is Wetlands Month! When you hear the word 'wetland', what comes to mind? Maybe you imagine a pond where you caught slimy frogs as a child. Or maybe you picture the great expanse of Great Salt Lake and the ducks, geese and shorebirds associated with its edges. Perhaps you think of yourself with a child, fishing from the edge of a river. All of these places are wetlands, and as such, are incredibly valuable to Utah.

So, what is a wetland anyway? Taking the word apart - 'land' that is 'wet' tells us a little to start with. But, nature is not as simple as that. To

be classified as a wetland, an area must have the correct combination of soils, plants, and presence of water.

First, let's talk about *soils*. Not all soils are created equally. The four main types of soil are clay, sand, silt, and organic. Organic soil forms where plant decom-

position is slowed down. The soil in a wetland can include any combination of these soils, but it must be *hydric*, or saturated with water, for at least part of the growing season – saturated long enough that there is little oxygen left in the soil. When this happens, the soil is *anaerobic* (without oxygen). Soil that is hydric usually smells like rotten eggs from the anaerobic bacteria which thrive in it, creating hydrogen sulfide. It will also often look dark and slimy. Little oxygen left in the soil and water greatly affects the things living in a wetland – especially the....

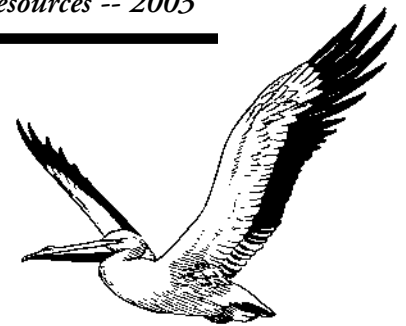
Plants! It takes a very special plant to be able to make it in a wetland. We all know that plants need water, but have you ever over-watered a house plant? If you have, you know that different plants require different amounts of water. Plants found in wetlands are called *hydro-phytic* (hydro = water, phytic = plant). They have special adaptations that allow them to live in a water-saturated environment where oxygen is hard to obtain. Some of these adaptations include having long tubes

that transport oxygen, as in reeds or grasses; floating on top of the water, like duckweed; or having buttressed trunks that are thicker where under water, such as with cypress trees.

But, of course we wouldn't have a wetland without *water!* Water in a wetland can come from many places including rain, groundwater, surface water runoff or flood waters. The interesting thing is that water in a wetland does not need to be above the surface of the ground all the time. It just needs to be there part of the year. Usually though, there is water just below the ground so that when it rains the ground gets saturated quickly. The kind of wetland that develops depends upon when water is present and the length of time it is present.

There are many different kinds of wetlands in the world, and scientists have numerous different names for wetlands. Many types of wetlands can be found in Utah. On the third page of this packet you will find a key that can be used to identify these different kinds of wetlands. Wetlands are especially important in Utah because Utah is essentially a desert - and deserts, of course, are dry. Water is essential for life so wherever you find water in a desert, it is very valuable for all living things!

This wetlands packet contains activities for educators and students. Try some of these wetland activities and then get out and experience a wetland too!



**Hydric -
saturated with
water**

**Anaerobic -
no oxygen**

Wetlands =

Hydric soils

+

Hydrophytic plants

+

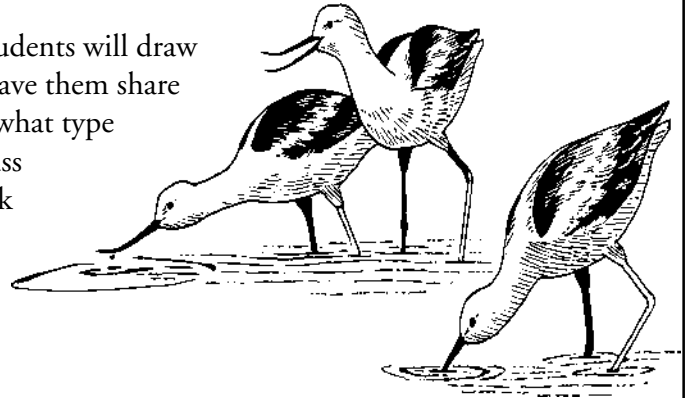
Water!

