



Nature Navigators: Appreciating Ecosystem Services

Duke Farms Lesson Plan

Elementary School:
Fourth Grade

Age Range: 9–10

Standards

Next Generation Science Standards

4-ESS3: Earth and Human Activity

- ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change have on humans.

3-5-ETS1: Engineering Design

- ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.



Nature Navigators: Appreciating Ecosystem Services

Guiding Question

- How can we create a planet where human and natural beauty both thrive?

Learning Goals

Objectives

Students will be able to

- Understand the four types of ecosystem services.
- Explore ways human-made and naturally occurring beauty in nature can benefit people.
- Identify and compose a design problem reflecting an ecosystem or climate need around the school, including criteria for success and materials, time, or cost needs.

Materials

- Lesson plan
- Aesthetics Handout
- Ecosystem Services Handout
- Call for Proposals Template
- Map of Duke Farms with locations for this activity highlighted

Background Information

In 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, healthy 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.



Duke Farms

For this and other lesson plans, go to:
dukefarms.org/education-resources/

Background Information (continued)

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.

Aesthetics as an ecosystem service depends on the appreciation of the environment. If we value the environment, we are more likely to take care of it. It is enhanced by our appreciation of biodiversity—we like to see different plants and animals—which improves the quality of our lives and is connected to environmental consciousness and supporting behaviors. For example, if we think a meadow is beautiful we are less likely to do something to hurt that beauty. If we appreciate how trees look, we hesitate to destroy forests. And, it encourages us to be pro-active. We plant gardens, we encourage the preservation of nature—like national parks. If we think it is beautiful, we take care of it.

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 concept of ecosystem services – that nature and ecosystems provide value and worth (sometimes economic value) to humans
- Show students an illustration of the concept:
 - From Island Nature Trust's "[An Introduction to Ecosystem Services](#)" - [Ecosystem-services-natural-areas.png](#) or
 - From the Fermi National Accelerator Laboratory and the U.S. Department of Energy's "[Ecosystem Services](#)" - [Ecosystem-Services.jpg](#)



Engage in the Classroom (continued)

- Define the four types of ecosystem services:
 - 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”).[1]
- Make a list on the board with the four kinds of services each as a column.
- Ask the students to think of some examples from their own experiences
- Explain to students that sometimes we focus on some of these services and neglect others.
 - Provisioning—making sure we have enough water, food, medicines, and resources to heat our homes and schools—can take up a lot of our attention! But sometimes the cultural services, like aesthetics can be just as important.
 - Ask if anyone in the class knows what aesthetics means.
 - Explain that aesthetics is about art and beauty, and how people can get enjoyment from something in nature or something another person made because it is pretty or beautiful or makes them experience an emotion or feeling.
- Give students the three-column chart handout and give them time to brainstorm examples of naturally occurring beauty, human-created beauty, and examples that might be both.
- Generate a list of their ideas on the board or on large chart paper.
- Ask them to think more deeply about their list—which of their examples of human-created beauty impacted nature? How do their examples of naturally occurring beauty impact humans?
- Ask if there are any examples they listed that they would like to move to a different list.
- Try to come to a consensus in the class.



Engage in the Classroom (continued)

- Ask students to think about what areas around the school have naturally occurring beauty, human-created beauty, or both.
 - Are there areas around the school where nature seems to be fighting against what people have put there?
- Have students list examples of spaces they inhabit that are designed – their school grounds, their neighborhoods, their homes, community organizations
 - Where are plants?
 - How are the plants tended?
 - Do they grow naturally or are they controlled, mowed, trimmed, etc.?
 - Are there any animals that impact those spaces?
 - Who is responsible for that?
- Have students brainstorm ideas for a project they could do around the school that could encourage both naturally occurring and human-created beauty.
- 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 ecosystem services and aesthetics.
- 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 ecosystem services in an area of the park that has both human-made and naturally occurring beauty
- Then after the trip, they'll use what they've learned to think about what would be needed to create a space at school that provides some of those same ecosystem services
- 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 the Old Foundation and Great Meadow area, where you can see beauty that is both naturally occurring and human-made and in between. And today's assignment will be to observe all the benefits we can get from nature.
- 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.



Duke Farms

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Explore at Duke Farms (continued)

Old Foundation and Great Meadow

- As you walk with students to the Old Foundation and Great Meadow area, remind them about your conversation about how sometimes humans try to contain nature's beauty and that sometimes nature impacts the things humans create.
- Ask students to take note of and point out to each other any examples of this that they see along the way.
- When you arrive at the Old Foundation and Great Meadow area, give students a few minutes to look and walk around and experience the place.
- Encourage them to focus on what they see, hear, smell, and how these make them feel.
- Bring students back together and ask them to share examples of naturally occurring beauty, human-created beauty, or both that they noticed.
 - For each student who shares, encourage them to explain not just what they saw and observed but also how it made them feel or what it makes them think about.
- Ask students to think about what this area might look like if the building had been finished and make notes or jot down their ideas. Would there be more beauty here? Why or why not?
- Give students time to think and then share out some of their thoughts.
- Explain the history of this building—that the Duke family was building a mansion but stopped after the completion of the foundation due to material shortages and other factors. So, nature has had decades to reclaim the foundation for itself. But if you turn around, there's an orderly and maintained yard with a natural meadow just behind it.
 - So this area is an example of both what people sometimes do to enforce their wills on nature—like building a home, landscaping a yard, etc.—and what nature sometimes does to take that area back.
 - Remind students that there are other benefits in addition to aesthetics that nature provides to humans.
- Give students the ecosystems services handout.



