

# Ecosystem Interactions



**UNIT**  
**5**

**Student Reader**

**Front Cover:**

The front cover shows a cottontail rabbit in its environment. Cottontail rabbits are very sensitive to changes in their environment.

# Unit 5: Ecosystem Interactions

## Table of Contents

<b>Section 1: Pollution and Plants</b>	<b>4</b>
Studying Acid Rain	4
Acid Rain Harms Plants	5
Acid Rain and a Plant's Life Cycle	6
Conservation	8
Section 1 Review	9
<b>Section 2: Traits and the Environment</b>	<b>10</b>
Cottontail Rabbits	10
Traits and Heredity	11
Rabbit Adaptations	12
Rabbit Senses	13
Environmental Influences	14
<i>Guayule Shrubs and Rabbits Investigation</i>	15
Section 2 Review	20
<b>Science Words to Know</b>	<b>21</b>

# 1

## Pollution and Plants

### *Studying Acid Rain*

Every year, Sarah Nelson joins a group of scientists to travel around six states in the northeastern United States. They take samples of water from 74 different lakes, from the crowded suburbs of Boston to the top of remote mountains in Maine.



*One cause of acid rain is the burning of fossil fuels.*

These scientists are measuring the amount of acid rain present in the water. **Acid rain** is any form of precipitation that has high levels of nitric and sulfuric acids. It is caused primarily by

the burning of fossil fuels, such as gas, oil, and coal. A small amount of acid rain also comes from natural causes, including volcanic emissions and forest fires.

Studying acid rain is important because too much acidity in the water harms many different living things. Acid rain is a form of **pollution**—any substance that has harmful effects on the environment.

## ***Acid Rain Harms Plants***

Acid rain generally doesn't kill plants directly. Instead, it damages their external structures. This makes it harder for them to grow and develop.

For example, plants use their roots to anchor themselves in place and take nutrients and water from the soil. Scientists know that acidic water dissolves the nutrients and minerals in the soil and then washes them away before trees and other plants can use them to grow. Acid rain can also slow down or reduce root growth.

Acid rain can also damage a plant's leaves. It can cause them to look spotted or to drop earlier than normal. This causes the plant to become weak because leaves have most of the plant's chloroplasts. When a plant's leaves are damaged by acid rain, they can no longer photosynthesize as well. Remember that leaves collect sunlight and convert it into energy the plant can use to grow and develop through photosynthesis.



***Acid rain damages the roots of plants. The plants on the right were exposed to acid rain.***



***Acid rain damages the leaves of plants.***

## *Acid Rain and a Plant's Life Cycle*

When the structures of a plant are damaged by acid rain, they are less able to complete their life cycle. A **life cycle** is the series of developmental stages an organism passes through on its way from birth to death.

There is a pattern to the changes that all living things go through as they grow and develop. All life cycles include birth, growth, reproduction, and death.

The seed is the first step in a flowering plant's life cycle. The seed protects the plant in a protective coat



*This seed is germinating. It is breaking out of the protective seed coat and beginning to sprout.*

as it travels from its parent to a new location.

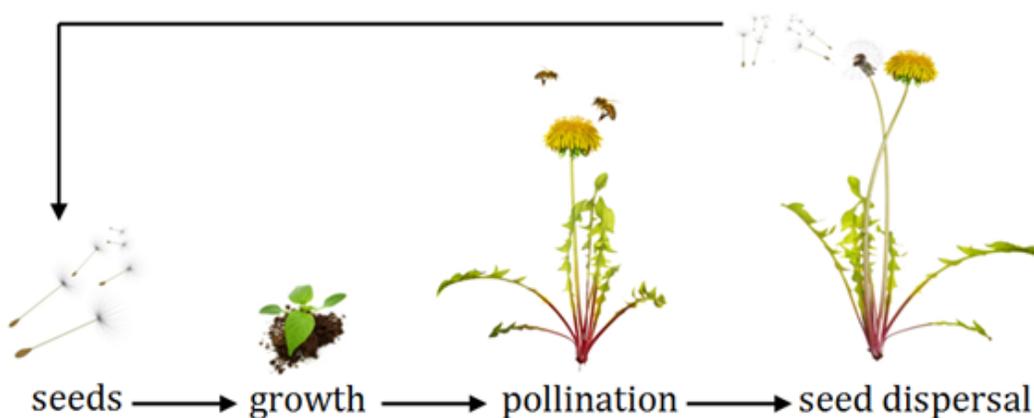
With enough light and warmth from the sun, the seed will start to grow. During this step, the plant breaks out of its seed coat and begins to sprout. This is called germination. It grows roots, stems, and leaves. With leaves, it can capture energy from sunlight.