Guided activities for educators & kids

The best way to learn about a wetland is to get out and experience it. The first group of activities can be done with kids indoors or outdoors. The second group of activities are to be done outside in a wetland.

Starting out - What is a Wetland?

Ask your kids to draw a picture of a place outdoors. Often students will draw a picture of a place like a forest, but not usually a wetland. Have them share their picture with the rest of the class. Discuss with the class what type of place they drew. Did many draw a forest-like place? Discuss other habitats in Utah, such as deserts and wetlands. Then ask them to draw a wetland habitat. What did they put in their pictures this time? How are these pictures different from the last? This is a good activity to stimulate kids thinking about what a wetland is.



Experiential Activities - Sensing a Wetland: There's Nothing Like the Real Thing

There's nothing like having kids experience a wetland themselves. Let them experience the wetland, allowing their senses to be their guide. Start by explaining that usually, when people lose one sense, such as sight, their other senses become strengthened. Therefore, for most of the following activities they will not be able to see. After the activities, to help them remember their wetland encounters, have them keep a journal of what they learned and felt in the wetland.



Touch - Wetlands have many neat things to feel such as mud, leaves from plants, shells from snails, and other such items. Have the children pair up. Have one child close his/her eyes, while the other child places something from a wetland in his/her hand. The child holding the item then tries to describe what is being felt. Then have them switch and use a different item.



Smell - Have the children close their eyes and take a few deep breaths while at the wetland. Ask them to use adjectives to describe the smell. Then ask what they think a smell the opposite of this one would be. While they have their eyes closed, pick up a clump of mud and hold it in front of each child's nose while their eyes are still closed. Ask what it smells like.



Hear - Have the children close their eyes once more, and hold up one hand in a fist. Ask them to listen for sounds. Tell them to put up one finger for each different sound they hear. After listening for a period of time, have them share what sound at least one of their fingers represents.



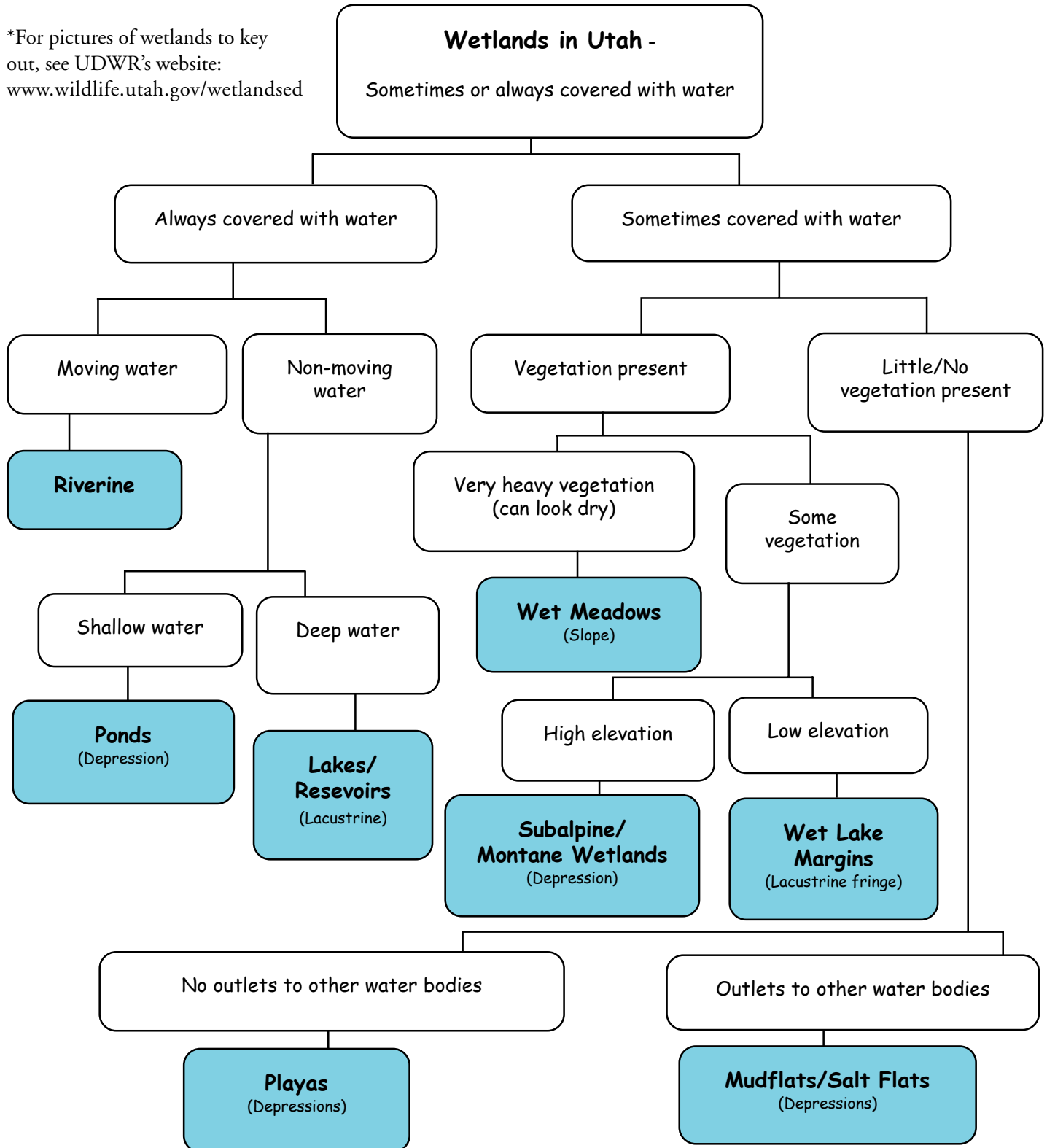
See - Play 'I Spy' with different items in the wetland. Have the children guess what it is that you are/were looking at. Have them lead their own 'I Spy' game using descriptive words for colors, textures and shapes.

