***What Lives in Wetlands?***

**NATURE Sunday Academy 2019-2020**

**Project Description:**

There are over a million wetlands in North Dakota (<https://gf.nd.gov/wildlife/habitats/wetlands-lakes>). Wetlands provide important ecological roles, including flood protection, water filtration and habitat for numerous plants and animals. A large proportion of North Dakota’s wetlands have been lost or threatened due to agricultural development, climate change and other environmental threats such as invasive species. Wetlands, and the organisms in them, are used for hunting and subsistence,

and there are direct connections with wetland science to these activities that could stimulate interest in environmental careers and STEM education.

**Project Objectives:**

* learn about the importance of wetlands and the interrelationships of wetland organisms
* Understand and appreciate that all organisms, not just the large ones, have an important role in a wetland community
* Understand how environmental changes (both natural like floods/droughts and direct impacts from humans, such as oil or contaminants) can alter habitat for aquatic organisms

**Session Organization:**

*11:00-11:30 Cultural connection/brief introduction* ***(optional: video from sacredrelationship.ca)***

*11:30-12:00 Activity I: What types of organisms live in wetlands? Building a food web*

*12:00-12:45 Lunch*

*1:00-1:45 Activity II: Interactions in wetlands: Ecosystem Tag*

*1:45-2:30 Activity III: The Migration Game*

*2:30-3:00 Wrap up*

**ND State Science Standards:**

*Performance Standard MS-LS2-1* Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

*Performance Standard MS-LS2-2* Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

*Performance Standard MS-LS2-3* Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem

*Performance Standard MS-LS2-4* Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

*Performance Standard 5-LS2-1* Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

*Performance Standard HS-LS2-6* Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions but changing conditions may result in a new ecosystem.

*Performance Standard HS-LS2-7* Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

*Performance Standard 5-ESS2-1* Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

**Materials and Equipment:**

* Activity 1: String or yarn, picture cards of ecosystem components
* Activity 2: Beanbags, 2-4 hula hoops, 3 different colored jerseys/pinnies (team decomposer, team consumer and team producer)
* Activity 3: large space (hallway). Hula hoops or other markers (about 10). Optional: duck hats or similar costume

**Activity I: *What types of organisms live in wetlands?* Building a food web (30 minutes)**

**Overview:**

In this activity, we are going to examine some of the things which live in wetlands and how they interact with each other. Students will form food chains and a food web and see what happens when different components of the ecosystem change.

*Key Concepts:* All life and things around them are connected in delicate balances called **ecosystems**.

**Introduction (5 minutes)**

* Discuss food webs and have students brain storm about some living things (biotic components) and that live in wetlands and some abiotic components (e.g. water, sun, soil, rocks)

**Food Web Activity (15 minutes)**

1. Each student is given a picture card with an image of one component of the wetland ecosystem (e.g. sun, water, cattails, duckweed, beaver, duck, crayfish, algae, etc). Each person picks a name tag and becomes that component.
2. Everyone sits in a circle to symbolize the ecosystem. Begin with a few simple food chains. For example, the sun person holds the end of the string and you ask who needs the sun? Algae; so the ball is thrown/rolled to the algae person. Who eats algae? Snail; so the ball gets passed to the snail and so on until the chain is complete. Try a few different chains.
3. Now form a web. Starting with any one component, use the ball of string to connect the component to another related component. The relationship may be that the second component eats the first (e.g., plant connected to rabbit.) Or, the relationship may be that the first component needs the second to survive (e.g., plant connected to soil).
4. Connect the second component to a third (e.g., rabbit eaten by fox, or rabbit needs water). Continue in this way until everyone is connected to several people in several ways. As you go along, discuss what each connection or relationship is. Also, discuss interdependence.
5. Once everyone is connected, remove one component of the web (e.g., there is no water because it was drained). The water person shakes his or her strings. All members who feel the shake then shake their strings as well. This continues until it's demonstrated that every component is affected. Discuss how the various components are affected when one component of the web is removed.
6. What would happen if an oil spill destroyed all the plants (plants tug their strings)? The plant eaters would starve, which would cause the meat eaters to starve. The web would be destroyed -- at least temporarily.

**Discussion (10 minutes)**

* Divide the class into groups of 2 students each
* Ask each pair to create a wetland food web using words on a a piece of paper. Draw arrows between each component to show how energy moves through the food web.

**Activity II: *Ecosystem Tag* (45 minutes)**

**Overview:** students act as either producers, consumers or decomposers and work to maintain an ecosystem by cycling “resources” (beanbags)

**Introduction** (powerpoint slide) **(5 minutes)**

* Explain that living things do one of three different jobs to maintain ecosystems - they are either producers, consumers or decomposers. (powerpoint slide). Discuss how these different jobs need to be balanced in an ecosystem

**Activity: Ecosystem Tag (~30 minutes)**

1. Students are divided into 3 groups: decomposers, consumers and producers. ratio: (1x decomposer, 2x consumers, 4x producers). To establish the groups, have the students line up and count off up to 7. All the ones become decomposers, the twos and threes are consumers and the rest (fours to sevens) are producers. Each group wears a different colour pinnie.
2. Set up a playing area (open area in classroom or hallway)
3. Beanbags represent abiotic resources. The number of beanbags equals the number of producers. Place beanbags in two or more piles inside the hula hoops, within the playing area.
4. Explain that the game involves the basic chain of abiotic components to producer, producer eaten by consumer, and consumer broken down by decomposer to return abiotic components to the environment. The overall idea is to maintain the ecosystem, while each group fulfills its goal.

