Lesson 2.5
Energy in Ecosystems
Lesson Overview

In this lesson, students work in small groups to determine how they can model the path that energy takes through an ecosystem. Through this engaging hands-on activity and follow-up discussion, students consolidate and communicate their understanding of the idea that energy in an ecosystem can always be traced back to the sun. Then, students are introduced to the unit’s reference book, *Restoration Case Studies*. They read a case study about the return of wolves to Yellowstone National Park and discuss the different perspectives of stakeholders, which serves as a segue to the argumentation-focused lessons to follow. This lesson helps students consolidate their understanding and practice using a model to communicate scientific ideas. Reading the case study helps students connect what they are learning to another real-world situation.

**Anchor Phenomenon:** The jaguars, sloths, and cecropia trees in a reforested section of a Costa Rican rain forest are not growing and thriving.

**Investigative Phenomenon:** Organisms in an ecosystem get the energy they need.

**Students learn:**

- Energy in an ecosystem can always be traced back to the sun.
- Human activities can have a negative impact on ecosystems; different communities are working to minimize that impact.
Reading a Restoration Case Study

Students are introduced to the unit’s reference book, *Restoration Case Studies*, and read the section about the Yellowstone Food Web.

Instructional Guide

1. **Return to the Science/Everyday Words chart.** Point out the chart and remind students that they are using this chart to keep track of scientific language they are learning.

2. **Discuss the word restore.** Explain that next, students will be reading a book about several real ecosystem restoration projects around the world. Ask students to think about the word *restoration* or the verb form *restore*.
   
   - In the “Science words” column of the chart, write “restore.”
   - Ask students to suggest everyday words that mean something similar to *restore*. [Put back, fix.]
   - Record these in the “Everyday words” column.

3. **Introduce the reference book.** Hold up a copy of *Restoration Case Studies*.

4. **Organize students into pairs and distribute books.** Distribute one copy of the book to each pair. Give partners a few minutes to preview the book and talk to each other about what they notice. Then, regain the class’s attention.

5. **Have students turn to page 4.** Point out that the Introduction will help them learn a bit more about what they might find in this reference book. Call on volunteers to take turns reading aloud while the rest of the class reads along.

6. **Have students turn to the content on page 3.** Let students know that they’re going to read the case study about the Yellowstone Food Web. Ask students to turn to the correct page in their books. [Page 20.]

We have discovered that the food molecules in an ecosystem come from plants and algae. We have also discovered that plants and algae capture energy from the sun and make it possible for all the other organisms in an ecosystem to access that energy.
Now, I’d like you to read about an ecosystem where there was a problem with the plants. As you read, pay attention to the different ideas that people have about fixing the problem in the ecosystem.

7. **Give pairs time to read.** As students read, circulate and provide support as needed.

8. **Briefly discuss the case study.**

    - What was the problem in this ecosystem?
      [The wolves were killed off, so there were too many elk. The elk trampled and ate the aspen trees, so no new ones grew after 1930.]

9. **Reflect on the different scientific perspectives in the reading.**

    - According to the reading, what is a restoration plan?
      [A restoration plan is a set of actions that are meant to help an ecosystem recover from damage.]
    
    - What is being done to help restore the ecosystem?
      [Wolves were reintroduced.]
    
    - Does everyone agree that this is the best solution?
      [No.]

   Ask students to point out the three different perspectives. [Some scientists believe that bringing the wolves back will mean fewer elk and more aspen trees. Some people believe that this will mean that too many elk are killed. Other people think that the wolves might eat the cattle that graze outside the park, so they don’t like that solution.]

10. **Connect to the practice of argumentation.**

    - Remember, when scientists disagree about ideas, they try to convince others by making scientific arguments—by making claims supported by evidence.
    
    - What claim were the scientists making who were in support of bringing the wolves back?
      [The wolves would help bring back the aspen trees.]
    
    - How do you think the scientists who wanted to bring back the wolves convinced others that their claim was correct?

   Accept all responses.

11. **Collect books.** Let students know they will have other opportunities to read more case studies in future lessons.

12. **Conclude the lesson.** Let students know that in the next lesson, they’ll read a book that will help them find out more about how scientists convince others that their claims are correct.
Teacher Support

Background

About the Book: Restoration Case Studies

*Restoration Case Studies* provides students with several examples of ecosystem restoration projects taking place in the real world. Each case study includes a description of the ecosystem along with a diagram of a food web, an introduction to the problems in the ecosystem, and information about the restoration work that is going on. The book helps students understand that ecosystems are complex and that all parts of an ecosystem affect one another. When there is a problem in one part of an ecosystem, it can have repercussions for all the organisms in that ecosystem. Diverse examples of restoration plans expose students to several varied examples of ecosystems and help students understand a range of human-caused environmental problems. The emphasis throughout the book is on the innovative ways that people are trying to remediate these problems. At the end of each section, readers are encouraged to think creatively about how to restore various kinds of ecosystems. At several points throughout the unit, students refer to this book to read about restoration plans that might spark ideas that they could apply to their own restoration plans for the Costa Rican rain forest.

