



SCIENCE

STUDENT BOOK

▶ **10th Grade | Unit 9**

SCIENCE 1009

Ecology and Energy

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Ecology and Energy

Introduction

All sciences are part of ecology. Wherever you go on our planet Earth, you can study ecology. Ecology is a science of relationships. Plants, animals, and people depend on each other and the environment for survival. Ecology is part of God's plan for human survival on earth.

Pollution is a problem facing many places in the world. Understanding more about ecology helps people to prevent and solve pollution problems.

The way people use energy has caused many pollution problems, but energy may also help solve many pollution problems. Understanding more about ecology helps people to understand the need for making wiser choices in energy sources and uses. How individuals choose to use energy can hurt or help the air, land, water, and life on earth.

God wants us to enjoy the world He gave us. He wants us to look at, study, and learn from living things around us. We are to solve the problems we can and trust Him for the problems we cannot solve. God wants us to take care of the earth that was created to supply our everyday physical needs.

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAK®. Each section will list according to the numbers below what objectives will be met in that section. When you have finished this LIFEPAK, you should be able to:

1. Define ecology.
2. Discuss how ecological relationships affect the environments of our world.
3. Relate principles of ecology to specific concepts.
4. Discuss the parts of an ecosystem.
5. List reasons why plants and animals live in certain environments.
6. Define the balance of nature.
7. List examples of good management principles for taking care of environmental resources.
8. Describe several important tools of the ecologist.
9. Describe various types of habitats and communities.
10. Demonstrate some methods used to study ecology.
11. Name several ways you can help to take care of the world God gave us.
12. Discuss pollution problems and possible ways of solving them.
13. Discuss energy problems and possible new sources of energy.
14. Discuss God's purpose and design in ecology.

1. PRINCIPLES OF ECOLOGY

In this section of your LIFEPAAC and in later sections, you will study about **ecology**. Many sciences are included in ecology because it involves the **relationships** among all living things, their **environments**, and the forces that alter the environments. The study of ecology is important for you to understand your world. Students have asked, “Why should I be involved in all this study of the world?” The answer is simple: “Because it is the only world we have.”

You will notice the word list found in the glossary is longer than in many other LIFEPAACs. Ecology is a popular topic of discussion, but the definitions are not always clear. For this reason the glossary should be studied before

beginning this section. As you understand ecology better, your choices should be wiser in taking care of your world.

An additional benefit to the student who studies and knows the words of the glossary is the help of word clues in understanding **principles** of ecology. You may have already learned that sciences are built not only on information but also on certain laws, or principles, which help to predict what will happen in problems, experiments, and real-life situations. As you learn more about ecology and its principles, you will be able to guess more correctly the outcome of questions you may have about the ecology of your neighborhood, country, and world.

Section Objectives

Review these objectives. When you have completed this section, you should be able to:

1. Define ecology.
2. Discuss how ecological relationships affect the environments of our world.
3. Relate some principles of ecology to specific concepts.
4. Discuss the parts of an ecosystem.
5. List reasons why plants and animals live in certain environments.
6. Define the balance of nature.
7. List examples of good management principles for taking care of environmental resources.
14. Discuss God’s purpose and design in ecology.

Vocabulary

Study these words to enhance your learning success in this section.

community
ecologist
energy
food chain
organism
plankton
resource

concept
ecology
environment
habitat
photosynthesis
principle
zooplankton

dynamic equilibrium
ecosystem
environmental factor
interrelationships
phytoplankton
relationship

Note: All vocabulary words in this LIFEPAAC appear in **boldface** print the first time they are used. If you are unsure of the meaning when you are reading, study the definitions given.

ECOSYSTEMS

Scientists are discovering that our world operates in a very complicated system of cycles. You may recall cycles such as the water (or *hydrologic*) cycle, the nitrogen (or protein) cycle, and the carbon (or organic) cycle. Briefly, in the water cycle the oceans are a source of water for cloud and rain formation, and eventually water that falls as rain returns to the ocean to be used again. Nitrogen is essential to protein formation, and carbon to the synthesis of foods. Both nitrogen and carbon are built into food molecules by green plants and are eventually converted back to atmospheric nitrogen and carbon or soil nutrients to be used again.

