Lesson 8: Balance

Summary

Ecosystems have a balance. As students saw in the previous lesson, each population level is held in check by predators, food, or non-living factors. A population level cycles up and down but stays within a certain range due to their interdependent relationships with these other factors.

If there is a natural disturbance, ecosystems usually can respond to it and then return to a stable state. Stability and change are natural processes in an ecosystem. In this lesson we will look at common natural disturbances that cause some changes in ecosystems, such as forest fires, and make arguments to explain how ecosystems respond to them and regain balance.

Goal: Students will focus on the balance of ecosystems and the fact that the system works as a unit that resists change.

Vocabulary

balance
invasive species

Materials

- ★ Disaster cards (see separate file). One set per group (recommended, or groups can pass around and share). Copy and cut out. Laminate these for more durability.
- ★ Additional resources about the different types of Natural and human made disasters (optional)

- ★ Lesson 7 READING: Wangari Maathai (for Explain)

Preparation

Copy and cut out the cards. Laminate if possible. If you have additional resources about the different kinds of disasters, such as books, images, or news stories, you can also set up stations around the room and have students travel around to find the information about the various disasters.

Engage (5 min.)

SLD If students are having trouble coming up with ideas, remind them to think of the potential damages of forest fires. Who is affected? Can they think of any positive benefits of forest fires?

OPENER

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- What are the effects of fire on a forest ecosystem? Write down as many effects as you can think of. Sample answers: Plants and animals die. Air is polluted when CO_2 and smoke are released into the air. Streams may be polluted with ash and debris. Fire also clears the way, burning dead leaves and wood.

➔ Debrief student answers, both positive and negative. Press students to think about all the biotic and abiotic factors in the forest ecosystem.

➔ *Stability and Change* Students may view fires as negative. Point out that they actually have many positive effects on the ecosystem as well. Fires get rid of old leaf litter, downed trees and make way for new plants to emerge. Although plants and animals may die in the fire, overall biodiversity increases after a fire in many ecosystems. Certain pine species and other types of trees cannot regenerate (their seeds won't grow) unless their seed pods are burst open by fire.

Explore (20 min.)

➔ *Engaging in Argument from Evidence* Hand out the Disaster cards. Students will consider a list of disturbances and brainstorm their possible effects on ecosystems. You can do this activity as a jigsaw. In group 1, students will be assigned 2 disaster cards and discuss the positives, negatives, and recovery times. They will be responsible for filling in their 2 rows. Then they will switch into a second group where students have different cards. In this second group they will fill in the remaining rows based on the shared information. They will need to explain their arguments for the negative and positive effects of each of these disasters.

EL Ensure students know what each disaster is. You may choose to add visual aids to the first column. Ensure they know what it means to *regain balance.*

SLD You may choose to complete a row as an example.

1. Read the Disaster cards and fill in the table.

	Negative Effects	**Positive Effects**	**How long before ecosystem regains balance**
Forest fire	Kills plant and animals - reducing their populations	Creates new soil, helps some seeds sprout, removes excess leaf material, clears space for new plant growth	Anywhere from a few months to many, many years. Plants will grow very soon after the fire, but it may take years to return to a similar ecosystem.
Flood	Kills plant and animals - reducing their populations	Clears space for new plant growth, removes excess leaf material, enriches soil.	Anywhere from a few months to many, many years. Plants will grow very soon after the flood, but it may take years to

			return to a similar ecosystem.
Gold mining	Pollution, kills plant and animal populations	none	Years, decades, or longer
Land Clearing for Building Construction	Kills animals and plants, releases greenhouse gases	None; could say that urban dwelling animals benefit because they will become more abundant with more buildings	Years, decades, or longer
Earthquake	Can cause other disasters such as landslides and tsunamis.	none	Varies by size of quake.
Nuclear power and accidents	Kills plants and animals, nuclear material causes mutations to the DNA (permanent changes to some animals), nowhere to dispose of waste products.	none	Decades, or longer
Storm	Mostly minimal damage, can cause flooding and can clear plants from habitat	minimal	Recovery usually happens fairly quickly
Invasive Species (Human Caused)	Can kill or reduce native plants or animals, can reduce the number of species in the habitat	Mostly none	Years, decades, or longer

2. Sort the cards into two piles: natural disasters and human made disasters. Compare the two piles. What are the similarities and differences? Answers will vary.
3. What is the biggest difference between natural disasters and human-made

disasters? Organisms have evolved with natural disasters and can survive these disasters fairly easily. In fact, some of these organisms require a fire or a flood to help them survive. For example, bishop pine trees have cones that won't open and seeds that won't sprout in the absence of fire. However, it takes a longer time to recover from a human-made disaster.

