Lesson 1.7: Ecosystem Resiliency

LESSON INTRODUCTION

Time Frame: 1-2 class periods
Materials:

- Lessons of Our Land: "A Slice of Planet Earth"
- Oak Woodlands Ecosystem Species Cards
- Sample Ecosystems 1 and 2 (also in Google Slide Deck)
- Resilient Ecosystem Activity direction sheet
- Resilient Ecosystem Scenarios Notetaker
- Resilient Ecosystem Rubric
- Resilient Ecosystem Google Slide Deck

In this lesson, students apply their knowledge of **biodiversity** and Oak Woodland species to a model of their own making. Students will design a **resilient ecosystem** and then test their ecosystem against a series of scenarios. This lesson prepares students to explore Traditional Ecological Knowledge in the next lesson.

Teacher Background:
The resiliency of ecosystems and food webs depends on the **biodiversity**, **adaptability,** and **ability** for the ecosystem to sustain itself through connections for energy transfer. Since settlers seized control of California, development has impacted the resiliency of California's Oak Woodlands and weakened its food webs. Mass deforestation, pollution of the air and waterways, development of cities and towns, fire suppression, and overall poor land management have challenged the ecosystem and destroyed many food webs that Native peoples and other species rely on.

Through this activity, students begin to see that organisms within an ecosystem do not exist in isolation from one another, and that the variety of interactions that they have with one another contributes to the strength of the food web.

Organisms that are able to make their own energy through **photosynthesis** are called **autotrophs,** while organisms that receive nutrition through consuming other organisms are called **heterotrophs,** or consumers. Both are important to the food web.

In addition, the relationship between **predator** and **prey** among animals will become clear through the modeling process. Many consumers are also predators, meaning they consume other animals, hunting or catching them. The prey, hoping to avoid being eaten by the predator, attempts to flee, hide, or disguise itself. When the prey animal is unsuccessful, it becomes food and energy for the consumer. Many animals are both predator and prey, depending on the situation. Apex predators, on the other hand, are at the top of the food chain and do not typically serve as prey for any organism.

Because all living organisms die, all organisms rely on **decomposers** to recycle nutrients back into the ecosystem. Decomposers, represented by mushrooms in this lesson, break down carcasses and waste so that their nutrients can be returned to the ecosystem.

ENGAGE

Explore the importance of taking care of our natural environment to secure access to food using the Lessons of Our Land: "A Slice of Planet Earth"

This lesson introduces students to the importance of supporting our food webs and ecosystems by modeling the percentage of farmable land using an apple.

Explain to students that because so little of our world is actually inhabitable by humans, it is important that we take care of our planet and natural resources in order to have the food and other resources we need to survive.

EXPLORE

Remind students of the "**Biodiversity Ecosystems and Ecological Networks**" Edpuzzle they completed earlier in the unit. Review the meaning of biodiversity.

Revisit the **Ecosystem Samples 1 and 2**, reviewing what students already know about ecosystems and food web resiliency. You may want to ask students where they see the keystone species in the examples, if they think there is enough biodiversity in the food web, etc.

Note: Students may want to take out their notes on keystone species and energy transference to support them through this activity.

EXPLAIN

Explain to students that in order to have strong, resilient food webs, ecosystems must maintain biodiversity. Biodiversity means having a wide variety of organisms that provide opportunities for energy transference. Biodiversity supports the food web by helping maintain and contain species populations.

For example, predators help control the population of their prey by consuming only as much of that prey as is sustainable for the ecosystem. Animals that consume plants support plant species by consuming that plant in just the right amounts so that the population does not grow out of control.

When the food web is out of balance, organism populations may grow out of control, or become over-consumed and disappear.

ELABORATE

Pass out the **Oak Woodland Species Cards**, and the **Ecosystem Resiliency Activity**.

In **groups of 2-3**, have students read through the direction sheet together. Notice the list of helpful materials in case students want to use work from previous lessons for reference.

Direct students to our Google Slides template and "Make A Copy" of the Slides so that students can edit. Provide students ~25 minutes to design their ecosystem using the elements provided (students can copy and paste elements onto their own slides),

focusing on creating a strong, resilient food web. Remind students to include arrows to show energy transference.

Pass out the **Scenario Notetaker**, and the **Resiliency Rubric**. Walk students through the first scenario, modeling your thinking for them.

EVALUATE

Once students have analyzed the impact of the scenarios on their food web, ask students to assess the resiliency of their ecosystem using the **Resiliency Rubric.** Students are assessing their ecosystem in a general way, not necessarily for each scenario.

Explain to students that the scenarios included in the lesson are all realistic and can occur in the Oak Woodlands Ecosystem. Because of this, we want our ecosystems and food webs to be able to withstand all of the scenarios.

Finally, review the following questions with students:

1. **Which scenario impacted your ecosystem's food web the most? Why do you think that is?**
2. **How could you have designed your ecosystem differently, in order to strengthen your food web?**
3. **Were any species populations eliminated from your ecosystem during the scenarios?**

VOCABULARY

Keystone Species: A species on which other species in an ecosystem largely depend, such that if it were removed the ecosystem would change drastically.
Ecosystem: A biological community of interacting organisms and their physical environment.
Consumer: An organism that derives the organic compounds and energy it needs from the consumption of other organisms; a heterotroph.

Apex Predator: A predator at the top of a food chain that is not preyed upon by any other animal
Predator: An organism that hunts, catches, kills, and eats other animals
Prey: An organism that is caught, killed and eaten by a predator
Trophic Level: One of the hierarchical strata of a food web characterized by organisms which are the same number of steps removed from the primary producers
Primary Producer: Organisms that convert energy from light or heat into energy and organic tissue. Plants are an example of a primary producer.

STANDARDS

Common Core:

WHST .6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content

RST .6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flow chart, diagram, model, graph, or table

CA Indian Essential Understandings:

Essential Understanding 3: Tribal traditional beliefs and practices, including links to spirituality, are practiced in communities where the culture, traditions and languages are vibrant parts of daily life.

This lesson builds towards Essential Understanding 3 by introducing students to some of the most important plants and animals in the indigenous ecosystem, specifically focusing on the Black Oak, which produces the staple food of the Pomo people.

Essential Understanding 4: California Indian peoples' histories and cultures have been and continue to be impacted by foreign, state, and federal policies.

This lesson builds towards Essential Understanding 4 by introducing some of the impacts that settler communities and climate change can have on Native food webs. The next lesson goes into further detail.

NGSS Standards:
Section 1: Lessons 3-8 work together to reach the following standards:

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

CA Environmental Principles and Practices:

Principle 1 - People Depend on Natural Systems
The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.

RESOURCES

- Lessons of Our Land: A Slice of Planet Earth
- "Biodiversity Ecosystems and Ecological Networks" Edpuzzle
- Dictionary.com
- Oxford.com