Pulling it all together - Spread the children out in a small area of the wetland. Allow them to have a 'silent sit' to reflect on their experiences in the wetland. Have them each secretly choose one element of the wetland to describe in their own way in their journal. The element can be anything in the wetland - a plant, insect, or even something like the wind or sun. When they are finished, have them switch papers with a partner, and have them try to figure out what their partner's 'wetland element' was. Afterwards have them share their descriptions with the rest of the class.

Kinds of Wetlands in Utah

The dichotomous key below can be used to identify the different kinds of wetlands found in Utah. Scientists often use this kind of key for identification. You can make use of this key in two different ways. You can either visit a wetland, and use the key to figure out what kind of wetland it is. Or, you can find pictures of wetlands on the internet* or in magazines or books, and try to figure out which kinds of wetlands they are. To use this key, start at the top, and make choices about what your wetland looks like at each step. For example, is your wetland always or just sometimes covered with water? If it is always covered with water, then decide whether it has moving water or non-moving water. Continue selecting between each two choices, and work your way down to identify your wetland! (The names in parentheses are more general, scientific names.)

*For pictures of wetlands to key out, see UDWR's website:
www.wildlife.utah.gov/wetlandsed



Wetlands = Water + Soil + Plants



Water:

Where and how do you use water? Draw a map or picture of you and your family showing where and how you use water. Try to think of every way you use water - at your house, school, garden, etc.

How do plants and animals in wetlands use water? Answer this question for the list of organisms below.