Explain/Elaborate (20 min.)

- ➔ *LS2.A: Interdependent Relationships in Ecosystems* Debrief students answers. They may have noticed that it takes ecosystems much longer to recover from human-made disasters.
- ➔ *Environmental Principle III Concept a* Natural systems proceed through cycles and processes that are required for their functioning. Point out that some things like fires occur on a regular basis and organisms sometimes require them to be successful (like some seeds need to be burned by fire before they will germinate).
- ➔ *LS2.C: Ecosystem Dynamics, Functioning, and Resilience* Organisms have evolved to deal with natural disturbances that occur regularly and predictably in ecosystems (such as fires, floods, droughts, earthquakes, storms). As a result the ecosystem is able to respond and recover from them.
- ➔ *Environmental Principle IV Concept c* Point out that the capacity of natural systems to adjust to human-caused alterations depends on the nature of the system as well as the scope, scale, and duration of the activity and the nature of its byproducts.
- ➔ The remaining examples of disturbances (mining, removing habitat for buildings, nuclear accidents, invasive species) are human caused. They are sudden and extreme; ecosystems either cannot recover from them or will recover only partially or after a very long time.

- ➔ Have students refer again to the Lesson 7 READING: Wangari Maathai. **Ask**: What problem was she trying to address? What solutions were effective? Deforestation was leading to other issues, such as erosion and drought. Raising awareness and replanting forests has improved the situation.

- ➔ *Environmental Principle III Concept c* Human practices can alter the cycles and processes that operate within natural systems. Here, you can point out that human disturbances are not part of the natural cycles and are thus harder for ecosystems to recover from.
- ➔ Define invasive species for students. An invasive species is one that is not native to an area (it has not evolved in this area) and its presence is new to that area.

- ➔ *Cause and Effect* **Ask:** Why do we do these things if they have such long-term negative effects? There are good reasons for many of these (students probably mentioned these in the Positive effects column):
  - We need homes and other buildings.
  - Nuclear power is cleaner than burning fossil fuels, if we can avoid accidents.
  - Gold is valuable for jewelry and electronic technologies.
  - We might like particular plants and animals (such as our pets), or sometimes invasive species are transported accidentally on boats or produce as we are transporting food or boating for enjoyment.
- ➔ **Ask:** Is there anything we can do to decrease the negative impact on ecosystems? We may be able to take certain steps:
  - Build smaller homes and other buildings, or build them on a smaller area, such as apartment buildings built over shops.
  - Take precautions so we can avoid nuclear accidents
  - Change mining techniques, and clean up afterward
  - Take steps to avoid bringing in invasive species (such as checking produce traveling from one place to another, or checking boats for organisms clinging to the hull) or minimize their impact (putting a bell on a cat before turning it loose in the neighborhood to minimize the impact on native birds).
- ➔ **Ask:** Is there any evidence of human (or natural) disturbances in your "Observe an Ecosystem" Project? Record these on the Lesson 8 section of your project packet. Answers will vary, but likely there will be some pollution, cement or asphalt, garbage, etc.

Extend

- ➔ Note that this Extension question is similar to the one from the previous lesson, but here we are looking at a different time period in the population.

EXTENSION

- ❖ Look up what happened on Angel Island in the 1960's. Deer were brought to Angel Island in 1915 and then hunted by the Army. The Army left in 160 and the deer had no predators. What happened to their population? How were they eventually controlled? Deer greatly overpopulated the island and ate much of the vegetation. They then died in large number from starvation during drought years. Some deer were airlifted off the island in an attempt to save them (although most of them died shortly after being relocated). Finally the park controlled them by selective hunting.

Evaluate (5 min.)

SLD Encourage students to make a Venn diagram to help them organize their thoughts.

EXIT CARD

- Choose a natural disaster and human-made disaster. Compare and contrast them in terms of their short-term and long-term effects on an ecosystem. Answers will vary, but should mention that recovery happens more quickly from a natural disaster.

Homework

HOMEWORK

- Do you think there is a "balance" in the plot that you are observing for your Ecosystem Observation project? Are there any missing elements that make it out of balance? Or is there any specific disturbance that would bring it out of balance? Answers will vary.