

## Unit 2

# Ecology

*A tropical rain forest ecosystem consists of interactions among organisms, and between organisms and their environment. For example, rain forest plants are adapted to use the ample water and sunlight in the production of nutrients. The plants use these nutrients for their own growth and development, and, in turn, the nutrients that make up the plants may then be passed to animals that feed on them. Scarlet macaws eat seeds and fruits from rain forest trees, but they also eat clay soil that helps to detoxify many of the poisonous plants that they eat.*

### UNIT CONTENTS

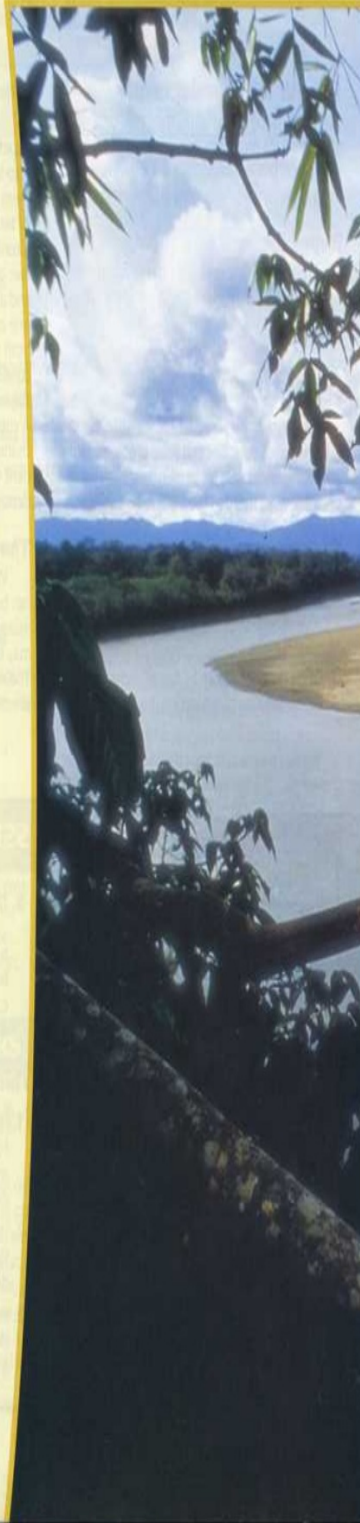
- 2 Principles of Ecology
- 3 Communities and Biomes
- 4 Population Biology
- 5 Biological Diversity and Conservation

**BIO DIGEST** Ecology

### UNIT PROJECT

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## Chapter

# 2 Principles of Ecology

### What You'll Learn

- You will describe ecology and the work of ecologists.
- You will identify important aspects of an organism's environment.
- You will trace the flow of energy and nutrients in the living and nonliving worlds.

### Why It's Important

To understand life, you need to know how organisms meet their needs in their natural environments. To reduce the impact of an expanding human population on the natural world, it is important to understand how living things depend on their environments.

