

Lesson Title: What Lives in Wetlands?

Lesson Overview: 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.

Topic(s): Wetlands, migration, food chains, food webs

Grade or Grade Band: 6-8

Lesson Objectives:

Students will:

- Define the following vocabulary terms: wetland, biotic, abiotic, ecosystem, organism, food web, food chain, producers, consumers, decomposers, habitat, and migration.
- Identify the importance of wetlands and the interrelationships of wetland organisms.
- Describe how environmental changes (both natural like floods/droughts and direct impacts from humans, such as oil or contaminants) can alter habitat for aquatic organisms.

National Next Gen Standards:

- **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.
- **MS-LS2-2:** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- **MS-LS2-3:** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- **MS-LS2-4:** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

North Dakota Standards:

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

Time Needed (estimate): Three 50-minute class periods

Lesson Author: Brittany Hagen

Dr. Brittany D. Hagen is an Associate Professor of Education and CAEP Accreditation Coordinator at Mayville State University in Mayville, ND. Dr. Hagen teaches courses related to foundations of education, educational technology, educational assessment, and elementary methods. Additionally, she has developed both online and classroom curriculums for a variety of age groups, including teach-the-teacher programs, assessment data modules, and high school aviation facilitator guides and interactive student activities. Dr. Hagen is also a proud Mayville State alumnus, dedicated to developing highly effective teachers who share a passion for educating young learners.

Scientist/K12 Collaborator & University: Jon Sweetman - Previously an Assistant Professor at NDSU, Dr. Sweetman as of August 2021 joined the Penn State faculty in the Department of Ecosystem Science and Management. While at NDSU his research focused on the topics of Aquatic Ecology and Environmental Change. His work focused on understanding the impacts of disturbances to freshwater communities and ecosystems from the cumulative effects of natural and human impacts. He also looked at the paleolimnology of lakes and wetlands with a focus on aquatic invertebrates. One of the goals was linking research to sustainable management and decision making.

Preparation/Materials

Background knowledge students must have to be successful

Students must have some background information on the different components of an ecosystems. They will also need to know about producers, consumers, and decomposers as well as food webs and food chains.

Differentiation and accommodation to support learning for all students:

When designing any lesson, it is important to address the needs of all learners. Please refer to the following resource for ideas on how to adjust your lesson to accommodate your students' particular learning needs: <https://www.understood.org/en/learning-thinking-differences/treatments-approaches/educational-strategies/common-classroom-accommodations-and-modifications>

Essential Terminology

- Wetland: land consisting of marshes or swamps
- Biotic components: living things in an ecosystem
- Abiotic components: nonliving things in an ecosystem
- Ecosystem: a biological community of interacting organisms and their physical environment.
- Organism: an individual animal, plant, or single-celled life form
- Food Chain: a hierarchical series of organisms each dependent on the next for food
- Food Web: a system of interlocking and interdependent food chains
- Producers: green plants that use the sun's energy to manufacture their own food
- Consumers: living things that eat other living things
- Decomposers: organisms that "break down" dead plant and animal material into abiotic elements; decomposers are recyclers.
- Habitat: the place where an organism lives, feeds, breeds and shelters
- Migration: seasonal movement of animals from one region to another

Resources:

- PowerPoint included in the lesson

Websites:

- <https://youtu.be/oo675fw9PTA>
- <https://www.youtube.com/watch?v=OI2oNcbh-xw>

Materials needed:

- String or yarn
- Picture cards of ecosystem components
- Blank labels
- Beanbags
- 2-4 hula hoops
- 3 different colored jerseys/pinnies (team decomposer, team consumer and team producer)
- Large space (gym, classroom, hallway)
- Hula hoops or other markers (about 10)
- Optional: duck hats or similar costume

Lesson 1: What types of organisms live in wetlands? Building a food web (50 minutes)

Engage:

1. Display PPT Slide 1 and give a description of the picture shown on that slide.
2. Ask students to turn and talk with a partner and guess how many wetlands are located in North Dakota. The answer is over 1 million and can be found on PPT Slide 2.
3. Explain to students that in this lesson, they are going to examine some of the things which live in wetlands and how they interact with each other.

Explore:

4. To ensure students have a firm understanding of the vocabulary words for this lesson, play Vocabulary BINGO with them. Write the following vocabulary terms on the board: wetland, biotic, abiotic, ecosystem, organism, food web, food chain, producers, consumers, decomposers, habitat, and migration. Then, give each student a blank "Vocabulary BINGO" card. Instruct them to write one word in each blank space. Each student should have a marker or small colored pieces of paper to mark their cards when the word is described. Once all students' cards are filled in, read off the definition of one word. Ask students to cover the word on their card that best matches the definition you just read. Continue this until all definitions have been read or someone has a BINGO. A student needs to get three words in a row horizontally, vertically, or diagonally to win. When students have a BINGO, they must read back the word and the definition (not listed on their cards) to win. This reinforcement of vocabulary will benefit students as they proceed in this lesson.
5. After students are more familiar with the vocabulary, discuss food webs and have students brainstorm about some living things (biotic components) and that live in wetlands and some abiotic components (e.g. water, sun, soil, rocks). Consider writing these things on the board for reference later.
6. Display PPT Slide 4 with students and explain the lesson objectives that students will accomplish over the next several lessons.