We are discovering that all life and the elements of the earth change in cycles. This discovery is not new. God told Noah (Genesis 8:22), “While the earth remaineth, seedtime and harvest, and cold and heat, and summer and winter, and day and night shall not cease,” referring to the seasons changing in cycles. The secret of the cycle as a process is the continuous supply of **resources** for more building. If a process only builds, raw materials and resources may soon run out and bring a halt to the process. If foods could only be made, but not broken down, they could not be used for **energy**. Foods would not be decomposed to release the nitrogen and carbon necessary for making more foods. Without food, life on earth would soon vanish. This fact is part of our modern-day ecology problem. Cycles are no accident. God’s wisdom and design are so much more than our human minds can imagine!

Definition. The word **ecology** is made up of two Greek words, *oikos* and *logia* which mean respectively *house* and *knowledge*. *House* means the *type of surroundings in which a group of plants and animals live*. *Knowledge* means the *science, or study, of these life houses*. Plants make the basic framework of the houses for other plants and many kinds of animals to

occupy. Scientists who study ecology are called **ecologists**.

Ecology includes the study of how living things grow and survive and how each **organism** helps, depends on, or hinders other living things in the **environment**. These requirements and dependencies are all examples of **relationships** organisms have with their environments or with other living things.

You may wonder how the complicated relationships of some life houses come into being. In Hebrews 3:3-4 the Bible gives us an answer to our question, “... He who hath builded the house hath more honor than the house. For every house is builded by some man; but he that built all things is God.” Just as life could not have happened by accident, neither could the life houses and ecological relationships be credited to fate or evolution. Because God has made everything, He alone is deserving of worship.

Ecological relationships. Understanding the **concept** of an **ecosystem** is basic to the study of ecology. If we add all the relationships of plants and animals to each other and their environment, we make what ecologists call an ecosystem. An ecosystem is a cycle with six main parts. The cycle shows how energy and food move through a series of relationships. The main parts of an ecosystem may be labeled: the sun; soil, water, and climate; green plants (food producers); herbivorous (plant-eating) animals; carnivorous (flesh-eating) animals; and decomposers (fire and nongreen plants such as fungi and bacteria). Each part of the ecosystem is essential for any group of living things to continue living in their environmental home as a group. If any part of the ecosystem is missing, the other parts of the system may be affected.

Some of the parts of the ecosystem are more critical than others. If the sun were missing, all

