Wetlands Wonderers:
Protecting Nature's Hidden Treasures

Duke Farms Lesson Plan

Elementary School:
Second Grade

Age Range: 7–8

Standards

Next Generation Science Standards

2-LS2: Ecosystems: Interactions, Energy, and Dynamics

- LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats.

K-2-ETS1: Engineering Design

- ETS1-1: Ask questions, make observations, and gather information about a situation people want to change (e.g., climate change) to define a simple problem that can be solved through the development of a new or improved object or tool.

Duke Farms

Wetlands Wonderers:
Protecting Nature's Hidden Treasures

Guiding Question

- Why are wetlands so important?

Learning Goals

Objectives

Students will be able to

- Describe wetlands.
- Describe the important impact of wetlands in nature.
- Describe the potential effects of climate change on wetlands.
- Identify potential solutions to wetland threats.

Materials

- Lesson plan
- *The Magic School Bus* episode "The Magic School Bus Gets Swamped" (season 4, episode 5, currently available for free on Archive.org, YouTube, and other sites)
- Scavenger Hunt Handout
- Map of Duke Farms with locations for this activity highlighted

Background Information

Wetlands are places where water accumulates because there is no place for it to drain. This makes the ground constantly wet and full of water. It is possible to see shallow water sometimes in marshes, swamps, bogs, or fens. All of the different wetlands have different soil, plants, and animals depending on where they are, where the water comes from, and how wet they are. For example, swamps and marshes can both be based on fresh water or salt water, but swamps can have trees and marches cant. Bogs and fens can only have fresh water but it's hard to walk through a bog because it is covered in peat and it's squishy and soft because they depend on rain and poor drainage. Fens depend on ground

Background Information (continued)

water and are the rarest kind of wetland. Wetlands are ecosystems that are different from any others ecosystem (like a forest or grasslands).

n this activity youth learn about the importance of ecosystem services. An ecosystem is a group of features that are interconnected and are formed by organisms interacting with their environment. Ecosystem services are part of our every day lives even if we don't always know it. They are natural processes that support a healthy environment and life on earth. Ecosystem services support essential processes like creation of clean water, heathy soils, production of oxygen, and breaking down waste products. Ecosystem services provide the benefits that humans receive from nature. They support almost every aspect of human well-being, including our health, security, and economy, and impact climate change in a positive way.

Most people are unaware of ecosystem services keep our planet, and us, healthy and safe. But there are ways that we can support the ecosystem! Every time we recycle, or turn lights off, or don't waste water we are helping.

Teaching This Activity

Preparing for your trip to Duke Farms

- Print or save a copy of the Map of Duke Farms with locations for this activity highlighted.
- Make copies of the handout for students to use while at Duke Farms.
- Bring pencils for each student to use.

Engage in the Classroom

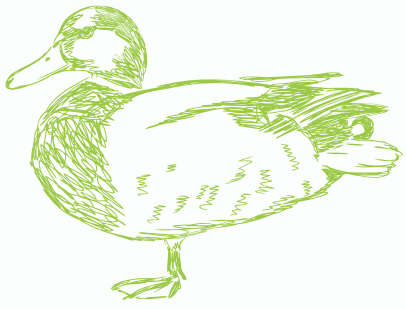
- Introduce *The Magic School Bus* episode "The Magic School Bus Gets Swamped" to students and ask them to pay attention to:
  - What wetlands are
  - The plants and animals that live in the wetlands or swamp,
  - What the swamp does for the town of Walkerville,
  - And the reasons Ms. Frizzle's students find to protect the wetlands.
- Pause the video as you go to discuss what they've noticed:
  - Describe wetlands together
  - A lowland area that is mostly covered with water all year or seasonally, with some marshy or soggy areas, so that the land is saturated with water[1]
  - Discuss the variety of plants and animals that live in the wetlands habitat in the video and in real life/the local community.
- Additional wetlands information to share with students from Essential Habitats | U.S. Fish & Wildlife Service (fws.gov):
  - "Up to one-half of North American bird species nest or feed in wetlands"
  - "Nearly half of federally threatened and endangered species need wetlands for their survival"
  - "Although wetlands only cover approximately 5 percent of the land surface in the lower 48 states, they are home to 31 percent of plant species."