In the third step, the plant grows buds and flowers. Flowers are external structures where seeds form and where pollination occurs. Flowers attract pollinators so the plant can make new seeds.

Finally, the plant produces fruits that attract animals. Some plants produce seed casings that allow the seed to travel by wind or water. This is called seed dispersal. The seeds grow and start the plant life cycle over again.

Acid rain can prevent a plant's flowers from blooming or cause them to fall off the plant before they are pollinated. This affects a plant's ability to reproduce. **Reproduction** is the ability of a mature organism to have offspring. Without reproduction, a group of organisms will die out. Because of this, reproduction is an essential step in the life cycles of all living things.

### a flowering plant's life cycle

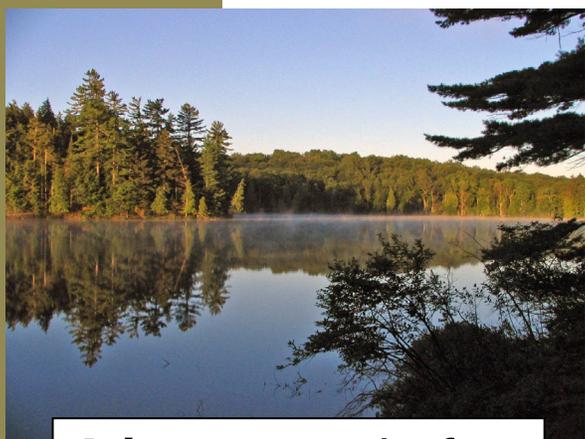


## *Conservation*

Acid rain is mostly a result of humans burning fossil fuels. Once people became aware of the dangers of acid rain, they began to work to protect the environment by reducing the amount of acid rain that occurs.

This is why Sarah Nelson and the other scientists collect water samples every year. They want to measure the amounts of acid rain present in the water. They compare the results to previous years to see whether the amounts have increased, decreased, or stayed the same.

The scientists are working to conserve the environment. Remember that conservation is the weighing of human needs against the needs of the environment to create a sustainable way for humans to live off of natural resources.



***Lakes are recovering from acid rain.***

The scientists have gotten good news in recent years. They've learned that acid rain was most destructive in the 1970s and 1980s. The regions they are studying have recovered more quickly than they expected.



## **Section 1 Review**

### **Reading Comprehension Questions:**

1. What is the main idea of Section 1?
2. What key details does the text provide to support the main idea of the text?
3. How does the text explain the connection between acid rain and a plant's life cycle?
4. Why is reproduction an important step in all life cycles?
5. How does the text explain the connection between acid rain and conservation?

## 2

# Traits and the Environment

## *Cottontail Rabbits*



*a cottontail rabbit*

Small trees, shrubs, vines, and tall grasses are the favorite hiding places of cottontail rabbits. Cottontail rabbits spend much of their time hiding because they have many predators. A **predator** is an organism that eats another organism. Raccoons, foxes, hawks, owls, snakes, cats, and dogs all prey on them.

The cottontail rabbit can run at speeds reaching 29 kilometers (18 miles) per hour. When running from a predator, it runs in a zigzag pattern to confuse the predator.