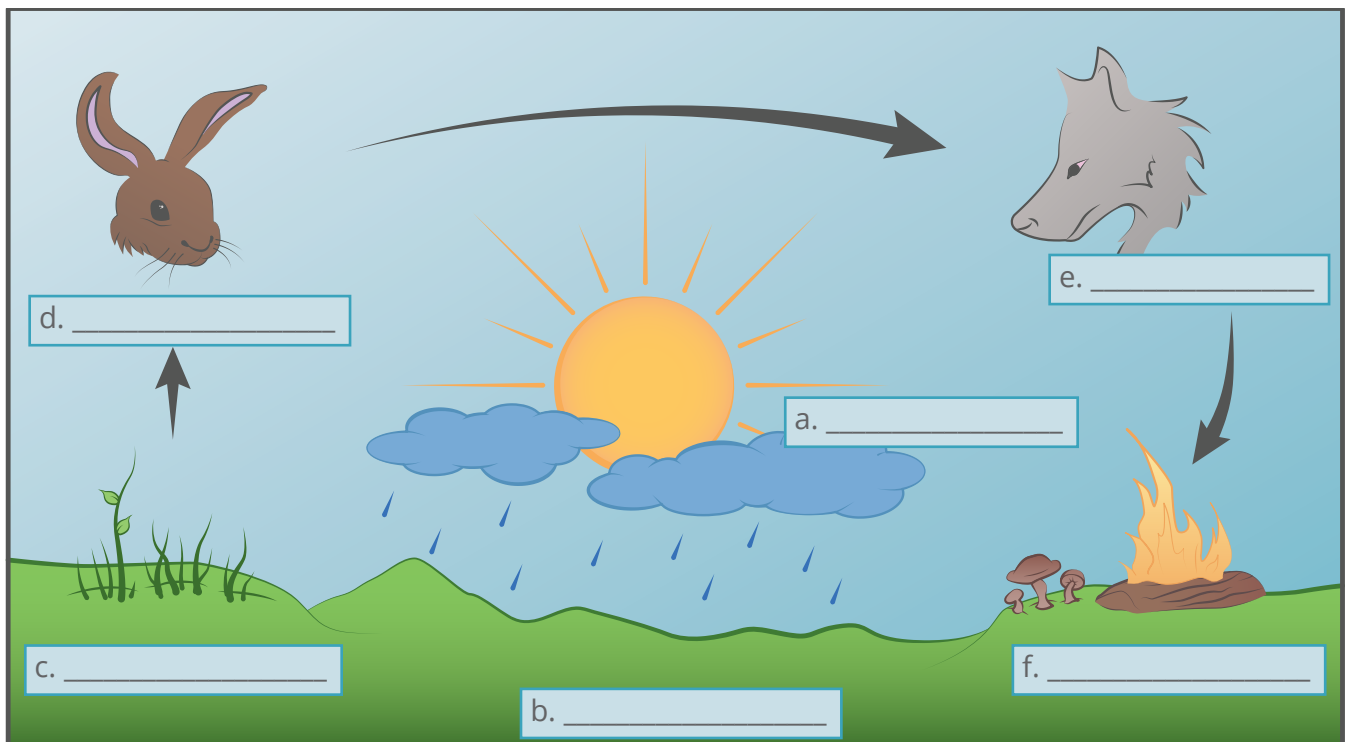
life on earth would die. If carnivores were missing, the herbivorous animals might be affected to a large extent, depending on the environment. An ecosystem could probably survive without carnivores or herbivores if the other

four parts were present. Many plants could survive; however, those plants that are dependent on insects or birds for pollination and seed formation would not survive.



Complete the diagram.

- 1.1** Find the six main parts in the diagram of an ecosystem. Write the correct label on the matching picture part in the diagram. Notice the order of relationships in the cycle. The parts of an ecosystem always fit together in a sequence from sun to decomposers. (Energy in the form of food comes from the sun's energy.) Eventually, the energy is used or released and the foods are broken down releasing heat, energy, and raw materials.



Related principles. Some **principles** of ecology that may be stated using the ecosystem concept are listed:

1. Living things affect other living things.
2. Basic relationships or **interrelationships** exist between organisms and their environments.
3. Both the living and the nonliving are connected.
4. An ecological system, or ecosystem may be a single population of organisms in an environment; one or more **communities** of plants and animals in an environment; many communities in a region of the earth; or the entire planet.
5. Ecological systems and interactions are best understood by a thorough knowledge of the living and nonliving environment.
6. Changes in or controls of an ecological system affect more than the organism to be changed or controlled.
7. All energy and materials for life originate in the nonliving environment.
8. The numbers and kinds of organisms making up an ecosystem affect the flow of energy and matter through the cycle.
9. The ecosystem will break down if energy and matter are not constantly supplied or recycled.
10. Energy and matter are continually escaping from the ecosystem as they are being used by living things.
11. The cycles of nature illustrate order in the universe.

Some of these principles of ecology may seem too simple. Do not be misled into believing that simple things are not important. As a matter of fact, many of the principles of ecology are really common sense and sound thinking. Someone has said that the trouble with man is twofold—he cannot learn truths that are too complicated, and he forgets truths that are too simple.

One of the definitions of ecology is the study of ecosystems. As you have seen in this section of your LIFE PAC, ecosystems are the basic unit for understanding relationships and interactions between plants and animals and their environment.



