

6th Grade Science Lesson Plan--Arts Express Conference Dance and Science Integration

Content Objective

SEEd Strand 6.4

The study of ecosystems includes the interaction of organisms with each other and with the physical environment. Consistent interactions occur within and between species in various ecosystems as organisms obtain resources, change the environment, and are affected by the environment. This influences the flow of energy through an ecosystem, resulting in system variations. Additionally, ecosystems benefit humans through processes and resources, such as the production of food, water and air purification, and recreation opportunities. Scientists and engineers investigate among organisms and evaluate design solutions to preserve biodiversity and ecosystem resources.

Standard 6.4.2:

Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. Emphasize consistent interactions in different environments, such as competition, predation, and mutualism.

Student Learning Outcomes

6th grade students will see that consistent interactions occur within and between species in various ecosystems. As organisms use resources in the ecosystems at an alarming rate, it can affect the environment. If one part of the ecosystem is disturbed, it could have a huge impact on the rest of the ecosystem.

Length of Lesson: Three 45-minutes class sessions

Background Information

Many endangered species are top predators whose numbers are dwindling due to conflicts with humans. Humans kill predators all over the world because they fear for their lives as well as pets and livestock. Humans compete with them for prey and they destroy their habitats to expand their communities and agricultural operations.

There was a huge human intervention on the gray wolf that caused a devastating effect of their dwindling population numbers on its own environment and biodiversity. Before a mass extermination effort in the U.S. for the removal of wolf populations in the first half of the 20th century, wolves kept other animals' populations from growing at a very fast rate. They hunted elk, deer, and moose and also killed smaller animals such as coyotes, raccoons, and beavers.

Without wolves to keep other animals' numbers in check, prey populations grew larger. The fast rate of elk populations in the western United States wiped out so many willows and other riparian plants that songbirds no longer had sufficient food or cover in these areas, threatening their survival and increasing numbers of insects like mosquitos that the songbirds were meant to control.

"Oregon State University scientists point to the intricacy of the Yellowstone ecosystem," reported *EarthSky* in 2011. "The wolves prey on the elk, for example, which in turn graze on young aspen and willow trees in Yellowstone, which in their turn provide cover and food for songbirds and other species. As the elks' fear of wolves has increased over the past 15 years, elk 'browse' less — that is, eat fewer twigs, leaves, and shoots from the park's young trees — and that is why, the scientists say, trees and shrubs have begun recovering along some of Yellowstone's streams. These streams are now providing improved habitat for beaver and fish, with more food for birds and bears."

But it's not only large beasts of prey that can impact the ecosystem in their absence, small species can have just as big of an effect. While the losses of large, iconic species like the wolf, tiger, rhino, and polar bear may make for more stimulating news stories than the disappearance of moths or mussels, even small species can affect ecosystems in significant ways.

Consider the meager freshwater mussel: There are nearly 300 species of mussel in North American river and lakes, and most of them are threatened. How does this affect the water we all depend on? "Mussels play an important role in the aquatic ecosystem," explains the U.S Fish and Wildlife Service. "Many different kinds of wildlife eat mussels, including raccoon, otters, herons and egrets. Mussels filter water for food and thus are a purification system. They are usually present in groups called beds. Beds of mussels may range in size from smaller than a square foot to many acres; these mussel beds can be a hard 'cobble' on the lake, river, or stream bottom which supports other species of fish, aquatic insects and worms."

In their absence, these dependent species settle elsewhere, lower the available food source for their predators and in turn causing those predators to leave the area. Like the gray wolf, even the small mussel's disappearance acts like a domino, toppling the entire ecosystem one related species at a time.

We may not see wolves on a regular basis, but the presence of these creatures is interwoven with the environment we all share. Losing even a small strand in the web of life contributes to the unraveling of our planet's sustainability, the fine balance of biodiversity that affects each and every one of us.

Materials, Videos, and Resources

Each student is to get one of each of the papers below:

- "Introduction of Wolves in Yellowstone in 1995" paper showing graphs.
- Worksheet for the "Introduction of Wolves in Yellowstone in 1995".
- Worksheet for the "Return of the Buttercup".
- "Notes on "Wolves of Yellowstone"" paper

Video of the "Return of the Buttercup"

<https://www.ksl.com/?sid=44822569&nid=148&title=friends-of-autumn-buttercup-say-yay-for-cows>

Video of "Introduction of Wolves in Yellowstone in 1995"

<https://www.youtube.com/watch?v=5Iddy0CVILg>

Habitat destruction, alteration, and fragmentations explanation

<https://amphibiaweb.org/declines/HabFrag.html>

Lesson Plan:

Day 1:

1. Have a discussion of what could happen if an animal or plant became extinct in an ecosystem. What would be the results?
 - a. The animals or plants they ate could over populate.
 - b. The animals that ate them could disappear.
 - c. It could change the habitat of the area for other animals and/or plants to thrive.
 - d. It could change the habitat of the area for other animals and/or plants to deplete.
 - e. Other animals and plants could come into that area to change the habitat.
 - f. Animals could leave and go to another area which could cause greater competition within that ecosystem.

