



# WETLAND PLANT ADAPTATIONS

Wetlands are a challenging place to live! What specialized structures do wetland plants have that allow them to function and survive here?

## LESSON AT A GLANCE

### GRADE LEVEL

- 9th - 12th grades

### CORRELATING STANDARDS

- SC.HS.7.2.C
- SC.HS.10.5.D & E
- SC.HS.10.5.C

### ACTIVITY TIME

- 5-10 min - Warm Up:
  - Wetland Challenges
- A Few Weeks - Main Activity:
  - Research Project

### MATERIALS

- Wetlands of Nebraska Outreach and Education Guide
- YouTube Channel with wetland videos:  
<https://youtu.be/mwcwnSNwqBM>
- Resources to research Nebraska Wetland plant species
- Access to natural resource professionals as needed
  - Contact  
[ngpc.wildlifefeed@nebraska.gov](mailto:ngpc.wildlifefeed@nebraska.gov)
- Materials as needed by students for projects

## INTRODUCTIONS

Wetlands are unique aquatic ecosystems in Nebraska. The plants that live there have amazing adaptations that allow them to thrive! Using their special structures like roots, stems, and flowers they are able to function and reproduce, continuing the cycle of life in wetland habitats.

## OBJECTIVES

This lesson was designed to be used in partnership with the video "Wetland Plant Adaptations". The video and lesson will allow students to better understand that many plants can be found in Nebraska wetlands. Students will see that changing environments like wetlands can lead to changes in populations within that habitat. Plant growth can be affected by this phenomena.

### As a result of this lesson:

- Students will provide evidence that changes in environmental conditions may result in a change in the number of species.
- Students will understand that wetland plants are unique depending on where they live in Nebraska by taking a deep dive into researching one type of plant that interests them.

# BACKGROUND INFORMATION

## What is a Wetland?

How do we define wetlands? This type of habitat is made unique by three key characteristics:

1. **Vegetation** - water loving plants adapted to growing in highly saturated conditions grow here
2. **Hydric soils** - soils found here have developed under saturated conditions that limit oxygen (anaerobic conditions), they often carry a rotten egg smell
3. **Hydrology** - wetlands are saturated by water at some time during the growing season (the time when plants are actively growing)

Wetlands in Nebraska include marshes, lakes, river and stream backwaters, oxbows, wet meadows, fens, forested swamps, and seep areas. These wetlands vary greatly in nature and appearance due to physical features such as geographic location, water source, water permanence, and chemical properties. At some points during the year we may find that some wetlands are bone dry while others always contain some amount of water. There are instances where we may come back after a steady rain and the wetland will be filled to the brim with water. Some wetlands receive their water from groundwater aquifers while others are totally dependent on precipitation and runoff. And finally, the water chemistry of wetlands ranges from fresh to saline, and from acidic to basic. These descriptions identify the extremes of wetland characteristics. Nebraska's wetland resources possess these extremes and virtually every combination in between.

The vegetation, soils, and water that make up a wetland provide habitat for the many species found in Nebraska. The plants that depend on these habitats for survival often face challenges while living in such a dynamic environment. Many plant species have incredible adaptations that allow them to grow and reproduce in wetlands, while other species without these specialized structures would not be able to survive as well. Using their unique features these plants are able to function well in floods, droughts, saline conditions and more.

**Begin by watching the video Wetland Plant Adaptations found at:**

[https://youtu.be/rFU21Or\\_jEo](https://youtu.be/rFU21Or_jEo)  
or scan the QR Code



## The Challenges Plants Face in Wetlands

### When the Water Dries Up

One thing people don't usually realize is that wetlands go dry. Depending on the year, they might even stay dry all the time. While many plants would not be able to survive without water, there are other species that have adapted specifically to make it through these circumstances. The endangered plant Saltwort lives in Saline Wetlands surrounding the Lincoln, Nebraska area. The salty soil of these wetlands might cause other plants to wither away, but the Saltwort thrives! The succulent-like stem and leaf structures hold in water, much like a cactus does in a desert. Saltwort also has a root structure called a tap root. This single root structure taps deep into the earth, reaching water and nutrients found in the groundwater even when the topsoil is dry and crusted. Though this plant is listed on Nebraska's endangered species list, the Saltwort survives well in these unique saline wetlands found nowhere else in the state.