Write the letter for the correct answer.

- 1.2 Ecology is made up of _____ .
 - a. mathematics
 - b. many sciences
 - c. the science of biology
 - d. animals
- 1.3 The basic framework for the life houses is composed of _____ .
 - a. plants
 - b. animals
 - c. decomposers
 - d. water
- 1.4 The process of decomposition releases into the environment _____ .
 - a. iron and lead
 - b. nitrogen and carbon
 - c. oxygen and helium
 - d. neon and argon
- 1.5 The word ecology comes from Greek words meaning _____ .
 - a. study of the environment
 - b. study of life
 - c. study of energy
 - d. study of houses

**Make a diagram.**

1.6 Sketch the ecosystem and label the six basic parts in proper order.

Answer these questions.

1.7 How are ecological relationships important to life? _____

1.8 Why should you be involved in ecology? _____

Complete this activity.

1.9 List five principles of ecology that use the ecosystem concept.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____

ENVIRONMENTAL FACTORS

All environments on the earth are somewhat the same, but they are also different in many ways. Living things require certain building blocks to compose an environment for survival and growth. These building blocks of the environment determine where in the environments of our planet specific kinds of organisms live.

Building blocks. Plants and animals depend on building blocks of the environment that we probably do not even think about. These unique parts of the environment, some that we can see and some that we cannot see, are called **environmental factors**. Some of the most important factors we can measure or detect are light, temperature, water, air, minerals, elevation, surface features, and growing seasons. Environments differ when variations, more or less, exist in the amounts of each of these factors. Environments and some environmental factors are studied and measured by the use of space satellites.

Habitat variation. We might imagine these environmental factors as actual building blocks. Environmental factors build **habitats**, the places where plant and animal communities live. You may wonder if these environmental factors are really important. The proper combination of these building blocks is essential for an organism to survive in a habitat.

If we vary the amounts of each environmental factor, different habitats can be designed. Consider some of these habitat variations. If a location has too much light and a scarcity of available water, the habitat may be a desert. If the “building block” for light is small, or absent, the habitat may be a cave with little or no light. If much water is present, the habitat may be a pond, a lake, or an ocean. The elevation may vary from a high mountaintop to a deep ocean canyon to create two entirely different habitats.

What kind of environmental factors determine whether the habitat is a salt flat in Death Valley



| Building Blocks of a Habitat

or a farmer’s cornfield in Iowa? What kind of environmental factors determine if the habitat is on a rock or under one?

Habitats in the country have air with more oxygen than smoggy air in the city. Gases in the air affect habitats. Air on mountaintops has less oxygen and less air pressure than air at sea level.

Plants can keep growing all year round near the equator, but the farther from the equator we travel, the shorter the growing season becomes. Growing seasons affect and build habitats, too.

If you have ever wondered how the earth could have so many different kinds of life, consider the many different kinds of habitats that exist. A fish is not designed for life on the hot desert sands; nor is an elephant designed for a

mountainous life. Environmental factors build habitats. Studying these factors helps us to understand how God planned for living things to live in certain habitats.

Related principles. Some principles of ecology that may be stated using the environmental factors concept are listed.

1. Organisms living in an area persist because their life requirements fit that particular habitat.
2. Environmental requirements and tolerances determine the distribution of a species of plant or animal.
3. Similar communities of living things are evidence of similar environmental factors.
4. Environmental factors operate together, not alone.
5. The extremes of conditions determine whether the habitat is suitable for an organism.
6. The hereditary characteristics of organisms limit or define their requirements for environmental factors.
7. Just as no two thunderstorms or forest fires are exactly alike, no two bodies of water or landscapes are identical.
8. Numbers of organisms can often be controlled by changing the limiting environmental factors.
9. When people do something to the natural environment, reactions happen that are often different than expected.
10. Organisms with similar requirements often compete for environmental factors.