Cottontail rabbits get their name for their poufy tails. Their tail is an example of a trait. A **trait** is a physical or behavioral characteristic of an organism. Size and color are other examples of physical traits. Running in a zigzag pattern is an example of a behavioral trait. A **behavior** is an organism's response to a stimulus (anything in the environment that causes an organism to react).

## *Traits and Heredity*

When rabbits reproduce, they pass along traits to their offspring. This passing on of traits from parents to children is called **heredity**. Heredity causes offspring to have traits that are similar to their parents and to their siblings.

There are patterns that occur as traits get passed along. Heredity explains why offspring look similar to their parents. This is because they inherit traits from their parents. To **inherit** means to receive a trait from parents or ancestors.

Heredity explains why baby cottontail rabbits have similar poufy tails, long ears, and running abilities as their parents.

However, offspring don't look or act exactly like their parents. There are always some differences. These differences are called variations. For example, some cottontail rabbits are bigger than others. Some rabbits can run faster than the other rabbits.



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*These baby rabbits have inherited their traits from their parents.*

## *Rabbit Adaptations*

Sometimes, variations in traits can provide advantages in surviving, finding mates, and reproducing. For example, a rabbit that blends into the environment more than the other rabbits might be better able to avoid predators. Similarly, a rabbit that can run faster than the other rabbits can outrun predators.

Over time, these variations can become more common in the rabbit population because rabbits without the advantageous traits die out. They become **adaptations**— traits that help an organism survive in its environment. To **change** is to make something different from what it is now.

Adaptations are developed across generations in response to the environment.



*A rabbit's eyes and ears help it sense its environment.*

For example, cottontail rabbits have adapted strong senses to help them survive. A **sense** is how animals get information about the outside world. Senses include sight, hearing, touch, taste, and smell. For example, the rabbit has large eyes that stick out on either side of its head. This allows it to spot predators from all directions. It also has large ears that allow it to hear predators that may be approaching.

## Rabbit Senses

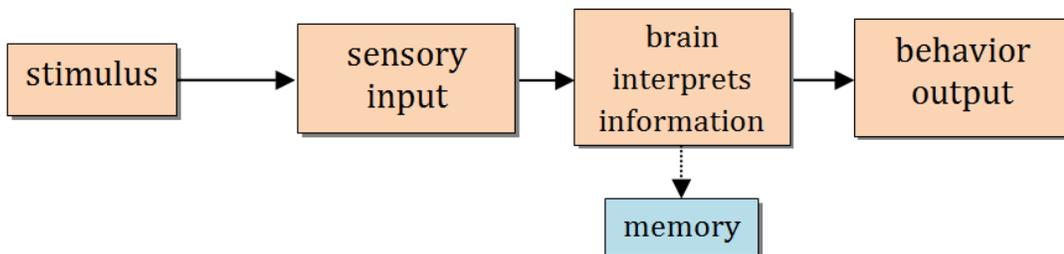
Once an animal's senses have gathered information from the environment, the senses then pass that information to the brain.



***Senses affect an organism's behavior.***

The brain interprets the information so the animal can make sense of the environment at that moment. The information can also be stored as memories.

Senses play an important role in an animal's ability to survive because they affect an organism's behavior. For example, if a rabbit senses a predator is nearby, it might run to the nearest hiding spot. Or it might freeze, hoping the predator won't notice it.



## *Environmental Influences*

Rabbits are very sensitive to their environment. In the wild, they generally know exactly where good hiding



*Rabbits need to live near areas where they can quickly hide from predators and protect themselves from bad weather.*

spots are so they can escape predators. They are often found in areas where there are a lot of different kinds of bushes and shrubs growing between forests and open grasslands.

Rabbits need the open areas for feeding because they are primary consumers. They eat only plant material. However, they need to live near areas where they can quickly hide

from predators and protect themselves from bad weather. Because of this, rabbits need a stable environment. **Stability** is a condition in which the parts of a system are unchanging.