### Lack of Oxygen in Wetland Soils

While not all wetlands have salty soil, many of them do have soils that develop in conditions that lack oxygen. It's one of the qualities that make wetlands different from other habitats. And though plants don't have lungs like humans, they still need oxygen to survive. The cattail is an emergent plant, usually found standing in three foot deep water on the edges of wetlands. It addresses this watery challenge by taking in oxygen at the top of the plant and moving air down its stem to the roots and rhizomes underground and often, under water. It's almost like when humans use a snorkel to breathe while our mouth is underwater! This rigid stem structure also provides the cattail great support when faced with heavy floods or wind. Multiple cattail species can be found throughout Nebraska and are highly adaptive.

### Flooding

Nebraska's state tree is the Eastern Cottonwood. When the waters rise in a wetland, plants like the Cottonwood tree are the first to become submerged because they usually grow nearby. Oftentimes, this flooding can interrupt the normal exchange of oxygen and carbon dioxide between the tree and its environment, weakening the tree and making it susceptible to diseases. The impact to the tree is usually determined by how long it is covered with water. However, the Eastern Cottonwood has a strategy - shallow roots! By keeping its roots close to the earth's surface, they are the first to dry out when flood waters recede. While this isn't a total guarantee that they will survive, it certainly does help!



## The Challenges Plants Face in Wetlands continued

### Fast Flowing Water

In especially harsh flooding conditions, water can move swiftly through an area and cause problems for the plants growing there. That's why you'll notice that many Nebraska wetland plants have narrow and pointed leaves. The Arrowhead is one of these, with its triangular leaves that allow water to pass more smoothly by, therefore sparing the plant from large damage.

### Reproduction

We know that the ultimate goal of living things is to create more of themselves through various methods of reproduction. Plants have some truly incredible methods to achieve this, dispersing their seeds far and wide. If we take a look at wetland plants, we will notice that there are unique methods of reproduction happening there.

- Cattail plants actually use two methods to spread and create more of themselves. **Rhizomes** are thick branching tubers at the base of the plant that spread horizontally by sending out shoots or nodes. When you look at a giant stand of cattails you may actually be looking at just one plant! Cattails also spread through the seeds that will puff out of the fruit - a long hot-dog looking seed pod. These seeds can be dispersed by wind or water
- Similarly, the Eastern Cottonwood tree also has wind dispersed seeds. There are actually male trees that produce pollen which is carried on the wind to the female trees and their "catkins" - the flowering body. Once pollinated, the catkin pods will produce millions of white fluffy seeds to be carried away on the wind and water. Hence the name, cottonwood!
- A completely different plant with an explosive reproductive strategy can be found growing in the damp wetland areas surrounding Nebraska streams. Jewelweed, which looks similar to an orchid with its yellow and orange petals - attracts pollinators like hummingbirds. Once this flower is pollinated, it develops into an elongated seed pod structure. When disturbed, this structure undergoes a process called "explosive dehiscence" where the stored energy in the tissues of the pod are transferred to the seeds, thereby launching the seeds into the air in an effort to disperse them.



# ACTIVITY PROCEDURES

## Warm Up Activity:

### What Challenges do Wetland Plants Face (5-10 minutes)

Setting: Indoors

1. Begin with a class discussion. Ask the questions below, giving students time to answer each one and process as a group.
2. Share your first impressions after watching the video. Have you ever been to a wetland before? Did you notice the plants there?
3. What can happen to species as a result of living in a highly dynamic or ever-changing environment?
4. In the video, did you see any evidence of biological evolution?
5. What factors influence how plants evolve to survive in these habitats?
  - o Potential answers may include:
    - o Drought
    - o Flooding
    - o Lack of Oxygen
    - o High Winds
    - o Water Pollution
    - o Stagnant standing water
    - o Insect Attacks
6. Is there a specific wetland plant species that you would like to know more about?



