

Lesson A1–2

Understanding Ecology and Ecosystems

Unit A. Natural Resources

Problem Area I. Introduction to Natural Resources

Lesson 2. Understanding Ecology and Ecosystems

New Mexico Content Standard:

Pathway Strand: Natural Resources and Environmental Systems

Standard: III: Apply scientific principles to natural resource management activities.

Benchmark: III-C: Examine natural cycles and related phenomena to describe ecological concepts and principles.

Performance Standard: 1. Describe the hydrologic cycle. 2. Describe the nitrogen cycle. 3. Describe succession. 4. Describe population dynamics. 5. Describe primary and secondary producers. 6. Identify potential pollution sources. 7. Define watershed boundaries. 8. Describe the influence of weather and climatic factors.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Define ecology and ecosystems.
2. Explain natural selection and succession.
3. Define homeostasis.
4. Identify communities found in nature.
5. Explain population ecology.
6. Describe food relationships found in nature.
7. Identify biomes and explain ecosystem diversity.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Lee, Jasper. *Natural Resources and Environmental Technology*. Danville, Illinois: Interstate Publishers, Inc., 2000. (Textbook, Chapter 3)

Porter, Lynn, et al. *Environmental Science and Technology*. 2nd Edition. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003. (Textbook and Activity Manual, Chapter 11)

Other Resources. The following resources will be useful to students and teachers:

Turk, Jonathan and Amos Turk. *Environmental Science*. 3rd Edition. New York: CBS College Publishing, 1984. (Textbook, Chapters 3 and 5)

Arms, Karen. *Environmental Science*. New York: Holt, Rinehart and Winston, 1996. (Chapters 2 and 3)

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheets
Examples of ecosystems for students to observe
Pictures or diagrams of various ecosystems

Terms. The following terms are presented in this lesson (shown in bold italics):

Abiotic factors
Adaptation
Aquatic communities
Biome
Biotic factors
Carnivore
Communities
Competition
Distribution
Dominant species
Ecology
Ecosystem
Ectothermic
Emigration
Endotherm

Food chain
Food web
Habitat
Herbivore
Homeostasis
Homeotherm
Immigration
Mortality
Natality
Niche
Omnivore
Poikilotherm
Population density
Population ecology
Predation
Selection
Species diversity
Succession
Terrestrial communities

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Set up pictures and diagrams of a variety of ecosystems for the students to look at. Once they have looked, ask them to write down all of the differences they observed. Note items such as location, types of animals and plants, other living creatures, temperature, and climate. Explain that there are a number of ecosystems and different organisms will thrive in each different type of ecosystem. Have students keep their lists handy for an activity to be completed throughout the lesson.

Summary of Content and Teaching Strategies

Objective 1: Define ecology and ecosystems.

Anticipated Problem: What is ecology and what are ecosystems?

- I. The study of how organisms exist in their environment is known as **ecology**. How nature is organized and the roles that each organism plays within its environment can be explained through the science of ecology.
 - A. An **ecosystem** is where an organism lives within the environment. An ecosystem can be as large as a rain forest or as small as a pond.

- B. There are two types of factors found within an ecosystem, biotic and abiotic factors. **Biotic factors** are the living things found in an ecosystem. Bio- means life. Biotic factors include plants and animals. The biotic factors need the abiotic factors to live. **Abiotic factors** are the non-living things found in an ecosystem. Abiotic factors include water and temperature.

Use TM: A1–2A to review the terms covered in this objective. To apply this objective, have the students look at a fish tank, animal cage, or terrarium found in the classroom. If one is not available, go to another classroom or go outside. Ask the students to determine which items within the chosen ecosystem are biotic and abiotic. Have them determine how the biotic factors rely on the abiotic factors within that ecosystem.

Objective 2: Explain natural selection and succession.

Anticipated Problem: What are natural selection and succession?

- II. Selection and succession are examples of change that occur within an ecosystem. Without change, ecosystems could not survive. **Adaptation** is an organism's ability to tolerate change in its environment. Adaptation is necessary for survival. The theory of evolution and adaptation of organisms is credited to Charles Darwin.
- A. **Selection** is the survival of organisms that are best adapted to their environment. Adaptation occurs because the species goes through change over time. Many of these changes occur through genetics.
- B. **Succession** is the replacement of one community by another. Succession occurs naturally over time. The rate of succession can be altered by humans, however. For example, humans may reduce the amount of a specific fish species in an area by over-fishing.