2. Watch the video "Return of the Buttercup".
 - a. Have a discussion about the video.
 - b. Have the students answer the questions on the worksheet then discuss them.
 - c. Ask why it is important not to disturb a habitat when it is working so well.
 - i. People can come in and take something away not knowing that it will have a great effect on something in the habitat.
3. Talk about other known things that have caused a change in habitats.
 Habitat destruction, alteration, and fragmentations
<https://amphibiaweb.org/declines/HabFrag.html>

<ol style="list-style-type: none"> a. Destruction for building space b. Digging for fossil fuels c. Urbanization d. Destroying wetlands e. Pollution f. Invasive species g. Agriculture development h. Diminishing resources (water, food) 	<ol style="list-style-type: none"> i. Fires j. Logging k. Mining l. Disruptive fishing industries m. Disease n. Climate change o. Acid rain p. Water diversions q. Dams
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Day 2:

1. Have a brief discussion of what was learned on day one.
2. From the background knowledge:
 - a. Give a brief overview of the environmental changes in Yellowstone from the 1935 to 1995 when wolves were absent from Yellowstone.
 - b. Give a brief overview of the environmental changes in Yellowstone from the 1995 to the present when wolves were returned to Yellowstone.
 - c. Show the video "Introduction of Wolves in Yellowstone in 1995"
<https://www.youtube.com/watch?v=5Iddy0CVILg>
 - d. Have a discussion of what they learned when the wolves no longer existed in Yellowstone
 - e. Have a discussion of what they learned when the wolves were brought back into Yellowstone.
3. Hand out the "Notes on 'Wolves in Yellowstone'" and have them read through them for reinforcement of knowledge.

Day 3:

1. Have the students read over the "Notes on 'Wolves in Yellowstone'".
2. Tell the students that they are going to be put in pairs to interpret the graphs of the changes that happened in Yellowstone after the introduction of wolves back into Yellowstone.
3. Pass out the "Worksheet for the 'Introduction of Wolves' in Yellowstone in 1995".
4. As pairs, they will discuss with each other and write it down on that worksheet two ideas:
 - a. What the graph is telling them.
 - b. What caused the change to directly happen. (They just can't say it was the introduction of wolves to Yellowstone.)
 - c. Give them 20 or so minutes for their reasoning. They can look at the "Notes on 'Wolves in Yellowstone'" paper to help them.
5. After the 20 minutes, have a class discussion what they think happened that caused the change.
6. End with a discussion of what the slightest changes to an ecosystem can do.

Notes on “Wolves of Yellowstone”

Wolves taken out of Yellowstone:

1. All life is linked to each other. Nothing is self-sufficient.
2. Earth relies on the balance that every being has a role to play and exists only through the existence of another being.
3. By the late 1900s the landscape of Yellowstone tragically shifted.
4. River erosion and habitat loss began.
5. Trees began to disappear—the aspen, cottonwood, and willows mostly.
6. It was suspected that climate change and fires were the blame, but only the trees in Yellowstone disappeared and not the rest of the trees in the Rocky Mountains.
7. It must have been something else for the Aspen trees had not regenerated since the 1930s.
8. The only change during that time was the wolves being totally taken away.
9. Due to the taking away of the wolf packs, the elk had nothing to hunt them. As a result, the population thrived tripling just after three years.
10. As elk began to browse on vegetation in the rich areas along the sides of riverbanks, the plants no longer were able to regenerate. The young sprouts were eaten too quickly to reseed the area.
11. This led to the mass erosion because of the wide meandering of the streams eroding away valuable soil.
12. Many plant species were lost because of this great erosion devastation.
13. There was also a great loss of other species that depended on those lost plant species.
14. The soil that was eroded away was a highly valuable resource to all ecosystems because the soil holds nutrients for things to grow.
15. As the water eroded deep into the of the volcanic rock it put dangerous toxins in the water that later became polluted, killing many aquatic lives. Many important acids were lost in the water as a result.
16. This put humans and other species at risk.
17. The rivers being toxic brought in a national epidemic.

Wolves taken brought back into Yellowstone:

1. Figuring out that it all began to change for the worst in the 1930s when all the wolves were gone, wolves were brought back in 1995.
2. As a result, the wolves began killing many elk decreasing the elk population.
3. Many of the carcasses that were left on the ground caused many scavenger species to returned to eat the dead meat, namely ravens and bald eagles.
4. As the dead animals bodies decayed, this put important nutrients back into the soil.
5. Wolves began to alter the behavior of the elk. Elk were avoiding certain areas of the park along valleys and streams where there were no forest coverage. That made them easy prey.
6. Almost immediate when the elk left those areas, those areas along the valleys and streams began to regenerate.
7. Barren valleys began to flourish again.
8. New cottonwood, aspen, and willow trees began to appear after being gone for almost a decade.
9. As soon as trees appeared, many birds returned. The number of songbirds and migratory species increased rapidly which caused the reappearing of the native snakes.
10. The number of beavers began to increase as the vegetation they depend on began to grow.
11. Beavers are ecosystem engineers. They create habitats niches for other wildlife species.
12. The dams they built slowed down the rivers providing habitats for foxes, muskrats, ducks, trout, salmon and other aquatic species.