Engage in the Classroom (continued)

- Additional wetlands information to share with students from Why are Wetlands Important? - Wetlands (U.S. National Park Service) (nps.gov):
  - "Wetlands provide habitat for many species of amphibians, reptiles, birds and mammals that are uniquely adapted to aquatic environments. Upland wildlife like deer, elk and bears commonly use wetlands for food and shelter. Wetlands are particularly vital to many migratory bird species. For example, wood ducks, mallards, and sandhill cranes winter in flooded bottomland forests and marshes in the southern U.S., and prairie potholes provide breeding grounds for over 50% of North American waterfowl."
  - "Freshwater and marine life including trout, striped bass, pike, sunfish, crappie, crab, and shrimp rely on wetlands for food, cover, spawning, and nursery grounds. Between 60% and 90% of U.S. commercial fisheries depend on wetlands."
  - "About one-third of all plants and animals listed as threatened or endangered species in the United States depend on wetlands for their survival, including whooping cranes, American crocodiles, the dwarf lake iris and several orchid species."
  - "Nearly 7000 plant species live in U.S. wetlands, many of which can only survive in these wet environments."
  - "Some wetland types are among the most productive ecosystems on earth. A stand of cordgrass in a salt marsh can produce more plant material and store more energy per acre than any agricultural crop except cultivated sugar cane. Nutrients and plant material flushed from some wetland systems during storms provide essential food for plants, fish, and wildlife in estuaries and other downstream ecosystems."

Engage in the Classroom (continued)

- List together the ways the wetlands support Walkerville.
  - Introduce the concept of ecosystem services – that nature and ecosystems provide value and worth (sometimes economic value) to humans, including provisioning ("food, water, and resources, including wood, oil and genetic resources and medicines"), regulating services ("climate regulation, flood regulation and other hazard regulation, pollination, water purification") cultural services ("non-material benefits … [like] spiritual enrichment, intellectual development, recreation and aesthetic values") and supporting services ("photosynthesis, the water cycle and nutrient cycles [that] are the basis of ecosystems, which in turn allow us to support ourselves"). (Explainer: What Are Ecosystem Services? | Earth.Org)
  - Make a list on the board with the four kinds of services each as a column.
  - Ask the students to sort the ways the wetlands in the video supported Walkerville into these categories.
- Use the last part of the video when the show's producer responds to a call from a kid viewer to have students check their work.
  - Did they get everything the producer listed?
- Explain that wetlands can be found in every county in the United States, and that the class will be taking a trip to Duke Farms to look at two special kinds of wetlands right here in their state—one that is constructed/human-made, and one that is reconstituted.
  - Explain that the constructed/man-made wetlands were created by Duke Farms staff to provide some of the ecosystem services shown in the video/that you talked about—the constructed wetlands help to filter the water used by staff at Duke Farms to prevent their wastewater from harming the environment.
  - The reconstituted wetlands means that the area was altered by people in the past, but that the staff recognized the importance of wetlands and ensured the area was able to become a wetland again.



Engage in the Classroom (continued)

- Help students get ready for their visit to Duke Farms.
  - Tell students that you'll be going on a trip to Duke Farms. Explain that the property is a special place that protects nature and provides spaces for children to learn about nature while in nature.
  - Let them know that on the visit to Duke Farms, they will have a chance to learn more about the important services wetlands can provide.
  - Duke Farms also provides a place where children can learn to be scientists and practice the scientific process. Older children sometimes even help the staff at Duke Farms to study the plants and animals there!
  - During the visit to Duke Farms, they'll be able to make observations about different kinds of wetlands.
  - Then after the trip, they'll use what they've learned to examine the areas around school.
  - Be sure to tell them that it will be fun and exciting to see different grasses, plants, leaves, flowers, and trees, but it's very important that they learn to be good observers, or lookers with their eyes. To be good protectors of nature, we don't want to pick any flowers or plants. And we definitely don't want to touch any birds or animals.