Use TM: A1–2B to review this objective. Have students go back to their list from the first objective. Have them determine which of the factors have gone through some type of change. Tell them to consider the reasons for these changes. Also, have them brainstorm and come up with changes that may occur in the future.

Objective 3: Define homeostasis.

Anticipated Problem: What is homeostasis?

- III. All organisms must deal with changes in their external environment. Failure to deal with these changes can cause elimination of the species. External environmental factors such as moisture, temperature, and climate can affect homeostasis. **Homeostasis** is the process in which organisms maintain a constant internal environment when the external environment changes. An example of homeostasis in animals is sweating in warm temperatures and shivering in cool temperatures. However, some animals can tolerate a variety of temperatures. Examples of these types of animals include homeotherms and poikilotherms.
- A. Humans, horses, deer, and dogs are examples of homeotherms. A **homeotherm** is an organism that maintains near constant internal temperature despite the temperature of

the environment. Homeotherms are warm-blooded or endotherms. An **endotherm** is an organism that can maintain a constant body temperature.

- B. Snakes, fish and turtles are known as poikilotherms. A **poikilotherm** is an organism that has a body temperature that equilibrates with the environment. Poikilotherms are considered ectothermic. An **ectothermic** organism does not have a constant body temperature.

Use TM: A1–2C to review the terms covered in this objective. Going back to the list made in objective one, have students determine whether or not the biotic factors are endothermic or ectothermic.

Objective 4: Identify communities found in nature.

Anticipated Problem: What communities are found in nature?

- IV. **Communities** are collections of organisms that live together. Each organism or species of organisms is its own individual. However, they all react and interact with each other. A **habitat** is the physical environmental characteristics of a community. A habitat includes biotic and abiotic factors. A **niche** is the function of an organism within its community.
- A. Communities can be found in the water and on the land. Interaction does occur between these two types of communities. This interaction can be good, for example some aquatic animals such as alligators can live on both the land and in the water. Sometimes though, the interaction can be bad. For example, water runoff can erode soil from the terrestrial community into the aquatic community. This excess soil is considered pollution.
1. Communities that occur in the water are called **aquatic communities**. Aquatic plants include water chestnuts and water hyacinths. Examples of aquatic animals include fish, shrimp, and eels.
 2. Communities found on the land are called **terrestrial communities**. Trees, soybeans, and grass are examples of plants found in a terrestrial community. Sheep, cattle, and hogs are examples of terrestrial animals.
- B. Within a community one species may begin to take over. A **dominant species** is a species that is stronger or has an advantage over another species. The dominant species is capable of altering the community for other species. **Species diversity** refers to a variety of different types of organisms living in a community. The greater the variety, the greater the species diversity.

Use TM: A1–2D to review the two types of communities covered in this objective. Again, refer to the list made in objective one. Have the students determine if the community they studied was aquatic or terrestrial.

Objective 5: Explain population ecology.

Anticipated Problem: What is population ecology?

- V. **Population ecology** is the study of how plant and animal populations within a community affect each other. Population ecology can be affected by the attributes of density, age, and distribution. Population ecology is also affected by population growth, competition, and predation.
- A. Population ecology attributes include the density, age, and distribution within a community.
1. **Population density** is the measure of how crowded organisms are in their environment. Because organisms compete for resources, keeping a balance is important. If the population is too high, some organisms will die.
 2. A population can also be classified by its age. The three groups of ages are preproductive, reproductive, and postreproductive. Preproductive organisms are young and have not reproduced, reproductive organisms are in the process of reproducing, and postreproductive organisms are past the stage of reproducing. To be productive, a community should contain each of these three age groups.
 3. **Distribution** is a description of how organisms are distributed within their community.
- B. Population growth is determined by immigration, emigration, natality, and mortality.
1. **Immigration** is the act of an organism moving into a habitat.
 2. **Emigration** is the act of an organism moving out of a habitat.
 3. **Natality** is the production of new individuals in a habitat.
 4. **Mortality** is the death rate in a population.
- C. Population ecology can also be affected by competition. **Competition** is the use of the same resources by different organisms to live. All resources are limited in supply. Because of this, some organisms will die or will be forced to move to other communities to survive.
- D. **Predation** is one living organism serving as food for another organism. The organism that consumes another is called a predator, the organism being consumed is called the prey. Cannibalism, or the eating of your own kind, is also considered predation.

Use TM: A1–2E to review the terms covered in this lesson. Refer back to the list made in objective one. Have the students decide which organisms are predators and which are prey. Also, have them consider the age and population density of their sample.