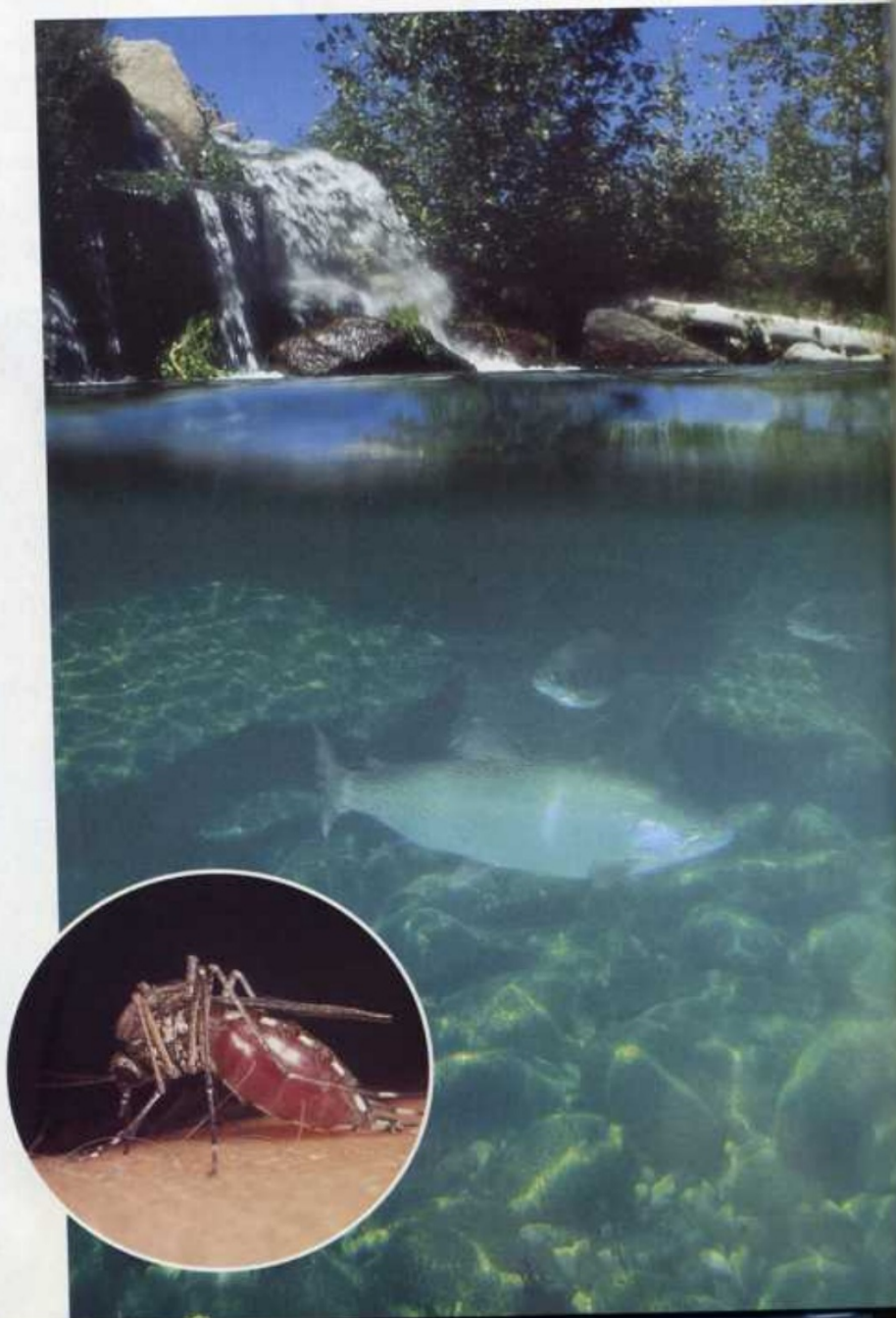
### GETTING STARTED

#### Make a Chain

Think of the things you eat. Now consider how these food items obtained their food when they were alive. *Can you make a food chain, starting with the sun and ending with one of your food items?*

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You might think mosquitoes are pests, but for trout and other animals, mosquitoes and their larvae are a major food source.





# 2.1 Organisms and Their Environment

As shown in the photographs, people can impact plant and animal communities in both positive and negative ways. Learning ecological principles explain the interaction between organisms and their environment can help you understand environmental issues and form your own opinion about them. In this section, you will learn some of the history and the basics of ecology.



Animals wander into cities in search of food (above). A wildlife rehabilitator releases an owl (inset).



## Objectives

**Distinguish** between the biotic and abiotic factors in the environment.

**Compare** the different levels of biological organization and living relationships important in ecology.

**Explain** the difference between a niche and a habitat.

## Vocabulary

- ecology
- biosphere
- abiotic factor
- biotic factor
- population
- community
- ecosystem
- habitat
- niche
- symbiosis
- commensalism
- mutualism
- parasitism

## What Is Ecology?

Do you know anyone who likes to observe nature? Perhaps it is a person who knows the names of many animals, plants, or rocks. People have enjoyed studying nature for thousands of years. Birdwatchers know the names and behaviors of the birds in their area. Some people carefully record observations of rainfall and temperature. Others make it a hobby to study plants; they keep log books with records of when plants produced leaves, flowers, and fruit, as seen in **Figure 2.1**. Some people are interested in nature record

observations, discuss their results, and note how patterns change from year to year.