**Game Rules:** (put up on powerpoint slide)

* **Producers** are the only players who can take beanbags from the piles. A safety zone (one foot inside the hula hoop) around the pile protects a producer from being tagged while he or she is picking up an object. The goal of the producers is to get all the beanbags (or as many as possible) out of the safety zones and hold onto them.
* **Consumers** get beanbags by making a two-handed tag on a producer holding one. The goal of consumers is to get as many beanbags as possible from producers and keep them.
* **Decomposers** can only get beanbags by making a two-handed tag on a consumer holding one. When decomposers get a beanbag, they return it to the safety zone. The goal of decomposers is to get all the beanbags (or as many as possible) back to the safety zones.
* **Players can hold only one beanbag at a time**. When players are tagged, they must give up the beanbag they are holding. Players can toss and pass beanbags to members of their own group.

**Starting the game:**

* **Producers start first** – they enter the playing area and collect beanbags
* **Consumers** are allowed into the playing area a few moments after the producers
* **Decomposers** enter the area last

Adjust the number of beanbags used in the game or players in each group if play is not progressing smoothly

**Round 2:** No decomposers

* Ask the students if an ecosystem can function without decomposers? Try the game again without decomposers (assign them to producers or consumers) and see what happens

**Optional:** round 3 – more consumers/less consumers, other variations

**Discussion:** (5 minutes)

* How are all the groups dependent on one another?
* How does each group contribute to the continuous functioning of the ecosystem, (i.e., abiotic components recycled and all groups have food)?
* What happens whenan ecosystem becomes unbalanced do to disturbance or human activities?

**Activity III: *Migration troubles* (45 minutes)**

**Overview:**

Students role-play migrating water birds travelling between nesting habitats and wintering grounds and are subject to hazards at either end of the migration path, as well as along the way.

**Introduction: (5-10 minutes)**

* Discussion about habitats (powerpoint). A habitat is the place where an organism lives, feeds, breeds and shelters.
* Another name for the Prairie Pothole Region of North Dakota is the “Duck Factory of North America” because of the large numbers of migrating birds move through this region
* Many different birds - ducks, geese, swans, cranes, herons, gulls, terns and shorebirds, for example - require the presence of wetlands in their breeding habitat and on their wintering grounds. Since these two regions are often thousands of miles apart, they also need wetlands to provide them with food and rest in-between.
* Ask students if they use wetlands for hunting or any other traditional activities

**Activity: Migration Game (20-30 minutes)**

Explain to the students that many factors will limit the survival of populations of migrating waterbirds. Some involve changes in the wintering and nesting habitats. There will be times of abundant food, water, shelter and space suitably arranged to meet the habitat requirements of the birds. There will be other times when the habitat is stressed, with many factors limiting the potential for survival. Sometimes the area of available habitat is reduced. **Tell the students that for purposes of this activity only three water birds can occupy a "habitat haven" (marker) at any one time.**

1. Select a large playing area about 20 meters (65 ft) long. Place habitat markers randomly at either end.
2. Tell the student that they are playing the role of **waterbirds** and will migrate between these two areas at my signal.

**Area 1** represents the wintering grounds down south where the birds spend their winters

**Area 2** represents the nesting area here in North Dakota and the prairie pothole region

1. Each of these markers represents a wetland which provides suitable habitat for birds. Remember only 3 of you can occupy a single site at a time
2. During the game, you will migrate from the wintering grounds up to the nesting area. At the end of the journey, you have to have one foot in a wetland to continue. If you cannot get your foot on a marker, it means you haven’t found any suitable habitat, and you die

[note: there will be opportunities to reenter the game]

1. **Have everyone start in North Dakota**

Announce the start of the first migration. Have the students migrate in slow motion until they become familiar with the process. Then they can speed up. On the first try, all the birds will successfully migrate to the nesting habitat.

 (During migration students should “flap their wings” while moving…)

* Explain that there has been no loss in the area of available habitat.
1. Before the students migrate back toward the nesting habitat, turn over one marker from the wintering region. Explain that a large wetland area has been drained to increase farmland
2. Repeat the instruction to migrate and send the birds to the wintering habitat. Have the three students that will be displaced stand on the sideline. Tell the students that these three died as a result of loss of habitat. Remind any "dead birds" that they will have a chance to get back into the activity. They can come back as surviving hatchlings when favorable conditions prevail and there is habitat available in the nesting ground.
3. Before the next migration to the wintering region, turn over four markers in the nesting habitat. This represents a catastrophic loss. Tell the students that this is the result of an oil spill in the Gulf of Mexico
4. Restoration efforts occur and habitat in the wintering grounds is rebuilt!

New birds introduced (all but 3 students). Three folks on the side are hunters

1. This time there is an invasive species that has come into the nesting grounds that limits the number of birds at each pond to only two!

**Note: Can repeat with other variations if there is interest and time**

**Discussion: (5-10 minutes)**

* Identify the apparent causes of the birds' population decline from year to year. (natural disasters, drought, pollution, predation by humans and wildlife, loss of habitat..) (make a list)
* What human activities cause habitat loss and degradation for migratory birds?
* Summarize what they have learned about some of the many factors that affect the success of aquatic bird migration.
* What kinds of things can and should be done to protect and restore habitats for migrating water bird populations? What human activities can help restore habitat?