Objective 6: Describe food relationships found in nature.

Anticipated Problem: What types of food relationships are found in nature?

- VI. All living organisms need some type of nourishment to live. This nourishment usually comes from food. A **food chain** is the order in which organisms obtain their food. Each species has

its own food chain. Food chains intertwine to form food webs. A **food web** is the interconnection of food chains within a community. Within a food web, animals are grouped according to the types of food they consume. These groups include herbivores, carnivores, and omnivores.

- A. A **herbivore** is an animal that eats only plants for food. Examples of herbivores include bison and grass carp.
- B. A **carnivore** is an animal that eats only animals for food. Examples of carnivores include hawks.
- C. **Omnivores** are animals that eat both plants and animals. Examples of omnivores include bears and catfish.

Use TM: A1–1F to show what a food web looks like. Refer back to the list made in objective one and have the students determine if there are any herbivores, carnivores, or omnivores in their community.

Objective 7: Identify biomes and explain ecosystem diversity.

Anticipated Problem: What is ecosystem diversity and what biomes can be found on earth?

- VII. A **biome** is an area made up of a distinct combination of plants and animals. Biomes are made up of the groups of ecosystems found on earth. Biomes are terrestrial or aquatic in nature.
 - A. The main types of terrestrial biomes are tropical forests, temperate forests, grasslands and savannas, tundra and taiga, and deserts. Tropical forests are found near the equator. Temperate forests can be found in warm, semiarid, cold, and wet areas. Grasslands and savannas are areas where grasses grow. Tundra and taiga are cold areas found near the Arctic. Deserts are areas with little or no rain fall.
 - B. Aquatic biomes include lakes and ponds, streams, oceans, and wetlands and estuaries. Lakes and ponds are inland areas of freshwater. Streams are ecosystems made up of flowing water. Oceans are large bodies of saltwater. Wetlands and estuaries are areas found near bodies of water.

Use TM: A1–2G to review the different types of terrestrial and aquatic biomes. Have the students name different biomes that they've learned about in a geography class or have visited. Ask them to explain what they know or have seen in these areas.

Review/Summary. In order to review and summarize this lesson, assign the students to define the terms and answer the anticipated questions.

Application. Use the chapter eleven worksheet from the *Environmental Science and Technology Activity Manual* to apply the information covered in this lesson.

Evaluation. Use the attached sample test to evaluate the students' understanding of the objectives covered in this lesson.

Answers to Sample Test:

Part One: Matching

1 = a, 2 = g, 3 = d, 4 = f, 5 = e, 6 = c, 7 = h, 8 = i, 9 = b, 10 = j

Part Two: Completion

1. herbivore
2. Natality
3. omnivore
4. niche
5. Immigration

Part Three: Short Answer

1. Adaptation is an organism's ability to tolerate change in its environment.
2. Population ecology is the study of how plant and animal populations within a community affect each other.
3. Terrestrial: tropical forests, temperate forests, grasslands and savannas, tundra and taiga, deserts

Test

Lesson A1–2: Understanding Ecology and Ecosystems

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | |
|-------------------|--------------------|
| a. ecology | f. predation |
| b. biotic factors | g. endotherm |
| c. competition | h. abiotic factors |
| d. ectotherm | i. selection |
| e. communities | j. succession |

- _____ 1. The study of how organisms exist in their environment.
- _____ 2. An organism that can maintain a constant body temperature.
- _____ 3. An organism that does not have a constant body temperature.
- _____ 4. One living organism serving as food for another organism.
- _____ 5. Collections of organisms that live together.
- _____ 6. The use of the same resources by different organisms to live.
- _____ 7. The non-living things found in an ecosystem.
- _____ 8. The survival of organisms that are best adapted to their environment.
- _____ 9. The living things found in an ecosystem.
- _____ 10. The replacement of one community by another.

