Energy Flow and the Food Chain

Summary
Students are introduced to the energy flow through levels of organisms in community structures. Drawing upon previous lessons and individual experiences, students will grasp the necessity of food and energy in an ecosystem and how it is passed from one organism to another. Each student will reflect on his or her own role in the energy flow and food chain of their community and ecosystem.

Objectives
• Students will be able to make a list of biotic and abiotic factors of an environment and distinguish between the two factor types.
• Students will be able to draw animals and classify them as producers, consumers, and decomposers and explain their roles in energy flow.
• Students will be able to explain the importance of producers, consumers, and decomposers in an ecosystem, and identify the consequences of their absence in energy flow.

Materials
Activity 1: Rainforest Brainstorm
For each group of 4 students:
1 piece of blank paper
Writing utensils

Activity 2: A Hawaiian Food Chain
For each student:
1 “Hawaiian Food Chain” worksheet
Writing utensils
Coloring utensils

Making Connections
Students will draw from personal experience to identify animals that would be a part of a rainforest ecosystem. It may be helpful for students to recognize if familiar animals are located in Hawaiʻi or not. In recognizing that many animals are not naturally found in Hawaiʻi, it may be beneficial to start up a conversation of the role of zoos and the media in our understanding of animal life.

Teacher Prep for Activity
Activity 1:
Have blank paper ready for students to take notes.
Activity 2:
Make copies of “Hawaiian Food Chain” worksheets for students.

Background
Energy flows from the sun and is used by plants as their sole energy source. Animals ingest plants (and other animals) to be used as their food and source of energy.
All living organisms on Earth need energy for survival. Energy is the fuel of life, usually in the form of food or sun. The sun is an abiotic factor, which means it is non-living. Other abiotic factors include: water, soil, and oxygen/carbon dioxide.

Most organisms can be classified in three categories based on their food sources and energy production and mapped in a food chain. A food chain is the series of organisms where the first organism is eaten by the second, and the second organism is eaten by the third and so on. Food is classified as biotic factors because it is or once was living (animals, plants, fungi). The first level is the producer level, organisms that make their own food. These organisms are usually plants and photosynthetic organisms. The second level is the first consumer level, organisms that consume producers. This is the first level that cannot make their own food. They are also known as herbivores – plant-eating animals. The third level is the secondary consumer level, organisms that consume producers and first consumers. They are also known as omnivores – plant- and animal-eating animals, or carnivores – animal-eating animals. The final level is the decomposer level. These organisms eat non-living material, such as deceased animals. Organisms in this category are usually bacteria, fungi, and small animals.

Vocabulary
Abiotic factors – a non-living agent (such as soil, sun, water, wind) that contributes to the survival of a living thing
Biotic factors – a living agent (such as an animal, plant, bacteria) that contributes to the survival of a living thing
Carnivore – a flesh-eating animal
Decomposer – a living thing that breaks down materials and disperses energy into the abiotic world
Energy – usable power, usually in the form of light or heat
First consumer – an animal that consumes producers (such as plants) in the food chain
Food chain – a hierarchical arrangement of organisms in an ecological community such that each uses the next usually lower member as a food source
Herbivore – an organism that feeds on plants
Omnivore – an organism that feeds on both plants and animals
Producer – an organism that makes its own food (such as plants)
Second consumer – an organism that consumes first consumers (such as plant-eating animals) in the food chain

Procedure
Activity 1: Rainforest Brainstorm (1 hour)
1. Introduce the activity by beginning with a discussion on energy and how it flows through a system.
a. The premier way energy flows through a system is by consuming food and expending energy in the form of movement necessary for living.
b. Encourage students to arrive at the idea of eating to gain energy and sustenance.

2. Introduce the concepts of abiotic and biotic factors.
   a. Energy, sun, water, and soil are abiotic because they are non-living, but are still needed for an organism’s survival.
   b. Food and food sources are biotic because they are or once were living organisms, such as plants, animals, and fungi.

3. Place students in groups of four and, on a blank piece of paper.

4. Give the assignment to list 10 organisms (plants or animals) that are found in a local rainforest. Give students 10 minutes to come up with a list.
   a. Name students in the group to be one of the following: Record er (writes the ideas), Time Keeper (watches the amount of time past), Task Keeper (keeps others on the task at hand), and the Communicator (in charge of asking the teacher for help or guidance).
   b. Encourage students to be creative and think of as many organisms as possible.
   c. Organisms need not be native, as long as they are found in a Hawaiian rainforest.
   d. If students can think of more than 10, allow them to list more.