13. Beside the elk, the wolves killed over populated coyotes. This resulted in a large number of rabbits and mice began to rise which meant that more hawks, more weasels, more foxes, and more badgers had a food source.
14. Even bears benefited from the introduction of wolves as they fed off the left over carcasses of wolf kill, and their population began to rise.
15. Also, more berries were growing on the regenerating shrubs and the abundance of fish in the streams that bears like to eat began to flourish.
16. The introduction of wolves changed the behavior of the rivers. As the riverbanks began to stabilized, this allowed volcanic soils to build up and settle under the riverbed making the water safe again for aquatic life.
17. The fresh water nourished the aquatic life and in turn benefited both the native flora and fauna.
18. The wolves not only transformed the ecosystem in Yellowstone National Park, but also its physical geography.

Name _____

Worksheet for the “Return of the Buttercup”

Answer these questions with full answers with extended thought.

1. What do scientists think caused the Autumn Buttercup to disappear in that certain area?

2. What do scientists think that caused the return of the Autumn Buttercup?

3. How did scientists figure it out?

4. What are the two theories of why the Autumn Buttercups are thriving when cows were returned?

5. What does this tell you about ecosystems and how fragile they are?

Name _____

Worksheet for the “Introduction of Wolves in Yellowstone in 1995”

Graph A

1. _____

2. _____

Graph B

1. _____

2. _____

Graph C

1. _____

2. _____

Graph D

1. _____

2. _____

Graph E

1. _____

2. _____

Graph F

1. _____

2. _____

Graph G

1. _____

2. _____

Graph H

1. _____

2. _____

Name _____

Worksheet for the "Return of the Buttercup"

Answer these questions with full answers with extended thought.

1. What do scientists think caused the Autumn Buttercup to disappear in that certain area?

They took the cows out of the pasture thinking that the Autumn Buttercup would grow better.

2. What do scientists think that caused the return of the Autumn Buttercup?

Because when they brought the cows back the Autumn Buttercup began to thrive.

3. How did scientists figure it out?

They noticed that the Autumn Buttercup was thriving in a field nearby where there were cows grazing.

4. What are the two theories of why the Autumn Buttercups are thriving when cows were returned?

- a. *When the cows ate the grass in the fields, it made the grass shorter that the mice couldn't live there and be safe from their predators.*
- b. *When the cows walk on the soggy ground it pushes up the soil on the sides of the cow print where the buttercup like to grow and not directly in the soggy soil.*

5. What does this tell you about ecosystems and how fragile they are?

Nature has been developing its habitats for thousands and thousands of years. In time there is a balance where there aren't too many plants and animals, but enough for food for each. When there is a change in any habitat and something is taken out or introduced, then it changes the population of different species where it may deplete one type of species and let another type of species over populate. It can cause species to extinct. It will take nature hundreds of years to find balance again.

Name _____

Worksheet for the “Introduction of Wolves in Yellowstone in 1995”

Graph A

- 1. Wolves increase in population.*
- 2. There are many elk and other animals available for them to eat.*

Graph B

- 1. Elk decrease in population.*
- 2. The wolves are eating many of the elk for there are many of them.*

Graph C

- 1. The browsing ground is decreasing.*
- 2. Less elk eating the grasses in the browsing area, and they are taking cover in the wooded areas.*

Graph D

- 1. The aspen are not only getting bigger, but also rapidly growing in population.*
- 2. Elk are not eating the grasses by the rivers anymore, so the aspen trees can begin to grow again.*

Graph E

- 3. The cottonwood are rapidly growing in population.*
- 4. Elk are not eating the grasses by the rivers anymore, so the cottonwood trees can begin to grow.*

Graph F

- 5. The willow are rapidly growing in population.*
- 6. Elk are not eating the grasses by the rivers anymore, so the willow can grow by the rivers.*

Graph G

- 1. The beaver are growing in population.*
- 2. High grasses are growing to hide the beaver. There are trees near the streams for them to build their dams and lodges.*

Graph H

- 1. Bison are growing in population.*
- 2. Bison came into the area because of the tall grasses that grew by the rivers.*

Introduction of Wolves in Yellowstone in 1995

Look at each graph. With the knowledge that you have answers the questions below for each graph.

- On “1”, write down what happened in each graph.
- On “2”, write a conclusion of why you think the graph