Part Two: Completion

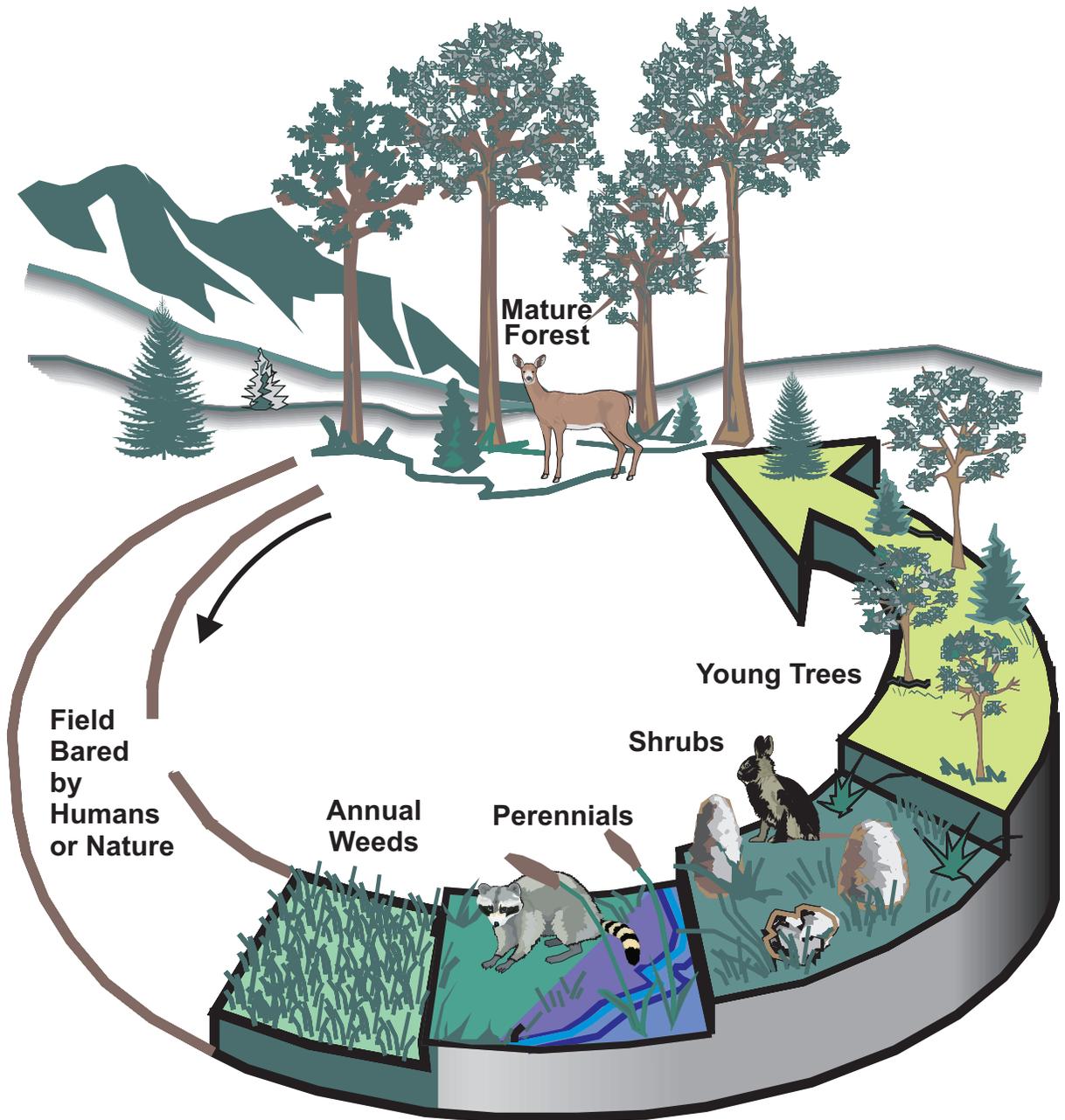
Instructions. Provide the word or words to complete the following statements.

1. A(n) _____ is an animal that eats only plants for food.
2. _____ is the production of new individuals in a habitat.
3. _____ are animals that eat both plants and animals.
4. A(n) _____ is the function of an organism within its community.
5. _____ is the act of an organism moving into a habitat.

TERMS FOR REVIEW

- ◆ **Ecology: the study of how organisms exist in their environment**
- ◆ **Ecosystem: where an organism lives within the environment**
- ◆ **Biotic factors: the living things found in an ecosystem**
- ◆ **Abiotic factors: the non-living things found in an ecosystem**

THE SEQUENCE OF SUCCESSION



(Courtesy, Interstate Publishers, Inc.)

TERMS FOR REVIEW

- ◆ **Homeostasis**
- ◆ **Homeotherms**
- ◆ **Endotherms**
- ◆ **Poikilotherms**
- ◆ **Ectotherms**

COMMUNITIES

Communities are collections of organisms that live together.