# ACTIVITY PROCEDURES CONTINUED

## Main Activity:

### Wetland Plant Research Project (A few weeks to quarter of year)

Setting: Indoors

1. This project will be done over an extended period of time to allow students more time to guide their own learning about a topic of their choosing related to wetland plants. Students could work in partners if it makes sense for the project type and the work will be evenly shared, otherwise they may work individually.

#### 2. Observation and Questioning Phase

- If it is possible, try to take your class out to a wetland to familiarize them with the plants they find there and the ecosystem in general.
  - If you can make it to a local wetland, do a bioblitz!
  - Learn all about what a bioblitz is by visiting: <https://media.nationalgeographic.org/assets/file/NationalGeographicBioBlitzGuide.pdf>
  - Check out a bioblitz trunk: <https://outdoornebraska.gov/learn/classroom-resources/wildlife-education-trunks/>
  - During the bioblitz, encourage students to ask several questions that have the potential to be explored with research.
- If you can't get to a wetland, have students watch videos from [nebraskawetlands.com](http://nebraskawetlands.com) or read through the Guide to Nebraska's wetlands.
  - Did anything stand out to students from this exploratory time? What do they want to know more about? Is there a local wetland plant that caught their attention?
  - Encourage students to choose a Nebraska wetland plant that they would like to know more about.
  - Research will be easier if students have one key question they are trying to answer about their plant.

#### 3. Research Phase

- Once students have chosen their plant, it's time to research this in depth.
- Using their question as a guide, such as "What strategies does this species use to survive?" or "How has this plant evolved over time in Nebraska?" students will begin looking for resources to help them answer this question. This should be displayed in the project.
- Ultimately, students should create something that displays a thorough understanding of their chosen species that shares the following information about the plant:
  - See next page



# ACTIVITY PROCEDURES CONTINUED

- Common Name
  - Scientific Name
  - Description of Plant
  - Habitat Type + Soil Type
  - Water Needs
  - Native Range
  - Ecological Significance
  - Cultural Significance
  - Pollination Strategies
  - Seed Dispersal Strategies
  - Interesting Facts
  - Observations
- If a local plant is chosen, hopefully students can do some in-person research and observation over some time. Revisiting the same plant once a week, etc. This phase will look unique depending on the student and what they want to know more about.

## 4. Project Creation Phase

- Oftentimes, video and photography can be a great way to share about research that has been done - much like the Wetlands Outreach and Education project. Other forms of art and writing can also be a great way to communicate science.
- Challenge students to take the findings from their research and create a product that shares what they learned. Allow students the flexibility to create something that is unique to them and in line with a format they are interested in.
- If you need some ideas, this could look like:
  - A tik-tok or reels-styled video clip that shares information about their chosen wetland plant (will require editing software)
  - Regular video
  - An infographic
  - A poster
  - A podcast episode
  - A work of art or nature journal entry series
  - A poem or short story



# ACTIVITY PROCEDURES CONTINUED

## 5. Project Sharing Phase

- Organize a way to share your students' projects in a way that works well for your classroom.
- Set aside time for viewing of any films or listening to any audio.
- Do a gallery walk-through for any art, graphics or posters created.
- This should be a culminating experience for everyone's project at the end of a quarter. Grading will be based on educators' preference.
- Student participation in this sharing of knowledge on wetland plants could include evaluating the work of classmates by answering basic questions for each project.
  - What is the name of the plant?
  - Where does it live?
  - What is one constructive critique you would give this project?
  - What is one compliment you can offer this project?
  - What is one thing you wonder about this plant based on your classmates' project?

## **Wrap Up:**

### **Discussion Questions**

- Have students' perspectives of wetlands changed over the course of their research? If so, how?
- What do students still wonder about wetlands and the plants that live there?
- What is something new that students learned during this process?





