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ABSTRACT

This autoinstructional unit is used in conjunction with a biology course with emphasis on Man and Environment. No grade level is suggested nor are any prerequisites listed. One behavioral objective is given. Equipment necessary for the unit is listed. A student study guide, a teacher's guide, and a script are included in the packet. A 30-minute time slot is suggested. (EB)

# PARASITES, COMPETITION, AND PREDATORS

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## TEACHER'S GUIDE

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| **PACKET NUMBER** | 312.8<br>DP |
| **SUBJECT** | Man and Environment |
| **TITLE** | Parasites, Competition, and Predators |
| **PREREQUISITES** | None |
| **BEHAVIORAL OBJECTIVES** | To describe how parasites, competition, and predators operate to regulate population size |
| **EQUIPMENT** | Slide projector - 10 slides<br>Cassette player - tape<br>Student study guide<br>Teacher's guide<br>Script |
| **TIME** | 30 minutes |
| **SPACE REQUIRED** | Carrel or table |
| **BIBLIOGRAPHY** | Edward J. Kormondy, 1969. Concepts of Ecology, Prentice-Hall. |

**SCRIPT**

**BIOLOGY**
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**MUSIC**

We have learned that populations have the capacity to greatly increase their numbers. However, populations rarely get too large because of the checks and balances in a community which tends to keep population size rather stable. In this lesson we will study several of these factors which limit population size.

Place SLIDE #1 in the viewer. (PAUSE) SLIDE #1 is a photograph of the American chestnut. It is unlikely that you have ever seen a mature American chestnut tree. The American chestnut was once a predominant tree in the forests of Eastern United States including Delaware. But in 1904, a parasitic fungus disease was accidentally introduced into this country from China. The parasitic fungus attacked the bark of the chestnut trees killing them. Perhaps you already know that a parasite is an organism that lives in another organism and causes harm to the organism it lives in. By the late 1940's the chestnut was practically extinct. In this example of the American chestnut and the fungus we can see how a parasite can reduce the size of a tree population.

There are many other examples of parasites which keep population size down. Mosquitos transmit a parasite which causes malaria in humans. Tsetse flies carry a parasite which causes African sleeping sickness in man and hoofed game animals.

Another example of a parasite is the Dutch elm fungus which has killed many elm trees in the United States. If you see elm trees in Delaware such as the large, beautiful ones on the University campus in Newark, chances are they are being protected by spraying with chemical poisons. Parasites, whether they cause the chestnut blight, malaria, African sleeping sickness, the Dutch elm disease, or a variety of other diseases, certainly operate to reduce the size of populations.

Turn the cassette player off while you answer question 1 on your study guide. (PAUSE)

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Place SLIDE #2 in your viewer. (PAUSE) SLIDE #2 is a photograph of a paramecium. Paramecium is a single-celled animal which lives in ponds and streams and eats smaller animals and bacteria.

Place SLIDE #3 in the viewer and study it for a minute. (LONG PAUSE) You can see that SLIDE #3 shows growth curves for two different species of paramecium - Species A and Species B. These species were raised in separate containers and were fed bacteria. You can also see that the population of Species A climbed to about 450 by the 9th day while the population of Species B climbed to about 300 by the 9th day. After the 9th day you can see that the populations remained constant.

Considering the fact that the 2 species of paramecium both eat bacteria, what would you predict would happen to the paramecium populations if both species were raised in the same container?

Turn the cassette player off while you attempt to answer question 2 on your study guide. (PAUSE)

Place SLIDE #4 in the viewer. (PAUSE) This slide shows growth curves for what did happen when the two species were raised together. What has happened here? You can see that the population growth curve for Species A kept going up and up, but the curve for Species B went down to zero indicating that Species B became extinct. You have probably already reasoned that the Species B became extinct because it could not successfully compete with Species A. Species A is evidently more successful at eating the bacteria than Species B. This experiment with paramecium illustrates how competition between two species can limit population size. Now let us turn to another mechanism which controls the size of populations.