◆ **Communities that occur in the water are called aquatic communities.**

→ **Aquatic plants include water chestnuts and water hyacinths.**

→ **Examples of aquatic animals include fish, shrimp, and eels.**

◆ **Communities found on the land are called terrestrial communities.**

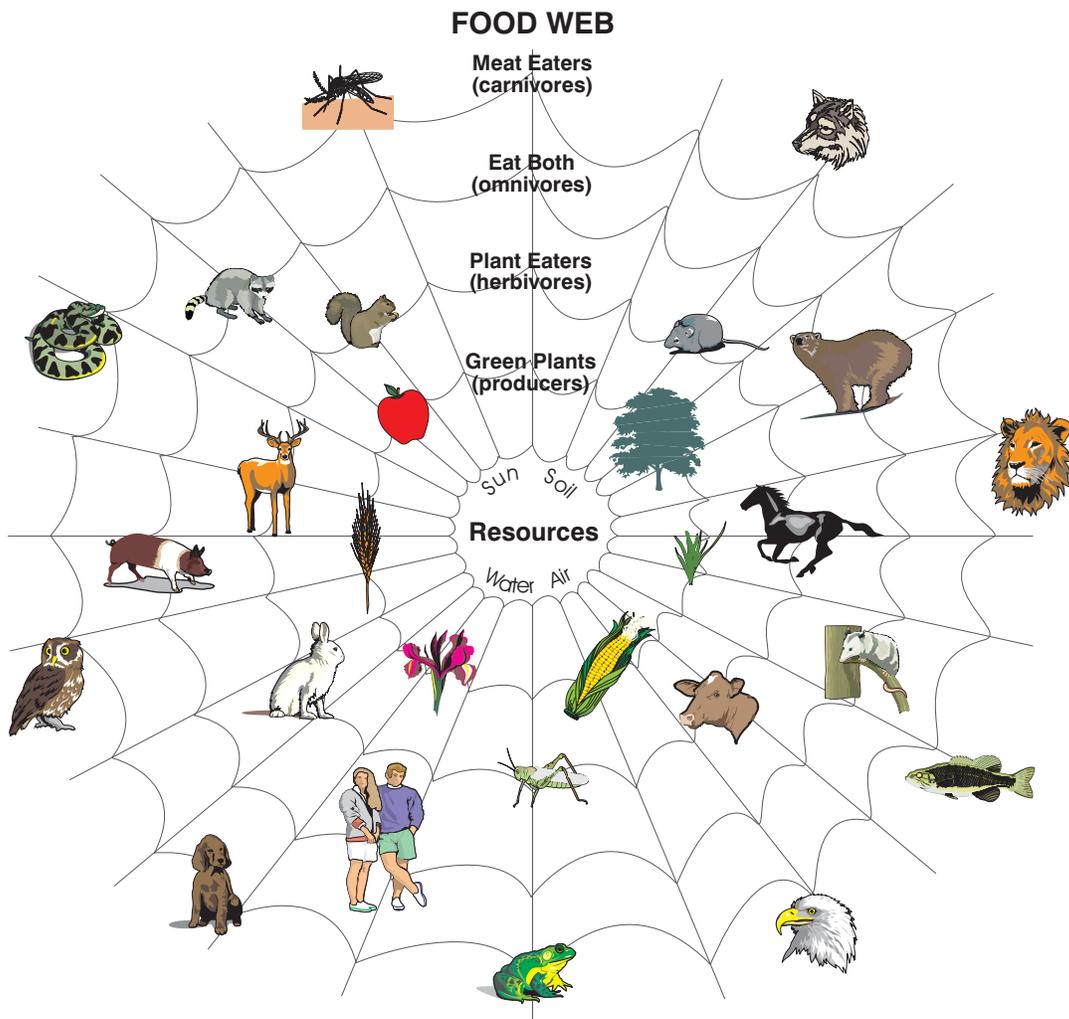
→ **Trees, soybeans, and grass are examples of plants found in a terrestrial community.**

→ **Sheep, cattle, and hogs are examples of terrestrial animals.**

TERMS FOR REVIEW

- ◆ **Population ecology**
- ◆ **Population density**
- ◆ **Distribution**
- ◆ **Immigration**
- ◆ **Emigration**
- ◆ **Natality**
- ◆ **Mortality**
- ◆ **Competition**
- ◆ **Predation**

THE TERRESTRIAL FOOD WEB



TERRESTRIAL AND AQUATIC BIOMES

Terrestrial Biomes	Aquatic Biomes
Tropical Forests	Lakes and Ponds
Temperate Forests	Streams
Grasslands and Savannas	Oceans
Tundra and Taiga	Wetlands and Estuaries
Desert	