When its environment suddenly changes and becomes unstable, cottontail rabbits are often in trouble. In some areas of the United States, populations of cottontail rabbits have declined as people have cleared the land for houses and other development.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Guayule Shrubs and Rabbits Investigation

### Question

How does the size of the guayule (pronounced why-YOO-lay) shrubs affect the number of desert rabbits eaten by desert owls?

### Research

1. Why is it important for an organism to survive in its environment?

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2. What is predation?

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3. Why do rabbits depend on shrubs for survival?

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### Hypothesis

Record your hypothesis for the question below.

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## Experiment Summary

The experiment will use a model to investigate the relationship between the size of the guayule shrub and the predation of desert rabbits by desert owls.

- The guayule shrubs will be represented by three transparencies with shrubs of different sizes printed on them.
- The rabbit population will be represented by a sheet of paper with rabbits printed on it.
- The owl's hunting area will be represented by clear plastic circles.

The variables in the experiment are the size of the shrubs: small, medium, and large. The constants in the experiment are the number of shrubs on each transparency and the number of owl hunting areas (five).

## Materials

- 1 rabbit template
- 1 large shrubs transparency
- 1 medium shrubs transparency
- 1 small shrubs transparency
- 1 ruler
- 5 clear plastic circles

## Procedure

1. Gently drop the clear plastic circles from 30 centimeters above the templates, one at time, onto the rabbit template. **NOTE:** All the plastic circles must land on the rabbit template and should not overlap. Drop a circle again if it overlaps or falls outside the sheet.
2. Count and record the total number of rabbits under or partially under the plastic circles. This represents the number of rabbits eaten by the owls. Collect the circles and repeat steps 1-2 for two more trials.
3. Place the small shrubs transparency over the rabbit template. Line up the transparency compass points with the rabbit template compass points. Repeat steps 1-2.
4. Repeat Step 3 with the medium shrubs transparency and then the large shrubs transparency.

## Scientific Diagram

Diagram your experiment-in-progress. Title the diagram and label the materials used.