Teaching This Activity (continued)

Explore at Duke Farms

Orientation

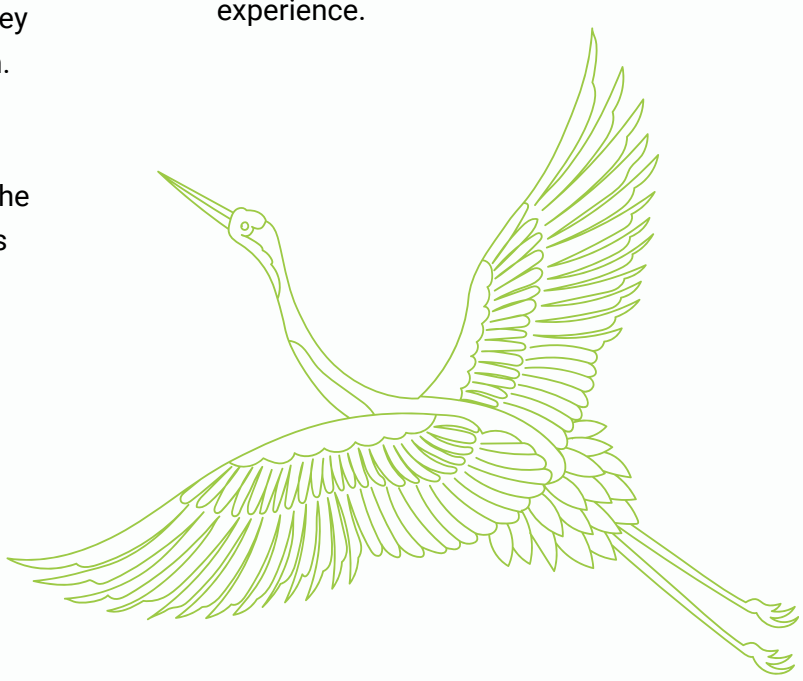
- Gather at the orientation center. Remind students that Duke Farms is a special place that protects nature and provides spaces for children to learn about nature while in nature.
- Explain that they are going to explore wetlands just like the kids from the *Magic School Bus* episode. And today's assignment will be to compare two different wetland areas here at Duke Farms.
- Remind the children that it will be fun and exciting to see different grasses, plants, leaves, flowers, and trees, but it's very important that they learn to be good observers, or lookers with their eyes. To be good protectors of nature, we don't want to pick any flowers or plants. And we definitely don't want to touch any birds or animals.

The Wetlands

- On the walk from the Orientation Center to the Wetlands, ask students to think of five things they know about wetlands after watching and discussing the video.
    - Have each student share one thing they remember from the video.
    - Stop with students at the constructed wetlands.
    - Explain the purpose of the constructed wetlands is to help filter waste from the staff and visitors.
- Give students time to observe the constructed wetlands.
    - What do they notice?
    - What do they see? Hear? Smell?
- Break students into groups and give each group the Scavenger Hunt handout.
- Tell them to work together to search for these plants and animals, mark the chart with the photos for all they find, and to take notes on the three-column chart of their observations.
    - Let students know that they may not find all of the animals. The blackbirds migrate south in the winter, so one may not be around if it's a colder month. Some animals may shy away from a large group of kids.
- It's okay if they don't find everything in the chart, but encourage them to make detailed notes on the animals and plants they do find.
    - Tell students to use the three-column page at the end of the handout to record these observations.
    - Tell them to note where they found their animals (the man-made or natural/reconstituted wetlands), how easy each was to find, if there are many or just a few, and what might make the wetlands a good habitat for them.
    - Have students make a list of observations at each of the two wetlands and compare the features they noticed.
        - Ask the students to list at least two things that are the same and two things that are different.
- Remind students that people made these wetlands to help offset human waste and activities on the property.
- Encourage students to ask questions about how the wetlands were constructed and what purpose(s) different elements of the construction serve.
    - There is a sign near the constructed wetlands with more information that can be helpful with their questions.

