

Ecology and Ecosystems—Part Two

WE LIVE in a complex world. Many different species of organisms have niches in this world and share the earth's environment. These niches provide for the well-being of these living organisms. Understanding relationships and systems helps humans relate to the world in which they live, as well as care for and improve the environment. In this E-unit you will learn about population ecology, food relationships found in nature, biomes, and ecosystem diversity.



Objectives:



1. Explain population ecology.
2. Describe food relationships found in nature.
3. Identify biomes and explain ecosystem diversity.

Key Terms:



biome

food chain

mortality

natality

population

population density

population ecology

predator

prey

Population Ecology

Population is the number of organisms inhabiting an area. It can be stated as the number within a species or across all species of animals, plants, or other organisms. The human population of the United States is about 300 million people. We can also count wildlife in an area and determine populations of various species. For example, Rocky Mountain National Park has a population of 3,200 elk, including cows, bulls, and calves.

The organisms in an area have an impact on the community in which they live. This is known as **population ecology**. It includes relationships of the species in a community with each other. Population ecology is often investigated by several population traits: density, age, distribution, population changes due to natality and mortality, competition, and predation.

DENSITY

The number of organisms within a given area is known as **population density**. This figure may show the extent to which the organisms are crowded together. Excessive population density may result in insufficient food, water, shelter, and other resources to meet the needs of a species or of all the species in a community. Predators often help keep population density within the carrying capacity of a community.

An example of how removal or introduction of a predator affects a community is the wolves in Yellowstone National Park. Years ago, wolves were killed off and became extinct in Yellowstone. Elk populations greatly increased because their natural predator had been removed. As Elk increased, pressure for browse, such as the leaves and twigs of willow trees, also increased. Willow trees then failed to thrive and grow because of the elk. The wolves were reintroduced into Yellowstone from wild populations in Canada just a few years ago. They have reduced the elk population so that the willow trees are able to grow again. Some wildlife biologists would say that the natural balance in the Yellowstone community is now much improved.

AGE

Populations, particularly forests, may be characterized by age. The nature of the community in an old-growth forest is markedly different from that in a young forest. Most communities strive toward a balance in age distribution. Young, adult, and older organisms should all be present. This leads to a stable population in that will reproduce itself.

DISTRIBUTION

Organisms may be dispersed, or scattered about, or they may be clumped, or clustered. For example, some trees may be dispersed over a wide area, whereas others may be clumped in one small location. Whether plant wildlife that is the source of food and shelter is scattered or clustered can affect the distribution of animal wildlife. As a case in point, if all acorn-bearing oak trees are in a small area, the squirrel population will be concentrated there also. Most populations are not uniformly distributed, though some dispersion is desired.

POPULATION CHANGES

Changes in a population result from natality and mortality. **Natality** is the production of new individuals in a population. It is most likely to occur when members of the population are

at a peak reproductive age. The presence of a high proportion of very young or old individuals depresses natality and may result in a population getting out of balance.

Mortality is death. The rate of mortality influences population. Disease, drought, food shortage, and other conditions may increase mortality. Harvesting by hunters of game species also affects population.

COMPETITION

Individuals within a community compete with each other for food, water, shelter, and other resources. The supplies of some of these may not be adequate to sustain a population. Food shortage caused by drought is an example. In normal years, the food supply may be adequate; but when drought results in insufficient food, the individuals cannot get enough to eat to survive, and mortality becomes a factor. Dominant species typically capture the space they need to survive, and less dominant species are forced out or naturally removed.

PREDATION

Predation can have a major influence on population. It is the process of one species of animal using another as its food. The animal that seeks others is a **predator**. The animal that is consumed is **prey**. An example of a predator is a hawk. The hawk consumes other animals, including small rodents, such as rats and mice.

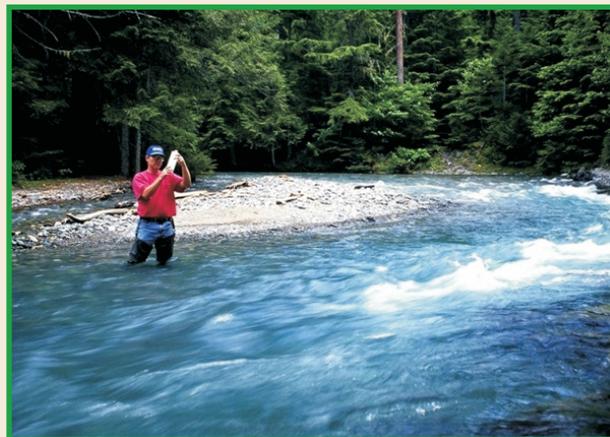
A large number of predators can put considerable pressure on the population of nonpredators. An example is the double-crested cormorant. This is a fairly large water bird that preys on fish. One cormorant may consume several small fish in a day. The presence of several



ON THE JOB...

CAREER CONNECTION: Water Conservationist

Water conservationists monitor water quality and implement practices to conserve water and provide adequate supplies for wildlife, agriculture, and other uses. The work is typically outdoors and may involve collecting water samples, studying water supplies, testing water samples, and preparing reports. Most water conservationists have college degrees in environmental science or a related area. Jobs are often with federal or state government agencies.