Place SLIDE #5 in the viewer. (PAUSE) SLIDE #5 shows a map of northern Arizona. You can see the location of the Grand Canyon on the map. On the northern rim of the Grand Canyon there is a large forest known as the Kaibab Forest. Locate this forest on the map. The Kaibab Forest consists of over 700,000 acres. Living there are plants such as juniper trees and sage bushes, and animals such as deer, cougers, wolves, and coyotes. Place SLIDE #6 in the viewer. (PAUSE) SLIDE #6 is a photo of a cougar which is also called a mountain lion. Mountain

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lions as well as wolves and coyotes prey upon deer. In 1906 the Kaibab Forest was made a National Game Preserve. There were about 4,000 deer in the forest then. Since deer are generally considered to be "nice" animals, it was decided to protect the deer population by forbidding all hunting and killing off all the natural predators of the deer. In 1907 a bounty was placed on cougars, wolves, and coyotes. What do you think happened to the size of the deer population as the predators were removed? Turn the cassette player off and answer question 3. (PAUSE)

Place SLIDE #7 in the viewer. (PAUSE) This graph shows what happened to the deer population as the predators were removed. You can see that by 1918 the deer population had reached the 40,000 mark which is ten times what it was in 1906. Clearly it seemed that one game management program was a success. The deer population was allowed to continue to grow. By 1925 more than 8,000 predator animals had been killed to allow this deer population growth to occur. Beginning about 1918 observers began to wonder about the wisdom of the predator control program. When they made field trips to the forest, they noticed things in the community that foretold of disaster. What kinds of things do you think these observers saw? Turn the cassette player off and answer question 4. (PAUSE)

Place SLIDE #8 in the viewer. (PAUSE) This slide shows that the deer population continued to grow and that by 1924 it had reached 100,000. This slide also shows what observers were noticing in the forest. They saw overgrazing and fawns dying.

Place SLIDE #9 in the viewer. (PAUSE) This photograph was taken in the Kaibab Forest in 1925. You can see the effects of overgrazing. The juniper trees have been stripped of their leaves up to a height of 7 feet and the usual sagebrush cover is absent. What do you think happened to the deer population as a result of the overgrazing? Turn the cassette player off and answer question 5. (PAUSE)

Look at SLIDE #9 in the viewer. (PAUSE) The winters of 1924 and 1925 were very severe winters. Snow covered the ground and there was little to eat. During these two winters 60,000 deer starved to death. By 1926 the herd numbered only 40,000. After 1926 the deer population continued to drop so that by 1940 there were only 10,000 deer remaining. This brings up an important question. Why did the deer population continue to decrease after 1926? Remember that the predators are gone. Turn the cassette player off and answer question 6. (PAUSE)

**STUDY GUIDE**

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Name _____

1. List at least 3 examples of parasites which limit the size of populations.

2. What do you think would happen if both species of Paramecium were raised in the same container?

3. What do you think happened to the size of the deer population as the predators were removed?

4. What did observers notice in the forest which indicated that disaster was coming?

5. What do you think happened to the deer population as a result of the overgrazing?

6. Why did the deer population continue to fall off between 1926 and 1940 even though no predators were present?

7. Are hunting seasons for animals such as deer necessary? Explain.

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How did you do with question 6? The deer herd kept falling in numbers because the overgrazing had greatly reduced the plant populations upon which the deer depended for food. It took many years for the plants to recover from the overgrazing.

Place SLIDE #10 in the viewer. (PAUSE) We would, I think, have to conclude that the game management program in the Kaibab Forest was a dismal failure. But it did teach man the importance of the checks and balances that must exist if a community is to remain healthy. Man still has a difficult time realizing that predators are necessary in maintaining delicate balances. The Federal Government still pays money to kill coyote out west. We recently heard news reports about the shooting of eagles from helicopters. Fortunately this practice was condemned by most people. We tend to have the attitude that predators are "bad" animals because they kill "nice" animals like deer and rabbits but we must consider the predators importance in maintaining proper balances. If we move closer to home and consider the deer population in Delaware or Pennsylvania, we will realize that there are no natural predators of the deer remaining and that it would be impractical to introduce lions or wolves into these areas with large human populations. So what is being done to check the deer population? Man has established hunting seasons on the deer. He, then, has become the predator of the deer. Even though we may not like to think of hunters shooting deer, it is necessary to control the size of deer populations to prevent overgrazing and starvation such as occurred in the Kaibab Forest. Turn the cassette player off while you answer question 7. (PAUSE)

In summary, we have studied three of the factors which operate to limit population size. These three factors are parasites, competition, and predators. This lesson has now been completed. MUSIC.