**Figure 2.1**

An amateur nature study log book from the 17th century.



uses numbers to describe      uses words to describe

## MiniLab 2-1

### Experimenting

**Salt Tolerance of Seeds** Salinity, or the amount of salt dissolved in water, is an abiotic factor. Might salt water affect how certain seeds sprout or germinate? Experiment to find out.



Salt marsh



Freshwater pond

#### Procedure



- 1 Soak 20 seeds in freshwater and 20 seeds in salt water overnight.
- 2 The next day, wrap the seeds in two different moist paper towels. Slide the towels into separate self-sealing plastic bags.
- 3 Label the bags "fresh" and "salt."
- 4 Examine all seeds two days later. Count the number of seeds in each treatment that show signs of root growth or sprouting, which is called germination. Record your data.  
**CAUTION:** Be sure to wash your hands after handling seeds.

#### Analysis

1. Did the germination rates differ between treatments? If yes, how?
2. What abiotic factor was tested in this experiment? What biotic factor was influenced?
3. Might all seeds respond to salt in a similar manner? How could you find out?

### Ecology defined

The branch of biology that developed from natural history is called ecology. Ecology is the scientific study of interactions among organisms and their environments. Ecological study reveals relationships among living and nonliving parts of

the world. Ecology combines information and techniques from many scientific fields, including mathematics, chemistry, physics, geology, and other branches of biology.

You have learned that scientific research includes both descriptive and quantitative methods. Most ecologists use both types of research. They obtain descriptive information by observing organisms in the field and laboratory. They obtain quantitative data by making measurements and carrying out carefully controlled experiments. Using these methods, ecologists learn a great deal about relationships, such as what organisms a coyote eats, how day length influences the behavior of migrating birds, how tiny shrimp help rid ocean fishes of parasites, or how acid rain threatens some of Earth's forests.

### Aspects of Ecological Study

As far as we know, life exists only on Earth. Living things can be found in the air, on land, and in both fresh- and salt water. The biosphere (bi uh sfir) is the portion of Earth that supports life. It extends from high in the atmosphere to the bottom of the oceans. This life-supporting layer may seem extensive to us, but if you could shrink Earth to the size of an apple, the biosphere would be thinner than the apple's peel.

Although it is thin, the biosphere is very diverse and supports a wide range of organisms. The climate, soils, plants, and animals in a desert are very different from those in a tropical rain forest. Living things are affected by both the physical environment and by other living things. Ecologists study these interactions among different organisms and their environments.



## nonliving environment: abiotic factors

Ecology includes the study of features of the environment that are not living because these features are an important part of an organism's life. For example, a complete study of the biology of moles would include an examination of the types of soil in which these animals dig their tunnels. Similarly, a thorough investigation of the life cycle of trout would need to include whether these fish lay their eggs on rocky or sandy stream bottoms. The nonliving parts of an organism's environment are the abiotic factors (ay bi AHT ihk). Examples of abiotic factors include air currents, temperature, moisture, light, and soil. Abiotic factors have obvious effects on living things and often determine which species survive in a particular environment. For example, lack of rainfall can cause drought in a grassland, as shown in Figure 2.2. Can you think of changes in a grassland that might result from a drought? Grasses would grow more slowly, wildflowers would produce fewer seeds, and the animals that depend on plants for food would find it harder to survive. Examine other pages that abiotic factors affect living things in the MiniLab and Problem-Solving Lab shown on these pages.

## Problem-Solving Lab 2-1

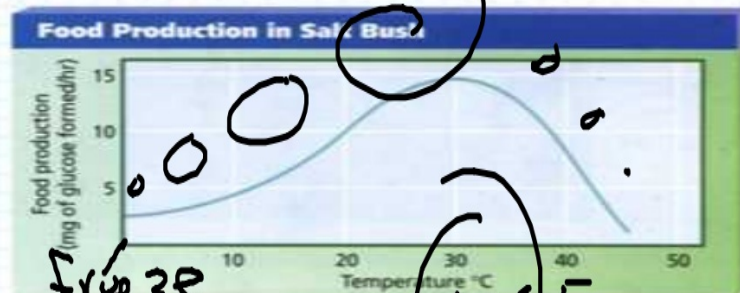
### Interpreting Data

#### How does an abiotic factor affect food production?

Green plants carry out the process of photosynthesis. Glucose, a sugar, is one of the products produced during this process. Thus, glucose production can be used as a means for judging the rate at which the process of photosynthesis is occurring.