This water conservationist is collecting a sample from a flowing stream. (Courtesy, Natural Resources Conservation Service, USDA)

cormorants, each consuming several fish, can have a big impact on population and cause it to decline. Fish farmers are often affected by large numbers of pesky cormorants that take up residence near fish ponds, tanks, or raceways and consume the fish.

Food Relationships in Nature

Organisms vary in how they obtain food. Some organisms, such as mammals, ingest or consume their food. Other organisms, such as plants, manufacture their food through the process of photosynthesis. Regardless of how food is obtained, the nutrients in food provide for the growth, energy, health, and productivity of an organism.

FOOD CHAIN

Organisms vary in the sequence in which they obtain food from their communities. This sequence is known as a **food chain**. The food chain begins with plants. Plants remove nutrients from the soil and, through the process of photosynthesis, produce their food. Some species of animals eat the plants and grow until death. Other animals prey on animals that eat plants. Regardless, the cycle of energy being converted to food by photosynthesis is complete when organisms die and decay to release nutrients that are again used in photosynthesis.

FEEDING GROUPS

Animals are placed into three feeding groups: herbivores, carnivores, and omnivores. Herbivores are animals that feed on plants. They derive needed nutrients from the plants they consume. Carnivores are animals that feed on other animals. They eat animal flesh. Some animals eat both plant and animal food materials. They are called omnivores.

If the feeding groups are assessed in terms of the food chain, the herbivores are at the bottom, with the omnivores immediately above and the carnivores at the top. Animals that consume plants, such as grasses and legumes, are felt to use nutrients most efficiently.

Some animal species are also grouped on the basis of feeding on living or dead food materials. Biophages are organisms that consume only living food materials, such as green grass in a pasture. Saprohages are organisms that feed only on food materials that are dead. Such animals are sometimes known as scavengers.

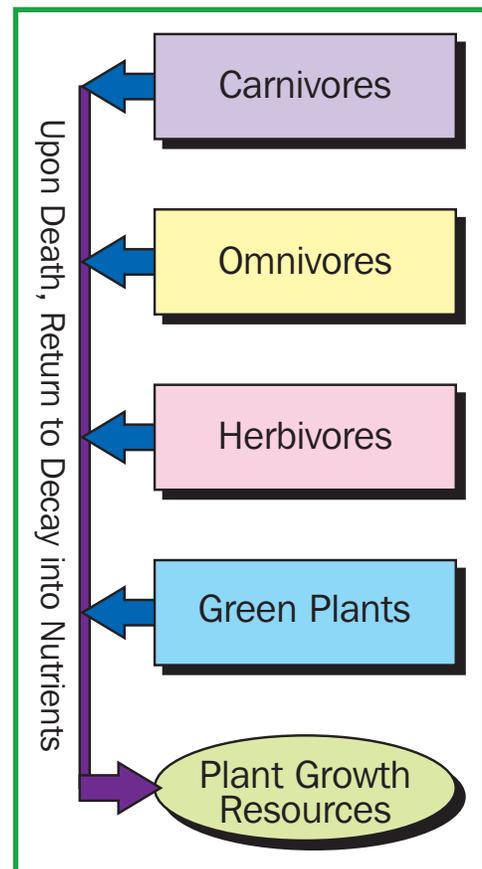


FIGURE 1. A food chain.

Biomes and Ecosystem Diversity

A **biome** is a major ecological community. Biomes are classified as terrestrial or aquatic. Common terrestrial biomes in North America are temperate forests, grasslands, and deserts. Aquatic biomes are in environments of fresh water, salt water, or brackish water.

Temperate forests cover much of North America. Climate varies. Some have high precipitation, and others are fairly dry. Temperatures range from warm to fairly cold. Pine trees cover most temperate forests but are gradually succeeded by dominant oak species. Temperate forests have birds, mammals, and other species adapted to the particular locations. Squirrels, deer, rabbits, and certain species of birds dominate.

Grasslands are areas where grasses naturally grow. In the United States, much of the plains and prairie land of the Midwest is considered grassland. The land has been cleared and plowed for producing grain, oil seed, and other crops. Species vary but have been altered by farming and development for residential, commercial, and factory uses.

The desert biomes are located in western areas of the United States, including Nevada, Utah, Arizona, New Mexico, and California. Precipitation is only a few inches each year and is far below the level needed to support much vegetative growth. Some of this land is used for low-intensity beef cattle and sheep pasture.

Summary:



The organisms in an area have an impact on the community in which they live. This is known as population ecology. Population ecology is often investigated by several population traits: density, age, distribution, population changes due to natal-ity and mortality, competition, and predation.

The need for food promotes feeding relationships that are often described as a food chain. Animals are placed into three feeding groups: herbivores, carnivores, and omnivores. If the feeding groups are assessed in terms of the food chain, the herbivores are at the bottom, with the omnivores immediately above and the carnivores at the top. Some animal species are also grouped on the basis of feeding on living or dead food materials.

Biomes are major ecological communities. They are classified as terrestrial or aquatic.

Checking Your Knowledge:



1. What is population ecology?
2. What is a food chain?
3. What is a biome? What three terrestrial biomes are found in North America?

Expanding Your Knowledge:



Use print media and/or the Internet to read and learn more about the meaning and importance of food chains. Prepare a brief report.

Web Links:



The Illinois Department of Natural Resources

<http://www.dnr.state.il.us/>

Ecology.Com

<http://www.ecology.com>