Explore at Duke Farms (continued)

- Ask the students, “If these wetlands were to disappear, what would happen?” and, “Can climate change affect the wetlands?”
    - Students might give examples from the video like that the plants and animals here would lose their habitat or home, or that the wildlife could struggle to survive, or that the land nearby might be more likely to flood during or after a strong storm.
    - They may also want to talk about there being more waste that would need to be handled somewhere else instead of through the constructed wetlands.
    - Wetlands are interesting in discussions of climate change because while they are “vulnerable […] to changes in temperature and the timing and amount of precipitation,” and “sea level rise and changes in water chemistry” and “can be a source of greenhouse gases, especially when disturbed,” they are also part of carbon sequestration. Wetlands are “an important sink for greenhouse gases, where carbon is stored and prevented from entering the atmosphere.” Potential vulnerabilities include loss of and changes to soil structure, more frequent flooding or drought, saltwater intrusion into freshwater wetlands, and changes to plant and animal life in the area. (Wetlands & climate change - Washington State Department of Ecology)
- As global temperatures rise, wetlands may become even more important because of the very ecosystem services that the class discussed and have seen in the video and here at Duke Farms.
- Make a note of any questions you don’t know the answer to and ask the students “How can we find out together?” Validate the suggestions.
    - If a student suggests asking Duke Farms staff then tell students that your class can reach out to ask the staff at Duke Farms just like kids could do with the producers of the Magic School Bus show, except via email instead of over the phone.
    - Students may suggest other ways as well: look on the internet, look in a book, etc.
    - Back in the classroom use a couple of these methods to deepen the experience.



Teaching This Activity (continued)

Elaborate and Extend Back in the Classroom

- Have students take out their scavenger hunt handouts. Ask each group to share one thing they found and explain:
  - What did they find?
  - What part of the wetlands had it?
  - Were there a lot of very few of this plant/animal?
  - What are some things that threaten this plant/animal?
  - What makes the wetlands a good habitat for them?
- Once all the groups have shared, compare the plants, animals, and observations they made about the two wetlands areas.
  - What were two things that were different?
  - Two things that were the same?

Elaborate and Extend Back in the Classroom (continued)

- Ask students if there are any areas around the school that remind them of wetlands.
  - Are there any spots where there's a lot of mud or where water stays for a long time after it rains?
  - What if a big storm came through, like the one in the video, and that part of the school grounds flooded?
  - What would that be like?
- Ask students to brainstorm ideas for what kinds of tools or objects or changes to that area of the school could help manage built-up mud or deep puddles after a heavy rainstorm.
  - Encourage the idea of plants helping with flooding.
  - Ask students if any of the parts of the constructed wetlands might be helpful.
- Consider helping students create a mini-constructed wetland habitat—or allowing a natural wetlands area to reconstitute—in that area of the school grounds if you can get permission from the administration.
  - Reinforce the idea that plants and animals make up the wetland.
  - What kinds of plants, animals, birds, and insects can they support on school grounds?
  - Have students observe this habitat periodically and make notes of what kinds of plants or animals they see there.
- Have students make a list of some things they can do to protect and support wetlands.

After This Activity

Measurement

- Student handouts, share outs, participation in discussions, and observation notes.

Feedback for Duke Farms

- Scan student observation notes to share with Duke Farms
- If you create a small constructed wetlands habitat, share photos with Duke Farms
- Complete feedback survey

Scavenger Hunt Handout

Wetlands Observations

Look for these animals and plants that were featured in *The Magic School Bus* episode we watched in class. Put a circle, X, or check mark in the box for every one you find. Note if you found it in the man-made wetlands or the natural/reconstituted wetlands.

Red-winged blackbird	Tiger mosquito	Cattail
		
• Their call ("conk-a-reeeeee!") is unique and recognizable. • They migrate south for the winter, so you may not see them in colder months.	• This is one of the most common mosquitoes we have, and easily identified by their stripes (hence, tiger). But it's one of many species.	• Cattails are a tell-tale signifiers of wetlands and can easily be recognized by their height and sausage-shaped flower. • The fluff attached to their seeds and helps with dispersal, so they'll look intact in the spring and summer, but then burst open in fall when the seeds are mature.