Explore at Duke Farms (continued)

- Explain that in pairs or groups (depending on the class size and the number of chaperones) the students will start by looking for examples of Cultural Services since they've already talked a little about the Aesthetics Services, and should already have some examples they can put in that row.
 - Split students into pairs or groups.
 - Give them time to explore the area again to provide examples of recreation, education, and stewardship this area of nature can provide for them.
 - Remind students to take some time to brainstorm and discuss the questions on the handout.
 - Bring students back together. Have one student from each pair or group share one example of recreation, education, or stewardship they wrote down. Tell students you'll come back to the brainstorming questions later, after they've had time to explore some of the other services.



Jigsaw Activity:

- Assign each group one of the other categories of ecosystem services.
- Give students time to explore more of the area and find examples of these other categories.
- When students have their examples, reorganize groups so each category is represented and have the original group members teach the others about their category examples.

Alternate Option 1:

- Have students explore a different area of Duke Farms for the remaining categories.
- Many areas of the park have overlapping ecosystem services, but you can have students try to identify the goal of the area:
 - Does it look pretty?
 - Are there lots of big trees?
 - Are there lots of flowers?
- Examples of other area include:
 - The Research Woods: this area's main objective is not aesthetics. It's an area where staff have added native plants and taken out invasive species.
 - The Orchid Range and the area outside it: students could compare the ecosystem services inside and out. This area features landscaping with native plants to combine human-made beauty with regulating services.
 - The Arboretum: While this area is a farther walk, it features a large collection of trees and would make a strong comparison to the Foundation and Meadow area.

Explore at Duke Farms (continued)

Alternate Jigsaw Option:

- If you have enough time and chaperones, send groups to different areas of Duke Farms to become experts on the ecosystem services those areas represent.
- Assign each group one of the other areas listed above (Research Woods, Orchid Range, and/or the Arboretum).
- Have each group explore their area and fill out the ecosystems services handout for that part of Duke Farms.
- Meet back together at a central location and have the groups serve as tour guides of their areas, pointing out examples the group found of the different ecosystem services as the whole group walks through.



Teaching This Activity (continued)

Elaborate and Extend Back in the Classroom

- Ask students to take out the ideas they had about spaces at school to encourage both naturally occurring and human-made beauty
- Thinking about the conversations you had at Duke Farms, ask students to choose one of their ideas and explore what would be needed to make it happen.
 - What kinds of resources would you need?
 - How much time would it take?
 - How could you create this space and how would you ensure that it has both naturally occurring and human-created beauty?
- Give students the Call for Proposals template. Explain the pieces required.
- Have students create a call for proposals to create their desired space.
 - Be sure to include specific criteria for success and constraints on materials, time, or cost.
- Ask students what their favorite part of going to Duke Farms was.

After This Activity

Measurement

- Student handouts, participation in discussions, and completed call for proposals.

Feedback for Duke Farms

- Share examples of student work with Duke Farms
- Complete feedback survey



Aesthetics Handout





List any examples you can think of that fit in the following categories of beauty:

Naturally Occurring Beauty	Both	Human-Created Beauty



Ecosystem Services Handout

Write down at least two (2) examples of each type of ecosystem service that you observe in the Old Foundation/Great Meadow area.

Cultural Services: Non-material benefits and values people get from ecosystems	
<p>Stewardship</p> 	
<p>Aesthetics</p> 	<p>(Include examples of naturally occurring beauty, human-made beauty, and both.)</p>
<p>Recreation</p> 	
<p>Education</p> 	



Ecosystem Services Handout

Brainstorming Questions

Why might Duke Farms have decided to keep the Old Foundation here?







What kind of ecosystem services were people tapping into when the mansion and Great Lawn were being constructed?

What kind of ecosystem services are the staff at Duke Farms benefitting from the land as it is now?



Ecosystem Services Handout




Write down at least two (2) examples of each type of ecosystem service that you observe in your assigned area of Duke Farms.

Regulating Services	
<p>Pollination</p> 	
<p>Climate Control</p> 	
<p>Flood Control</p> 	
<p>Cleaning Water</p> 	
<p>Storing Carbon</p> 	
<p>Cleaning Air</p> 	



Ecosystem Services Handout





Write down at least two (2) examples of each type of ecosystem service that you observe in your assigned area of Duke Farms.

Provisioning Services Products made by ecosystems	
Food 	
Drinking Water 	
Resources (wood, oil, etc.) 	



Ecosystem Services Handout

Write down at least two (2) examples of each type of ecosystem service that you observe in your assigned area of Duke Farms.

Supporting Services Services necessary to produce the other ecosystem services	
<p>Habitat</p> 	
<p>Biodiversity</p> 	
<p>Photosynthesis</p> 	
<p>Soil Formation</p> 	





Call for Proposals Template

Background Information

What is the current situation? Why should it be changed or enhanced?

Goals for the Project

What should be the result of this project?

This Work Should Include

What specifically should happen?



The Work Should Cost No More Than

Possible Challenges

What are some things that might make it more difficult to do this project?

Proposal Evaluation Criteria

How will you decide which proposal to choose?

Some examples include:

- Quality and specificity of the description of the suggested work
- Ability to work within the budget
- Ability to complete the work on time