#### Analysis

Examine the following graph of a plant called salt bush (*Atriplex*). It shows how this plant's glucose production is influenced by temperature.



#### Thinking Critically

1. Name the abiotic factor influencing photosynthesis and describe the influence of this factor on photosynthesis.
2. Name the biotic factor being influenced.
3. Based on the graph, describe the type of ecosystem this plant might live in. Explain your answer.
4. Does the graph tell you how the rate of photosynthesis might vary for plants other than salt bushes? Explain your answer.
5. Hypothesize why the formation of glucose drops quickly after reaching 30°C.

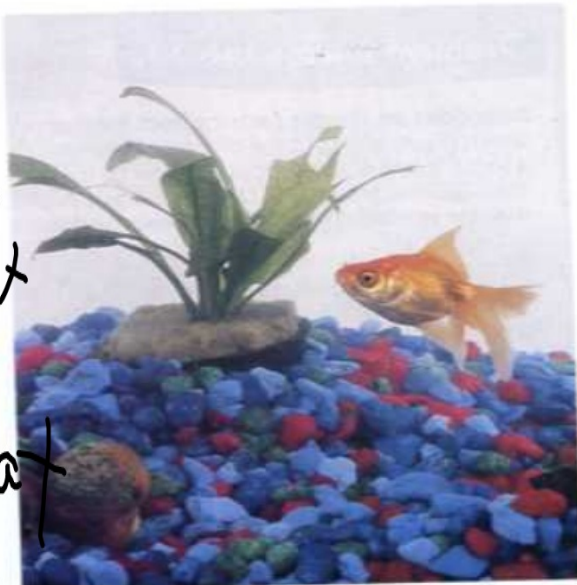


**Figure 2.2**

Droughts are common in grasslands. As the grasses dry out, they turn yellow and appear to be dead, but new shoots grow in the low-lying areas soon after it rains. Some animal species are adapted to living in grasslands by their ability to burrow underground and sleep through the dry periods.



**Figure 2.3**  
How might  
other living  
things affect  
this goldfish?



### The living environment: Biotic factors

Look at the goldfish in *Figure 2.3*. Now consider its relationships with other organisms. It may depend on other living things for food, or it may be food for other life. The goldfish needs members of the same species to reproduce. To meet its needs, the goldfish may compete with organisms of the same or different species.

A key consideration of ecology is that living organisms affect other organisms. **All the living organisms that inhabit an environment are called biotic factors (by AHT ihk).** Ecologists investigate how biotic factors affect different species. To help them understand the interactions of the biotic and abiotic parts of the world, ecologists have organized the living world into levels.

### CAREERS IN BIOLOGY

#### Science Reporter

**D**oes science fascinate you? Can you explain complex ideas and issues in a clear and interesting way? If so, you should consider a career as a science reporter.

#### Skills for the Job

As a science reporter, you are a writer first and a scientist second. A degree in journalism and/or a scientific field is usually necessary, but curiosity and good writing skills are also essential. You might work for newspapers, national magazines, medical or scientific publications, television networks, or Internet news services. You could work as a full-time employee or a freelance writer. You must read constantly to stay up-to-date. Many science reporters attend scientific conventions and events to find news of interest to the public. Then they carefully and accurately translate what's new so nonscientists can understand it.

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### Levels of Organization in Ecology

The study of an individual organism, such as a male deer, known as a buck, might reveal what food items it prefers, how often it eats, and how far it roams to search for food or shelter. Although it spends a large part of its time alone, it does interact with other individuals of its species. For example, it periodically goes in search of a mate, which may require battling with other bucks.

All organisms depend on others for food, shelter, reproduction, or protection. So you can see that the study of an individual would provide only part of the story of its life cycle. To get a more complete picture requires studying its relationships with other organisms.

Ecologists study interactions among organisms at several different