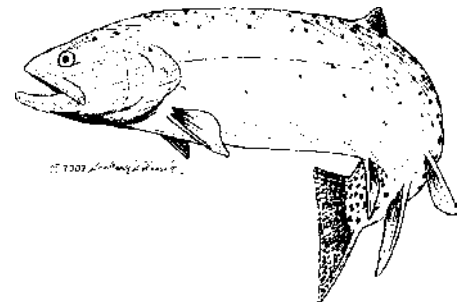
Example: A muskrat uses water for food (cattails), swimming, building their homes in (with cattails & mud), hiding in, and drinking

Beaver

Cutthroat Trout

Leopard Frog

Cattail

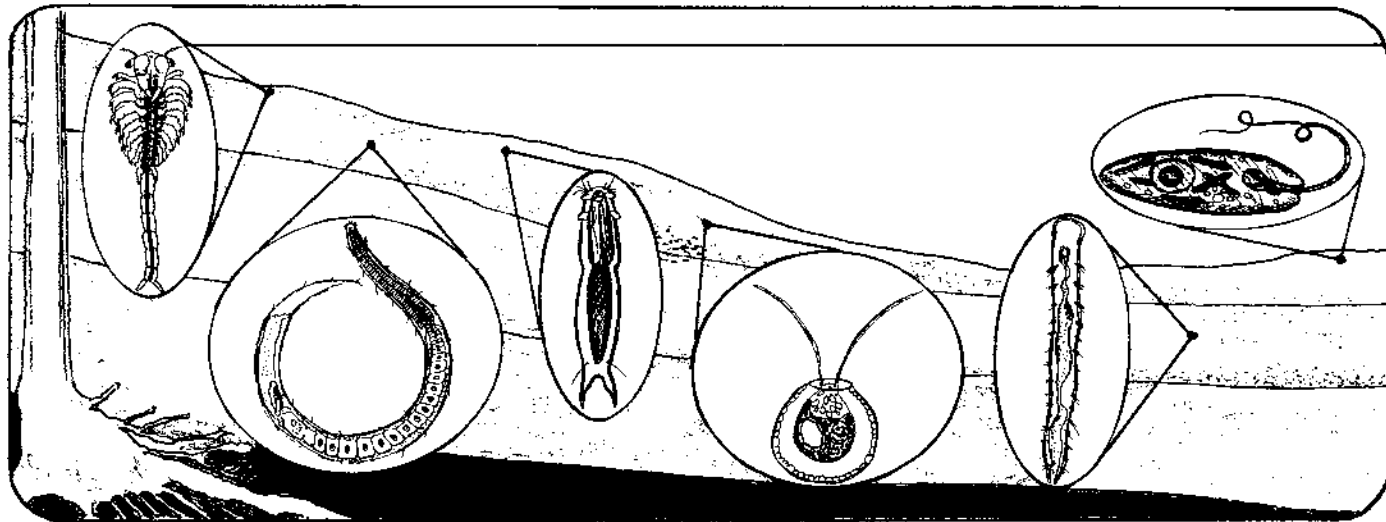


Can you think of other wetland plants or animals and how they use water?

Did you know that water in wetlands comes from the same place as the water you use? How might your use of that same water affect living things in a wetland?

Soil: Soil is more than dirt!

Wetland soil includes minerals and organic material. Minerals are found in sand, silt, or clay soils. Organic material is made up of things that used to be alive, like plants and animals, that have been broken down. Plants need these minerals and organic materials to live. It can be hard for plants to live in wetlands because there is very little oxygen in wetland soil. Just like us, they need oxygen. They survive, though, because they have special adaptations to help them out. Other living things besides plants have adapted to help them live in wetland soil too. Try to match the organisms found in wetland soil below with their correct names.



Soil organisms drawing by Steve Roundy

- A. **Euglena** - This is a one-celled organism (a kind of protist) that looks like it has a tail, which is really something called a flagellum. It uses its flagellum to move in the water and mud.
- B. **Volvocidae** - This protist is similar to the *Euglena*, but has two flagella (tails) that look like antennae.
- C. **Nematode** - This is a roundworm that measures less than 1cm long. It moves by whipping its body back and forth in water and across vegetation.
- D. **Gastrotrichs** - These are flat worms with a distinct head and tail. Insects love to eat them. There are 2 of them in the picture - can you find both?
- E. **Fairy Shrimp** - This organism is found at the bottom of a pond, or on top of mud. What look like wings on this little animal are actually what it uses to swim and breathe.