# ACTIVITY PROCEDURES CONTINUED

## Extension Activity:

### Dissect a Cattail (45-60 minutes)

Setting: Indoors

#### Tools

1. Evaluate your dissection tools on a regular basis. Only use quality dissection tools that are sharp and free of rust. Handle all scalpels, razor blades and other sharp instruments with caution, and don't use excessive force when working with or cleaning sharp instruments. Dull and dirty scissors, scalpels or blades are much more dangerous than sharp, clean ones. Throw away any instruments that are damaged and cannot be repaired.
2. If dissection is new to students, practice the procedures first with an orange and necessary tools to ensure proper usage and student's ability to follow instructions.
3. How to dispose of materials if needed. Always cut away from the body and away from other people. Reposition the specimen or move it to ensure safety if needed.

#### Cattails

1. Identify an area where Cattails are abundant, and removal won't harm existing activities such as bird nesting. Remove enough plants for students to split in groups of 3 to 4 (ex. 27 students - about 9 stems of cattail)
2. Reach out to your local natural resources group if you're not sure where to source cattails. Resource professionals should be able to advise you.
  - o If possible, remove the invasive Narrow-leaved cattail.
    - <https://elibrary.dcnr.pa.gov/GetDocument?docId=1738749&DocName=cattails.pdf>
  - o Broadleaf or Common Cattail is native to Nebraska.  
[https://www.wildflower.org/plants/result.php?id\\_plant=tyla](https://www.wildflower.org/plants/result.php?id_plant=tyla)  
each structure.
3. Once you have acquired enough cattails, begin by securing the specimen to something secure. Because cattails are quite long, you may want to use several dissection trays or simply a long piece of cardboard where it can be secured. If it's easier, assign students in their small groups to separate the cattail by its structures.



# ACTIVITY PROCEDURES CONTINUED

4. If it's easier, assign students in their small groups to separate the cattail by its structures.
5. Each cattail structure could have its own tray. The flower/seeds, stem, leaf, and roots make up four separate structures on the cattail and each could be looked at individually. This could allow for each student to take a turn making observations with each structure.

## Procedures

1. You may choose to use the I Notice, I Wonder worksheet to begin the observation phase. Otherwise, begin by having students sketch all the different parts of the cattail from observation, using the worksheet attached if desired. If you are going to split the cattail into pieces, it may be best to sketch before this is done, allowing students to view the whole plant. If possible, students should label each part of the plant as well.
2. Inspect the roots.
  - What shape are they?
  - Do they have a smell?
  - Can they identify the roots?
  - Can they find any rhizomes attached? If so, cut a cross-section!
3. Check out the shoot area.
  - Cut a cross-section and sketch what you see.
  - What is the texture of this area like?
4. Take a closer look at the stem. Note that the inner part of the stem is called the pith.
  - What is the stem's function?
  - Do they have a smell?
  - Does it have a texture?
  - Cut a cross-section of the stem and use a microscope if needed to see what it looks like. Sketch what you see! Does it differ from other cross-sections?
  - What are those holes for? (Hint: It's in the video!)
  - If desired, cut a section of the stem length-wise. What is inside?
5. Examine the leaf.
  - Where does it attach to the stem?
  - Does the leaf look the same on both sides?
  - Does the cattail leaf tear easily?
  - Cut a cross-section of the leaf and sketch what it looks like. Use a magnifier to view more closely if needed.

