chapter 2 Principles of Ecology

section 2 Flow of Energy in an Ecosystem

MAIN Idea

Autotrophs capture energy, making it available for all members of a food web.

What You'll Learn

- the flow of energy through an ecosystem
- food chains, food webs, and pyramid models

Before You Read

If a pet had to survive without your care, how would its diet change? Write your ideas on the lines below. Read about how organisms get food and energy in their environment.

Study Coach

Make Flash Cards Make a flash card for each question heading in this section. On the back of the flash card, write the answer to the question. Use the flash cards to review what you have learned.

Read to Learn

Energy in an Ecosystem

One way to study the interactions within an ecosystem is to trace how energy flows through the system. All organisms are classified by the way they obtain energy.

How do autotrophs obtain energy?

All green plants and other organisms that produce their own food are the primary producers of food in an ecosystem. They are called autotrophs. An **autotroph** (AW tuh trohf) is an organism that captures energy from sunlight or inorganic substances to produce food. Autotrophs make energy available for all other organisms in the ecosystem.

How do heterotrophs differ from autotrophs?

A **heterotroph** (HE tuh roh trohf), also called a consumer, is an organism that obtains energy by consuming other organisms. A heterotroph that consumes only plants is an **herbivore** (HUR buh vor). Cows, rabbits, and grasshoppers are herbivores.

Heterotrophs that prey on other heterotrophs are known as **carnivores** (KAR nuh vorz). Wolves and lions are carnivores. **Omnivores** (AHM nih vorz) eat both plants and animals. Bears, humans, and mockingbirds are examples of omnivores.

Reading Check

1. **Define** What type of heterotroph consumes only plants for energy?

How do detritivores help an ecosystem?

Detritivores (duh TRYD uh vorz) decompose organic materials in an ecosystem and return the nutrients to the soil, air, and water. The nutrients then become available for use by other organisms. Hyenas and vultures are detritivores. They feed on animals that have died. Fungi and bacteria are also detritivores.

Detritivores play an important role in the biosphere. Without them, the biosphere would be littered with dead organisms. The nutrients in these dead organisms would not be available to other organisms. Detritivores make these nutrients available for use by other organisms.

Reading Check

2. Explain How do organisms in an ecosystem depend on detritivores?

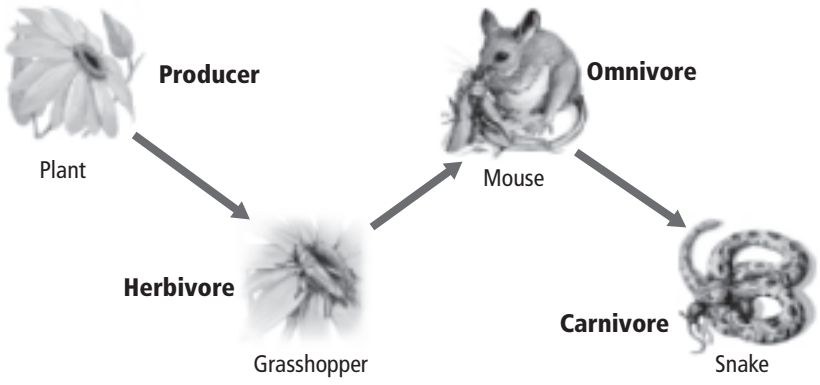
Models of Energy Flow

Ecologists study feeding relationships to learn how energy flows in an ecosystem. Ecologists use food chains and food webs to describe the flow of energy. Each step in a food chain or food web is called a **trophic** (TROH fihk) **level**. Autotrophs are the first trophic level in all ecosystems. Heterotrophs make up the remaining levels.

Organisms at the first trophic level produce their own food. Organisms at all other levels get energy from the trophic level before it.

What is a food chain?

A **food chain** is a simple model that shows how energy flows through an ecosystem. A typical grassland food chain is shown in the figure below. Each organism gets energy from the organism it eats. The flow of energy is always one way—into the consumer. An organism uses part of the energy to build new cells and tissues. The remaining energy is released into the environment and is no longer available to these organisms.



Picture This

3. Label Draw a circle around the autotroph. Draw a box around the heterotrophs.

Think it Over

4. Synthesize Why might an ecologist use a food chain for one study and a food web for another study?

What does a food web show?

Feeding relationships are usually more complex than a single food chain model can show. Most organisms feed on more than one species. A **food web** is a model that shows all the possible feeding relationships in an ecosystem. Food webs give a more accurate picture of how energy flows in an ecosystem than food chains.

What do ecologists model with an ecological pyramid?

Ecologists also use ecological pyramids to model how energy flows through ecosystems. A pyramid model can be used to show energy flow in three different ways. Each level of the pyramid represents a trophic level.

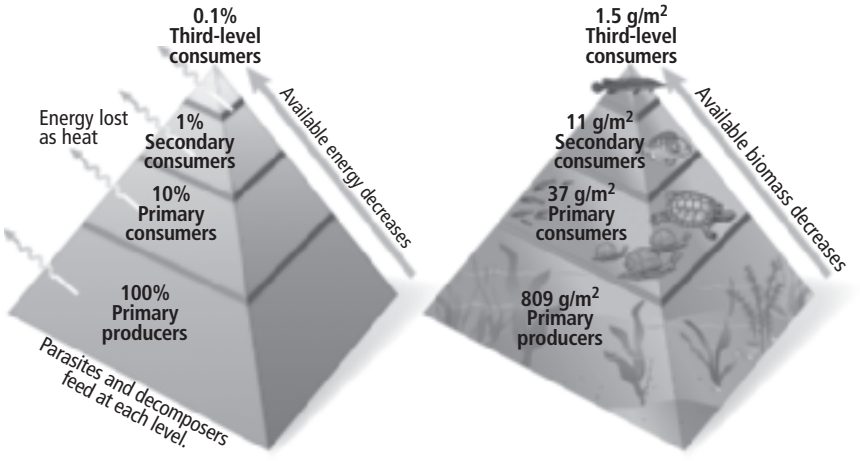
A pyramid of energy indicates the amount of energy available to each trophic level. In the energy pyramid below, notice that about 90 percent of the available energy is used by the organisms at each level. Some of the energy is used to build cells and tissues. Some is released into the environment as heat. Only about 10 percent is available to the next level of the pyramid.

The **biomass**, or total mass of living matter at each trophic level, can also be modeled by an ecological pyramid. In a pyramid of biomass, each level shows the amount of biomass consumed by the level above it.

A pyramid of numbers shows the number of organisms consumed at each trophic level in an ecosystem. The number decreases at each level because less energy is available to support organisms.

Picture This

5. Explain How is mass measured on the pyramid of biomass?



Pyramid of Energy **Pyramid of Biomass**