The Colors of Wetland Soils

Wetland soils look different from other soils too! Color each of the following circles with the Crayola® crayon colors, to discover how beautiful soil can be! Each colored circle represents a different kind of soil... and you thought soil was just brown. See if you can find soil somewhere that matches one of these colors. You might have to dig a little to get to different soil layers. If a color matches the two top rows of colors, it's probably a wetland soil. If it more closely matches the last row of colors, it is probably a drier soil.

You can also go to a paint store and get color swatches to find more colors of wetland soils. Look for the following colors and brands:

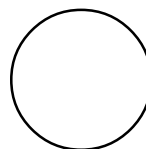
Glidden: Mountain Shadow (looks like gray + asparagus)

Ralph Lauren: Polaris (looks like cadet blue + gray)

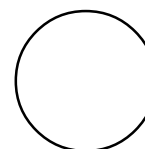
Lowe's Olympic: Black Magic (guess what it looks like!)

Behr: Peach Whip (looks like mac & cheese - not wetland soil)

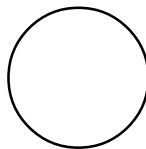
Try to find other colors you think might match those of wetland soils - grays, gray-greens and almost black colors are a good bet.



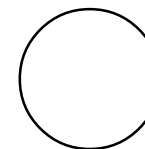
Gray +
Asparagus



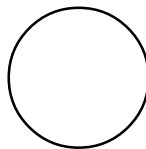
Black



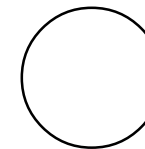
Cadet Blue +
Gray



Black + Brown



Apricot



Mac &
Cheese

Plants:



Plants in wetlands are specially adapted to live in a low oxygen environment - even plants need oxygen! They also need carbon dioxide for photosynthesis, as you have probably already learned. Most plants can get oxygen from the water through their roots, but wetland plants usually have some type of adaptation that allows them to get oxygen from the air instead. Plants found under the water are called *submergents*, those found on top of the water are called *floaters*, and those found above the water are called *emergents*. Emergents get their oxygen through a tube that goes above the water surface. Floaters can breathe through the parts of their leaves that are above the water. Submergents often have extra air pockets to store oxygen for when it is needed. Have you ever seen a wetland plant? You can find wetland plants in pet stores to put in your fishtanks (but don't ever put these in outside ponds! If they don't belong in your area, they can do a lot of damage).

Wetland plants help wetlands too. All plants create oxygen (as well as use it), and submergents actually release oxygen into the water. Plants in wetlands are also part of the wetland food web, being eaten by many wetland animals. Wetland plants also absorb and remove pollutants from the water - a very important duty!

Try to match the following pictures of wetland plants with their description - write the correct letter in the blank space. Then visit a wetland and try to find some of these plants!

1. This plant has blue flowers, and leaves that are directly opposite each other on the stem. You can find it around wet meadows, and along the edges of other wetlands too. _____

2. This plant is found often around salt marshes, but also along roads at low elevations. It has long, narrow leaves. _____

3. This might be the most commonly known wetland plant. You can find it on the edges of wetlands like wet lake margins. Sometimes it can spread quickly (sometimes too quickly) and take over an area. _____

4. The leaves of this plant are heart-shaped, and the flowers are white. It lives in subalpine/ montane wetlands and blooms early in the season. _____

5. This 'edgy' plant (the stems of sedges have edges) is found in swamps, meadows, and around lakes and ponds. Waterfowl love to eat it. It is found in Utah, as well as Nebraska. _____



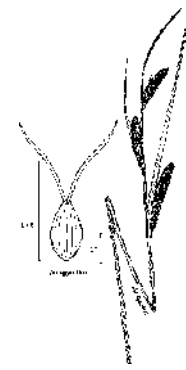
A. Marsh marigold



B. Narrowleaf cattail



C. American speedwell



D. Nebraska sedge



E. Inland saltgrass

Wetland plant drawings from 'Western Wetland Flora: Field Office Guide to Plant Species', USDA Soil Conservation Service, West National Technical Center, Portland, Oregon. Copied with permission from artist.

