

Energy in the Food Pyramid

"When we tug on a single thing in nature, we find it attached to everything else"

John Muir,

Founder of the Sierra Club, dedicated to protecting and restoring the quality of the natural and human environment.

By David Cochran

Living **organisms** need energy to live. Plants need energy to grow leaves, and animals need energy to breathe and move about. The source of all energy for plants and animals is the Sun, the star in our solar system. The Sun transfers its energy by light rays to the Earth. It heats the Earth and, through the process of **photosynthesis**, causes plants to grow. Plants are the producers of food for all other parts of the food chain.



Green grasses, fueled by the Sun's energy, are at the bottom of the food pyramid.

Primary Consumers

Small insects and mammals eat the plants. Sometimes large animals eat plants, too. Animals that only eat plants are called **herbivores**. (From herba, plant; voro, to eat.) When an animal eats a plant, energy and organic matter are transferred from the plant to the animal, giving it energy and nourishment to live and grow. Animals that eat plants are called **primary consumers**. A plant-eating insect, like the grasshopper, is a primary consumer. Other animals like mice, deer, and rabbits are also primary consumers.

Secondary Consumers

Some animals eat only other animals. These are called **carnivores**. (From carno, meat; voro, to eat) They get energy that is second-hand. Their energy comes from the other animals that got their energy from the plants. These animals are called **secondary consumers**, and they feed on primary consumers. A snake that eats a grasshopper and a cat that eats a mouse are secondary consumers.

Tertiary Consumers

Animals that eat secondary consumers (the snake and the cat) are not only carnivores. They are also called **tertiary consumers**. These animals are often larger and there are fewer of them. Lions are an example of a tertiary consumer because they eat other larger animals.

Some animals eat both plants and animals. These are called **omnivores**. (From omni, all; voro, to eat.) Bears eat fish, other animals, and grasses. Turtles eat crickets and algae.

Balanced Ecosystem

For an ecosystem to work there needs to be the right mix of plants and animals so that energy gets transferred properly. If there are not enough plants, there will be fewer primary consumers, even less secondary consumers, and almost no tertiary consumers.



Lions are examples of tertiary consumers.

Even though not all the energy is transferred between levels of the food pyramid, it isn't totally lost. It changes to heat in the atmosphere. Energy can never be lost; it can only be changed from one form to the other. This is the Law of the Conservation of Energy. See the ENERGY issue of Spigot, Jan/Feb 2009, at www.spigotsciencemag.com.

Science Connection

Continued from page 1

These food levels look like a pyramid. The large base of the pyramid represents the primary consumers. The smallest number of consumers is at the top.

At each level some energy is lost. This is because each time there is a transfer of energy from one level to another, not all the energy is transferred to the animals. Some of the energy from the animal that is eaten goes to the animal that is eating it and some of the energy is lost as body heat. Some energy is lost from plants as they give off heat and oxygen.

Primary consumers give off heat energy, so there may be only half of the original energy left for secondary consumers. In turn, the secondary consumers give off more energy, so the tertiary consumers receive the least amount.

Animals always depend on the next level down on the pyramid for food. If the producers (plants) were to suddenly disappear, all the animals on the rest of the **pyramid**

would die. If the next level down is abundant, the animals will thrive. In a lush tropical rainforest there are plenty of plants. Many animals are able to live there because of the large amount of energy in the food pyramid.

In a dry desert, there are few plants, so there are some primary and secondary consumers, but few tertiary consumers.

To keep an ecosystem in balance there needs to be many plants, many primary consumers, fewer secondary consumers, and the fewest tertiary consumers. This allows the system to have the most energy at the bottom so that the animals at the top will have enough energy to live.

Activities

1. Go to these web sites to learn more about the food pyramid: http://www.arcytech.org/java/population/facts_foodchain.html or <http://www.vtaide.com/png/foodchains.htm>.

Draw a blank pyramid and divide it into three levels - primary, secondary, and tertiary.

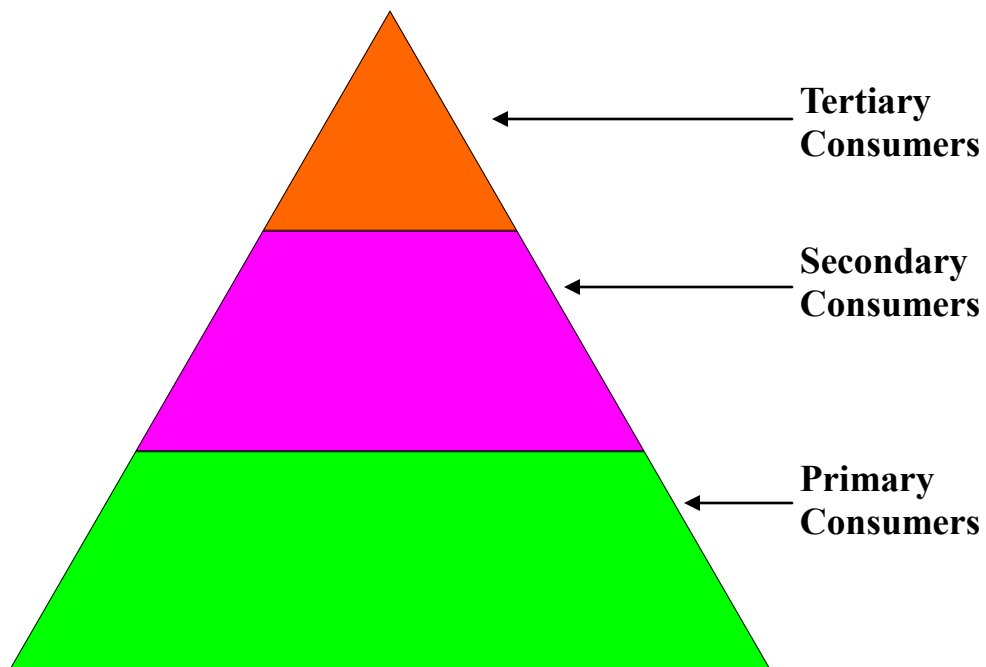
Do some research in books or on the Internet to write examples of plants and animals that are at each of these levels.

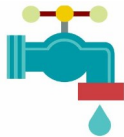
2. Create a story, song, poem, or video that explains how the food pyramid works.

Ponder

Humans are at the top of the food chain. We're tertiary consumers.

Why is it important for humans to be concerned about what happens to all the levels below us on the food pyramid?





For More Information

See the *Ecosystems* publication at Spigot Science <http://www.spigotscience.com>