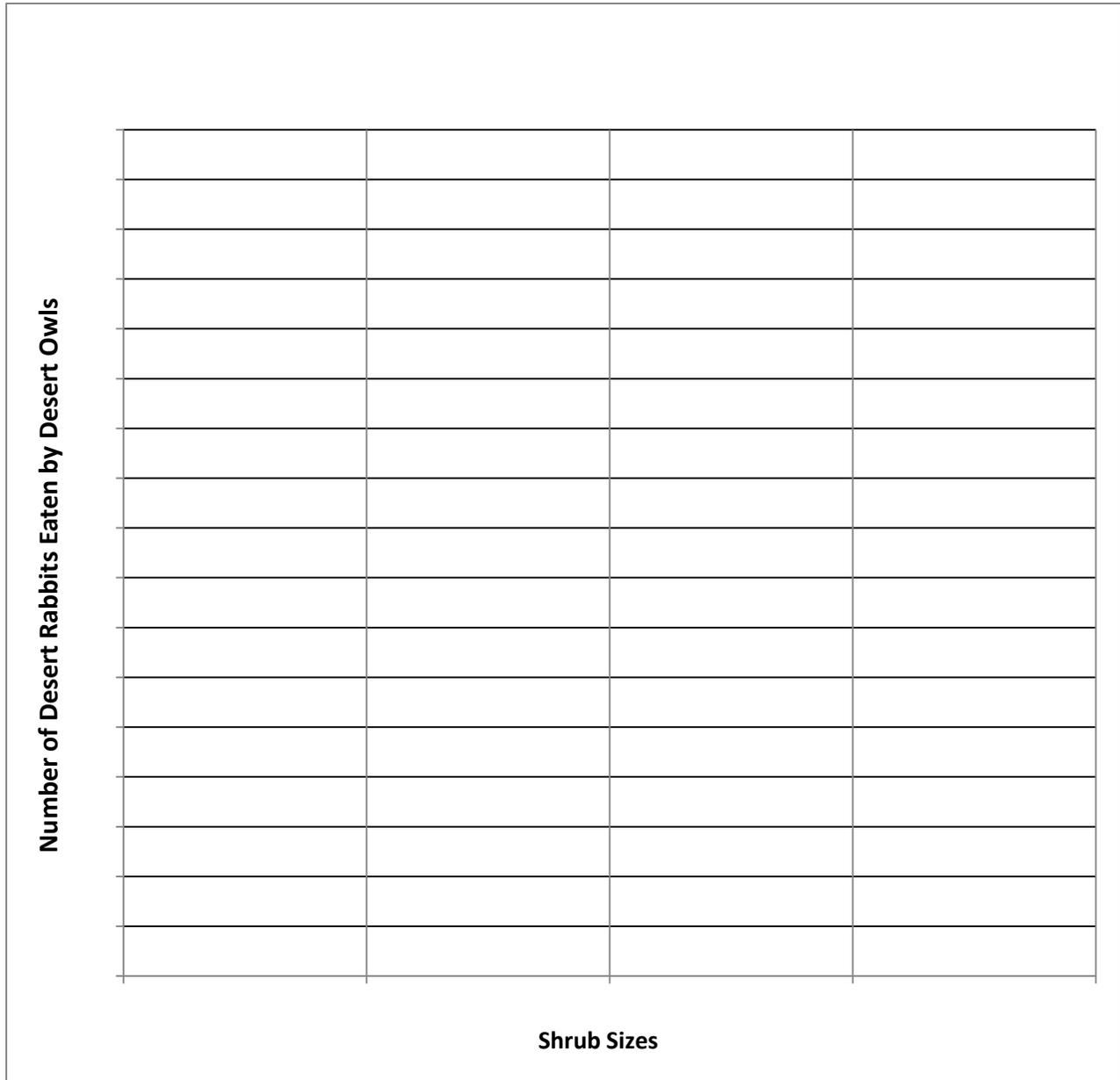
## Data

Record data in Table 1 below during the procedure.

<b>Table 1: Comparing Effect of Guayule Shrub Size on Number of Desert Rabbits Eaten by Desert Owls</b>				
<b>Rabbits Eaten by Owls</b>	<b>No Shrubs</b>	<b>Small Shrubs</b>	<b>Medium Shrubs</b>	<b>Large Shrubs</b>
<b>Trial 1</b>				
<b>Trial 2</b>				
<b>Trial 3</b>				
<b>Average (round to nearest whole number)</b>				

## Graph Data

Graph the averages calculated in Table 1 in the blank bar graph below. The graph should show the relationship between the sizes of the guayule shrubs (including no shrubs) on the x-axis and the number of desert rabbits eaten by desert owls on the y-axis. Title the graph and include a scale for the y-axis and labels for the x-axis.







## Section 2 Review

### Reading Comprehension Questions:

1. What are two main ideas of Section 2, and how are these ideas supported by key details?
2. How does this section connect back to the first section's main idea of life cycles?
3. What prediction can you make about what would happen if acid rain were a problem in the area where the rabbits lived?
4. How are the rabbit's senses connected with its ability to hide underneath bushes and shrubs?

## Science Words to Know

**acid rain** – any form of precipitation that has high levels of nitric and sulfuric acids

**adaptation** – a trait that helps an organism survive in its environment

**behavior** – an organism's response to a stimulus

**change** – to make something different from what it is now

**heredity** – the passing on of traits from parents to children

**inherit** – to receive a trait from your parents or ancestors

**life cycle** – the series of developmental stages an organism passes through on its way from birth to death

**pollution** – any substance that has harmful effects on the environment

**predator** – an organism that eats another organism

**reproduction** – the ability of a mature organism to have offspring

**sense** – how animals get information about the outside world

**stability** – a condition in which the parts of a system are unchanging

**trait** – a physical or behavioral characteristic of an organism