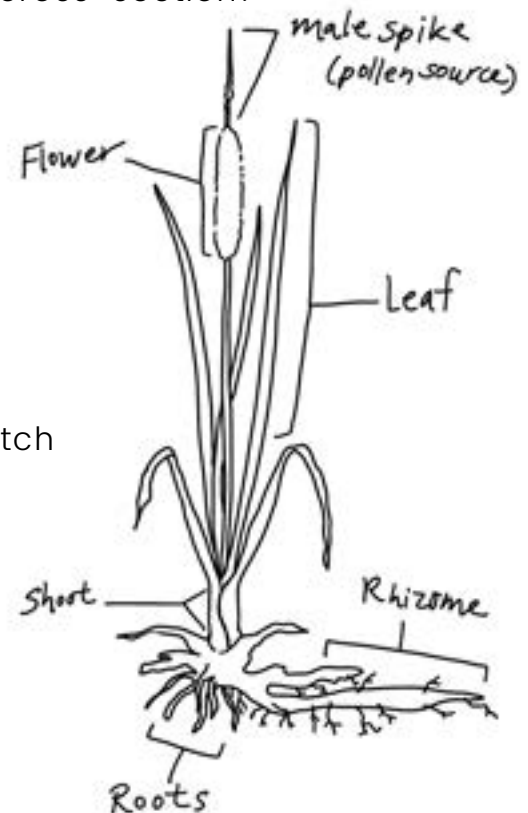


Illustration by Grace Gaard

# ACTIVITY PROCEDURES CONTINUED

## Procedures Continued

6. Explore the “cats’ tail” or “hot dog” part of the cattail. This is the flower and eventual seed pod structure if pollinated. Pollen usually emerges from the top half of the flower structure, with the female structure and future seeds (if pollinated) lying below.
  - Pull out some of the seeds. Are they developed?
  - Sketch an individual seed.
  - Inspect the area above the flower where pollen is released by wind. Can they see any signs of this?
  - If possible, cut a cross-section of the flower area. What do you see? Sketch this by making close observations.

## Wrap Up:

### Discussion Questions

- What did students learn about cattails from this exploratory dissection?
- What surprised them the most?
- What was most interesting about the flower part of the cattail?

## Check out the entire Wetlands of Nebraska Project:

Take a deep dive into Nebraska’s best wetlands resources, including expanded website content, documentaries featuring Nebraska’s five main wetland types, printed guides and more!

Find it at [www.nebraskawetlands.com](http://www.nebraskawetlands.com), or scan the QR code.

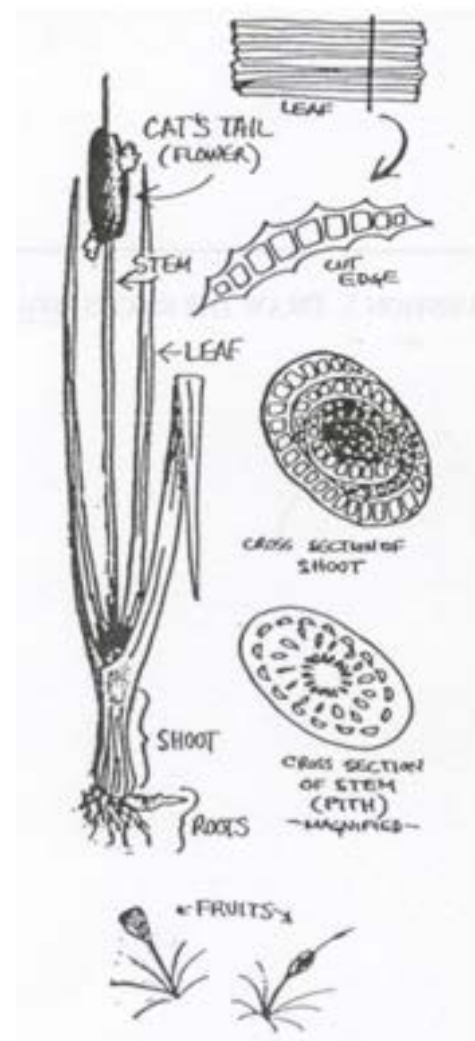


Diagram by allegheny.edu

Author: Grace Gaard  
Nebraska Game and Parks Commission, 2023

Contact: [NGPC.WildlifeEd@nebraska.gov](mailto:NGPC.WildlifeEd@nebraska.gov)

I NOTICE...

I WONDER...

IT MAKES ME THINK OF...

MAKE A DIAGRAM OF THE CATTAIL PLANT AS YOU DISSECT IT. LABEL ITS STRUCTURES AS YOU GO. TURN OBSERVATIONS INTO SKETCHES.