Explain:

7. Show students the "What Lives in Wetlands?" video found on PPT Slide 5 and here: <https://youtu.be/oo675fw9PTA>. Remind students to pay attention to the many purposes of wetlands while watching the video.
8. After viewing the video, review essential content vocabulary found on PPT Slide 5 with students.

9. Then, give each student 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 student should receive a blank label or name tag and write their ecosystem component on the label and stick it to their shirt to signify that they will become that component for the next activity (PPT Slide 7).
10. 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.
11. Re-roll the string and now work with the students to 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).
12. 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.

Extension of learning more about this topic:

13. 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.

Evaluation

14. Review food webs and chains using the diagram on PPT Slide 8. Ask students, "What would happen if an oil spill destroyed all the plants (plants tug their strings)? The answer is: the plant eaters would starve, which would cause the meat eaters to starve. The web would be destroyed -- at least temporarily.
15. To wrap up the lesson, ask students to share one thing they learned about ecosystems and food chains/webs. Highlight key concepts students draw and clear up misconceptions, as necessary.

Lesson 2: Interactions in Wetlands: Ecosystem Tag (50 minutes)

Engage:

1. Write producers, consumers, and decomposers on the board. Using the ecosystem picture cards you created for the first lesson, call one student up at a time to draw the image on the card. Then, the rest of the class must guess what it is and whether it's a producer, consumer, or decomposer. Do as many examples as needed to ensure students can recall several examples of each. Highlight key concepts and clear up misconceptions as necessary.

Explore:

2. Once the drawing and guessing is done, review with students that living things do one of three different jobs to maintain ecosystems - they are either producers, consumers or decomposers. (PPT Slide 9). Discuss how these different jobs need to be balanced in an ecosystem

Explain:

3. Using PPT Slide 10, explain the game rules of Ecosystem Tag.
4. Divide students 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 color pinnie to designate their role.
5. Use the gymnasium, a big open area in the classroom, or the hallway for the playing area. Within the playing area, place the number of beanbags that equal the number of producers. Place beanbags in two or more piles inside the hula hoops, within the playing area. The beanbags represent abiotic resources.
6. 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.
7. To start the game, producers go first. They enter the playing area and collect beanbags. The consumers are then allowed into the playing area a few moments after the producers. The decomposers enter the playing area last. Consider adjusting the number of beanbags used in the game or players in each group if play is not progressing smoothly.

Extension of learning more about this topic:

8. Extend Ecosystem Tag by playing round 2 where there are 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. After round 2 debrief what happens and ask students to explain why.

9. Another extension for Ecosystem Tag is round 3 where you add more consumers or less consumers and have students predict what will happen. At the end of each round, debrief what happened in each instance and why.

Evaluation

10. To evaluate students' learning, lead a discussion and ask the following questions:
 - a. How are all the groups dependent on one another?
 - b. How does each group contribute to the continuous functioning of the ecosystem, (i.e., abiotic components recycled and all groups have food)?
 - c. What happens when an ecosystem becomes unbalanced do to disturbance or human activities?
11. As questions are discussed, highlight key information and clear up misconceptions as necessary.
12. To wrap up the lesson, review the graphic on PPT Slide 11 related to producers, consumers, and decomposers.

Lesson 3: Migration Troubles (50 minutes)

Engage:

1. To engage students in this lesson, ask them to think about their own home. What about their home makes it a good place to live? Explain that their home is their habitat. Ask them why having a good habitat is important for organisms?

Explore:

2. Display PPT Slide 12 and define the word habitat. Discuss the picture on this slide and have students identify where a particular animal lives, feeds, breeds, and shelters within that habitat.

Explain:

3. Explain to students that 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 that 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.
4. Ask students if they use wetlands for hunting or any other traditional activities. Allow time for students to share personal stories or connections.
5. Display PPT Slides 13 and 14. 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.

Extension of learning more about this topic:

6. To extend this lesson, students will play the Migration Game.
7. Select a large playing area about 20 meters (65 ft) long. Place habitat markers randomly at either end.
8. Tell the student that they are playing the role of waterbirds and will migrate between these two areas at the teacher's 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. 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

9. 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].
10. Once you have explained the rules verbally, display PPT Slide 15 and go out into the hallway to walk through the expectations again.
11. 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...if you have duck costumes or headbands, those would be great here, too!)
12. Explain that there has been no loss in the area of available habitat. 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.
13. 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.
14. 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. Restoration efforts occur and habitat in the wintering grounds is rebuilt!
15. New birds introduced (all but 3 students). Three folks on the side are hunters. 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.

Evaluation

16. End the lesson with a discussion about the activity. As a group, identify the apparent causes of the birds' population decline from year to year and record on the board. (Example answers include: natural disasters, drought, pollution, predation by humans and wildlife, loss of habitat, etc.)
17. Ask students, "What human activities cause habitat loss and degradation for migratory birds? 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?"

Allow time for responses and then summarize what they have learned about some of the many factors that affect the success of aquatic bird migration.

18. If time allows, show the Wetland Odyssey Video on PPT Slide 16:

<https://www.youtube.com/watch?v=Ol2oNcbh-xw>

Additional Lesson Resources / Materials

References:

None

Websites for purchasing materials:

- All items can be purchased at Walmart or Target