One of the definitions of ecology is the interrelationship of living things to each other and to their environment. As you have seen in this section of your LIFEPAK, the nonliving environment is essential in providing the source of energy, materials, and conditions for living things to survive, grow, and multiply.



Write the letter for the correct answer.

- 1.10** A habitat is best described as _____ .
 a. the place where organisms live
 b. the organisms that live in a place
 c. the factors controlling the organisms
- 1.11** Some environmental factors are studied by the use of _____ .
 a. space satellites b. telescopes c. astrolabes d. electroscopes
- 1.12** A habitat that has less oxygen and less air pressure than many organisms require would be a _____ .
 a. cave b. desert c. high mountaintop d. seashore
- 1.13** The _____ is longer at the equator than at other places on the earth.
 a. winter b. growing season c. surface feature d. mineral



Complete these activities.

1.14 List eight important environmental factors that affect a habitat.

1.15 Construct and label one habitat you know about, using the building blocks idea for environmental factors. Select any three environmental factors.

1.16 Explain one of the following principles of ecology related to environmental factors.

a. Organisms living in an area persist there because their life requirements fit that particular habitat.

b. Organisms with similar requirements often compete for environmental factors.

a. _____

b. _____

SELF TEST 1

Match these items (each answer, 2 points).

- | | | | | |
|------|-------|-------------------|----|------------------------|
| 1.01 | _____ | phytoplankton | a. | tiny animals |
| 1.02 | _____ | relationships | b. | surroundings |
| 1.03 | _____ | ecosystem | c. | dynamic equilibrium |
| 1.04 | _____ | environment | d. | cycle |
| 1.05 | _____ | balance of nature | e. | grass of the seas |
| | | | f. | dependent, competitive |

Answer true or false (each answer, 1 point).

- 1.06 _____ Organisms with similar requirements usually share environmental factors.
- 1.07 _____ All forms of life on earth are linked together in some type of food relationship.
- 1.08 _____ The ultimate source of energy for life on earth is the sun.
- 1.09 _____ Everything living depends on something else for its life.
- 1.010 _____ The balance of nature is like a living seesaw.
- 1.011 _____ Nature is not balanced as long as a state of dynamic equilibrium exists.
- 1.012 _____ Only people upset the balance of nature.
- 1.013 _____ Nothing is free in nature; what is removed must be replaced.
- 1.014 _____ Habitats vary because environmental factors vary.
- 1.015 _____ Every time people do something to the environment, reactions usually happen as predicted.

Complete these statements (each answer, 3 points).

- 1.016** The word *ecology* is made up of two Greek words meaning a. _____ ,
and b. _____ .
- 1.017** Common needs, mutual benefit, and interactions are all examples of
_____ .
- 1.018** All relationships of living things to each other and to their environment added together
form _____ .
- 1.019** The sun's energy is trapped by a chemical, _____ .
- 1.020** The last three parts of an ecosystem in order are a. _____ , b. _____
and c. _____ .
- 1.021** When a living system cannot adjust to environmental changes, it begins to
_____ .
- 1.022** Good management duplicates _____ .
- 1.023** Good management decisions are based on a. _____ , not
on b. _____ .
- 1.024** Environmental factors may be studied by using space _____ .
- 1.025** A scientist who studies ecology is "termed" a(n) _____ .

Match these items (each answer, 2 points).

- | | |
|--------------------------------|---------------------------|
| 1.026 _____ habitat | a. sun |
| 1.027 _____ herbivorous | b. used to aid or assist |
| 1.028 _____ decomposer | c. bacteria |
| 1.029 _____ resource | d. place |
| 1.030 _____ organism | e. living plant or animal |
| | f. animal |

Complete these activities (each answer, 5 points).

1.031 Explain what is meant by *relationships* in ecology.

1.032 Explain how a food chain operates.

1.033 List two examples of good management to maintain or restore the balance of nature. (5 points)

a. _____

b. _____

1.034 Name five environmental factors. (5 points)

a. _____

b. _____

c. _____

d. _____

e. _____

	SCORE _____	TEACHER _____	initials	date
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