   (Elapsed Time Check: 20 minutes)

5. Collect papers from groups and refocus students’ attention on the teacher.

6. Introduce the levels of the food chain: Producers, First consumers, Second Consumers, and Decomposers.
   a. Give word spelling and definition for each term and highlight some real-life examples of these organisms.
   b. Producers – organisms that make their own food. Most types of plant life are included in this category.
   c. First consumers – organisms that consume producers (plants). Animals that eat plants include: birds, sea turtles, rabbits, etc.
   d. Second consumers – organisms that consumer producers and first consumers. Animals that eat plants and animals include: sharks, lions, mongoose, etc.
   e. Decomposers – organisms that break down non-living material into nutrients for producers. Organisms that break down non-living material include: insects, bacteria, fungi, etc.

   (Elapsed Time Check: 35 minutes)

7. Regroup students in same groups of 4. Pass out the group work papers randomly to any group in the classroom.

8. Challenge the groups to categorize the organisms from the rainforest into Producers, First consumers, Second consumers, and Decomposers.
   a. Students may be given a separate piece of paper to complete the task.
   b. Students may feel uncomfortable about using another group’s work to complete the assignment, but encourage them to try their best.
      i. This also can be used as a lesson in accountability for student work.

9. When groups have completed their categorization, reconvene as a class to review the students’ work and make corrections as necessary.

Activity 2: Hawai‘i-Based Food Chain (1 hour)
1. Review the four types of organisms in the food chain: Producers, First consumers, Second consumers, and Decomposers. Review how energy flows through a system.
2. Introduce the concept of a food chain and how the four types of organisms are connected in it.
3. Provide a visual example of the food chain by calling four student volunteers to the front of the class.
   a. Student 1: Producer. *Limu* or seaweed.
   b. Student 2: First consumer. *Honu* or green sea turtle.
   c. Student 3: Second consumer. *Mano* or shark.
   d. Student 4: Decomposer. Tiny ocean bacteria.
   e. Have the four students assemble themselves in a line that would suggest a food chain.
4. Pose the question to the class: What would happen if there were no *limu*? (Take Student 1 out of the line).
   a. Encourage students to come to the answer that there would be no food for the *honu* and thus no food for the *mano* or the bacteria.
   b. Put Student 1 back into the food chain and take another character out. Students should come to the understanding that all levels of the food chain are necessary for a healthy and prosperous food chain and energy flow in the ecosystem.
5. Pass out the worksheet “A Hawaiian Food Chain” to each student.
6. Students complete the worksheet by drawing pictures of organisms that belong to each level of the food chain.
   a. The first level, on the bottom, is the producer level. The food chain ascends to the decomposers at the top.
   b. Outside of the triangular food chain, there is a space to draw abiotic factors such as: sun, water, wind, etc., which are all necessary components of organism survival.
   (Elapsed Time Check: 20 minutes)
7. Allow students to work on the worksheet for the remaining of the hour.
   a. Encourage students to use organism examples other than those given in the class activity (*limu, honu, mano*).
   b. Students should have all levels completed.
   c. If time permits, levels and drawings may be colored.

**Assessments**
Thoughtful discussion in “Rainforest Brainstorm” activity.
Group participation in “Rainforest Brainstorm” activity.
Successful completion of “Hawaiian Food Chain” worksheet.

**Resources**
For more information about food chains, visit:
For an online food web activity, visit:
http://www.vtaide.com/png/foodweb.htm

**Extension Activity**
If time permits, students may identify specific food chains with native animals by looking through books or going online. By determining the exact food source of native animals, students will be able to make connections with the need for specific environment conservation.

**Math Connections**

If time permits, students may determine the amounts of energy needed by each level of the food chain. In doing so, students will approximate how many animals or plants a specific animal must consume within a day. Then, students will relate this to the quantity of plants or prey needed to sustain a healthy ecosystem. For example, one I‘iwi bird may need nectar from 8 different lehua flowers in one day. How many lehua flowers are needed for the survival of 10 I‘iwi? What happens if there are more I‘iwi than flowers?
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