Duke Farms

Scavenger Hunt Handout

Dragonfly	Snapping turtle	Muskrat
		
• Dragonflies are easily differentiated from a related group called damselflies by the way the hold their wings when at rest: dragons spread them out to the side, while damsels hold them alongside their bodies. Dragons are generally stouter-bodied and damsels more slender.	• Lots of turtle species live in wetlands, but snapping turtles are unmistakable. They're huge and have gnarly, spiky bumps on their shells. • You might see them lumbering along as they move from one body of water to another, but most often you'll just see their little heads poking up from the surface of the water. • Their bite is fierce. If you're lucky enough to see one, observe from a distance.	• You can differentiate muskrats at a glance from beavers, which Duke Farms also has, by their tails. Beavers have a flat, paddle-like tail, while muskrats' tails are scaly. • Otters and fishers are some other wetland mammals, but they're all pretty distinct in person. If you're fortunate enough to see any of these, you'll probably remember enough about what they looked like to look it up successfully later.

Duke Farms

Scavenger Hunt Handout

Red-tailed hawk

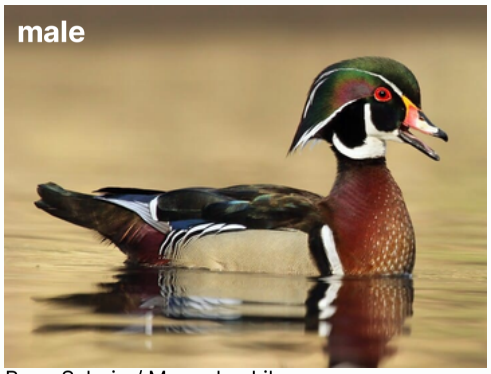
- Red-tailed hawks are pretty common at Duke Farms, so there's a good chance you'll see one.
- Their red tails look tawny, and they have white and brown speckled breasts.
- What is easy to tell apart from a hawk, even for beginners, are turkey vultures. These are common at Duke Farms. You know you're looking at a turkey vulture if they're flying in a lazy, tilting manner with their wings in a shallow V (for vulture) shape while soaring. Hawks hold their wings flat across when they soar.

Wood frog

Green frog

- If either of these frogs stays put long enough for you to notice details, you can tell the wood frog from the green frog by the size of the tympanum (ear drum). The green frog's is bigger.
- Also, wood frogs have a dark eye mask that greens do not.

Wood duck



Ryan Schain / Macaulay Library

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Duke Farms

Scavenger Hunt Handout

Mallard

Christoph Moning / Macaulay Library

Joshua Vandermeulen / Macaulay Library

Red maple

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- Maple vs. oak (next page) is a good place to start with tree identification for beginners, because they're both quite common and have some recognizable traits.
- Maple leaves look like the Canadian flag, and red maple leaves in particular have 3 lobes (the pointy bits). 3 for R-E-D is easy to remember.
- Maples also have helicopter seeds ("samaras", technically) and distinct looking buds, as above.
- They also have what's called opposite branching, meaning that their twigs emerge from their branches two on each side, opposite from one another, like arms.

Scavenger Hunt Handout

Blue flag iris

- This blooms reliably in the constructed wetlands beginning in May.
- When it does, there's no mistaking it. The color, size of the flower, and robust, blade-like leaves are all giveaways.

White oak

- Instead of opposite branching like maple trees, oaks have what's called alternate branching. Twigs emerge from branches one at a time, first on the left, then the right, and so on.
- The oak leaf shape is also pretty recognizable for most people. Note that white oaks have rounded lobes, while some other oaks (like red oaks) have sharply pointed lobes.
- Then, of course, there's the acorns. Look for these on the ground for a clue that there are oak trees nearby.
- Oak flowers emerge in spring and look like dangly, bright green strings of beads.

Scavenger Hunt Handout

Great blue heron

Common reed

- This is an aggressive invasive wetland plant that gets very, very tall. And when there is any of it, there's A LOT of it.
- It often co-occurs with cattails (and unfortunately will outcompete them in a lot of cases).

Wetlands Observation Notes

Constructed Wetlands	Both	Natural/Reconstituted Wetlands

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Wetlands Observation Notes

Constructed Wetlands	Both	Natural/Reconstituted Wetlands

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KEY: Wetlands Observation Notes

Constructed Wetlands	Both	Natural/Reconstituted Wetlands
• Blue flag iris	• Great blue heron • Red-winged blackbird • Cattails • Common reed • Dragonflies	• Trees (red maple, white oak) • Frogs (green frog) • Dukes (wood ducks, mallards)

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