Answers: 1-C, 2-E, 3-B, 4-A, 5-D

Express Yourself!

Wetlands can be a source of artistic and poetic inspiration. Visit a wetland and then try to share your experience with someone in an expressive way. Try poetry! One fun and easy poetry form to do is called Cinquain. Just follow the simple instructions to create a totally original Cinquain wetland poem!

Cinquain instructions:

- Line 1: a person, place, or thing (noun)
- Line 2: two words that tell about the noun
- Line 3: three *-ing* words that show action about the noun
- Line 4: one four-word phrase or sentence about the noun
- Line 5: the noun again (or a word that means the same thing)

Example:

Beaver
Large rodent
Gnawing, chewing, slapping
Creates his large lodge
Beaver

Now, draw a picture of the subject of your cinquain poem somewhere in the wetland below. You can also add to the picture, creating an entire wetland ecosystem, with maybe cattails, fish, ducks, crayfish, etc. Have fun with it!



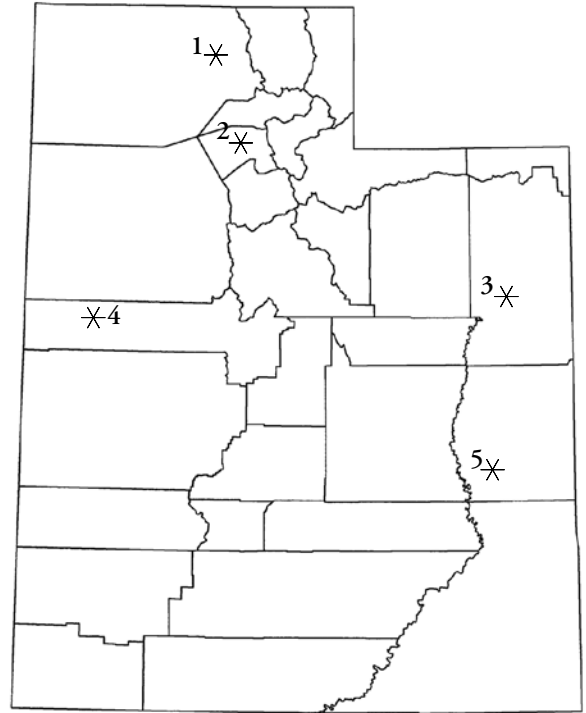
Wetland drawing by Steve Roundy

Wetland Resources for Educators

Where are wetlands in Utah you can visit? Here are just a few (see map):

1. Bear River Migratory Bird Refuge (435) 723-5887
2. Farmington Bay (801) 451-7386
3. Ouray National Wildlife Refuge (435) 545-2522
4. Fish Springs National Wildlife Refuge (435) 831-5353
5. Matheson Wetlands Preserve (435) 259-4629

For more wetland sites to visit, go to <http://www.wildlife.utah.gov/calendar>. Many of these sites will have events during May, Wetlands Month.



Wetland Education Resources

Project WILD Aquatic

Diana Vos, Utah Project WILD Coordinator,
(801) 538-4719 or <http://www.wildlife.utah.gov/projectwild>

Project WET

Andree' Walker, Utah Project WET Coordinator,
(435) 797-2580 or

<http://extension.usu.edu/coop/natres/wq/projectwet>

Shorebird Sister Schools Program (SSSP)

Hilary Chapman, SSSP US Coordinator, (304) 876-7783
or <http://sssp.fws.gov>

WOW! The Wonders of Wetlands

Environmental Concern, Inc., (410) 745-9620 or <http://www.wetland.org>

Web resources

Utah Division of Wildlife Resources: <http://www.wildlife.utah.gov/wetlandsed>

Federal Junior Duck Stamp Design Program: <http://www.wildlife.utah.gov/projectwild>

Ducks Unlimited: <http://www.ducks.ca/edu/resource.html>

Izaak Walton League of America: <http://www.iwla.org/SOS/awm/resources>

International Migratory Bird Day: <http://birds.fws.gov/imbd/educators.html>

Society of Wetland Scientists: <http://www.sws.org/education>



project WILD

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