Literacy Note: About Reference Books

Reference books provide in-depth information about specific topics and are typically read for particular purposes. For this reason, students do not read every section in reference books, nor do they read reference books from beginning to end. Rather, they search for the information they need and then read the relevant sections carefully. In this lesson, students will be guided to read one particular section as an example of a problem in a specific ecosystem. You may wish to provide instruction around the table of contents, glossary, and index if students are not familiar with these features.

Rationale

Pedagogical Goals: Time for Exploration of the Book

The first time students are introduced to *Restoration Case Studies*, they may need a few minutes to look through the text and the images. Providing this time can aid students in becoming familiar with helpful text features, give them clues for where to find information, and spark interest in reading the various case studies in the book. This type of open-ended exploration enhances student interest as well as provides students with the opportunity to share their thinking and learn from their peers. Giving students time for this exploration can reduce distractions, helping them to subsequently read the text with focused goals.
Reading a Restoration Case Study

Students are introduced to the unit’s reference book, *Restoration Case Studies*, and read the section about the Yellowstone Food Web.

**Instructional Guide**

1. **Return to the Science/Everyday Words chart.** Point out the chart and remind students that they are using this chart to keep track of scientific language they are learning.

2. **Discuss the word restore.** Explain that next, students will be reading a book about several real ecosystem restoration projects around the world. Ask students to think about the word *restoration* or the verb form *restore*.
   - In the “Science words” column of the chart, write “restore.”
   - Ask students to suggest everyday words that mean something similar to *restore*. [Put back, fix.]
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3. **Introduce the reference book.** Hold up a copy of *Restoration Case Studies*.

4. **Organize students into pairs and distribute books.** Distribute one copy of the book to each pair. Give partners a few minutes to preview the book and talk to each other about what they notice. Then, regain the class’s attention.

5. **Have students turn to page 4.** Point out that the Introduction will help them learn a bit more about what they might find in this reference book. Call on volunteers to take turns reading aloud while the rest of the class reads along.

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   Hemos descubierto que las moléculas del alimento en un ecosistema vienen de las plantas y las algas. También hemos descubierto que las plantas y las algas capturan energía del sol y hacen posible que todos los otros organismos en un ecosistema accedan a esa energía.
Ahora, me gustaría que leyeran sobre un ecosistema en donde hubo un problema con las plantas. Mientras leen, pongan atención a las diferentes ideas que tiene la gente acerca de cómo arreglar el problema en el ecosistema.

7. **Give pairs time to read.** As students read, circulate and provide support as needed.

8. **Briefly discuss the case study.**

   ¿Cuál era el problema en este ecosistema?
   [Mataron a los lobos, así que había demasiados uapitíes. Los uapitíes pisotearon y comieron los álamos temblones, así que no creció ninguno nuevo después del 1930].

9. **Reflect on the different scientific perspectives in the reading.**

   De acuerdo con la lectura, ¿qué es un plan de restauración?
   [Un plan de restauración es un conjunto de acciones que sirven para ayudar a un ecosistema a recuperarse del daño].

   ¿Qué se está haciendo para ayudar a restaurar el ecosistema?
   [Introdujeron los lobos de nuevo].

   ¿Todas todas están de acuerdo en que esta es la mejor solución?
   [No].

   Ask students to point out the three different perspectives. [Some scientists believe that bringing the wolves back will mean fewer elk and more aspen trees. Some people believe that this will mean that too many elk are killed. Other people think that the wolves might eat the cattle that graze outside the park, so they don’t like that solution.]

10. **Connect to the practice of argumentation.**

   Recuerden, cuando los científicos no están de acuerdo con una idea, intentan convencer a otros haciendo argumentos científicos, es decir, haciendo afirmaciones respaldadas por evidencia.

   ¿Qué afirmación estaban haciendo los científicos que estaban a favor de reintroducir a los lobos?
   [Los lobos ayudarían a recuperar los álamos temblones].

   ¿Cómo piensan que los científicos que querían reintroducir a los lobos convencieron a los otros de que su afirmación era correcta?

   Accept all responses.

11. **Collect books.** Let students know they will have other opportunities to read more case studies in future lessons.

12. **Conclude the lesson.** Let students know that in the next lesson, they’ll read a book that will help them find out more about how scientists convince others that their claims are correct.
Teacher Support

Background

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