Name Date Class

Lab 4-2

EXPLORATION

# The Lesson of the Kaibab

The environment may be altered by forces within the biotic community, as well as by interactions between organisms and the physical environment. The carrying capacity of an ecosystem is the maximum number of organisms that the ecosystem can support on a sustained basis. The changing density of a population may produce such profound changes in the environment that the environment becomes unsuitable for survival of that species. Humans can interfere with these natural interactions and have either a positive or a negative effect.

## OBJECTIVES

- Graph the size of the Kaibab deer population of Arizona from 1905 to 1939.
- Analyze the actions responsible for the changes in the deer population.
- Propose a management plan for the Kaibab deer population.

## MATERIALS

colored pencils (1 green and 1 red)
goggles

## PROCEDURE

Before 1905, the deer on the Kaibab Plateau in Arizona were estimated to number about 4000 on almost 300 000 hectares of range. The average carrying capacity of the range was estimated then to be about 30 000 deer. On November 28, 1906, President Theodore Roosevelt created the Grand Canyon National Game Preserve to protect the "finest deer herd in America."

Unfortunately, by this time the Kaibab forest area had already been overgrazed by sheep, cattle, and horses. Most of the tall perennial grasses had been eliminated. The first step to protect the deer was to ban all hunting. In addition, in 1907, the Forest Service tried to exterminate the predators of the deer. Between 1907 and 1939, 816 mountain lions, 20 wolves, 7388 coyotes, and more than 500 bobcats, all predators of the deer, were killed.

1. Using the green pencil, draw and label a straight horizontal line across the graph in Data and Observations to represent the average carrying capacity of the range.
2. Using the red pencil, graph the data in Table 1.
3. Answer Analysis questions 1–4.

Signs that the deer population was out of control began to appear as early as 1920—the range was beginning to deteriorate rapidly. The Forest Service reduced the number of livestock-grazing permits. By 1923, the deer were reported to be on the verge of starvation, and the range conditions were described as "deplorable."

**Table 1**

| Deer Population from 1905 to 1924 | |
|---|---|
| **Year** | **Deer population** |
| 1905 | 4 000 |
| 1910 | 9 000 |
| 1915 | 25 000 |
| 1920 | 65 000 |
| 1924 | 10 000 |

A Kaibab Deer Investigating Committee recommended that all livestock not owned by local residents be removed immediately from the range and that the number of deer be cut in half as quickly as possible. Hunting was reopened, and during the fall of 1924, 675 deer were killed by hunters. However, these deer represented only one-tenth the number that had been born that spring.

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## PROCEDURE continued

4. Using the red pencil, plot the data in Table 2 on your graph. Label the completed graph.
5. Answer Analysis questions 5 and 6.

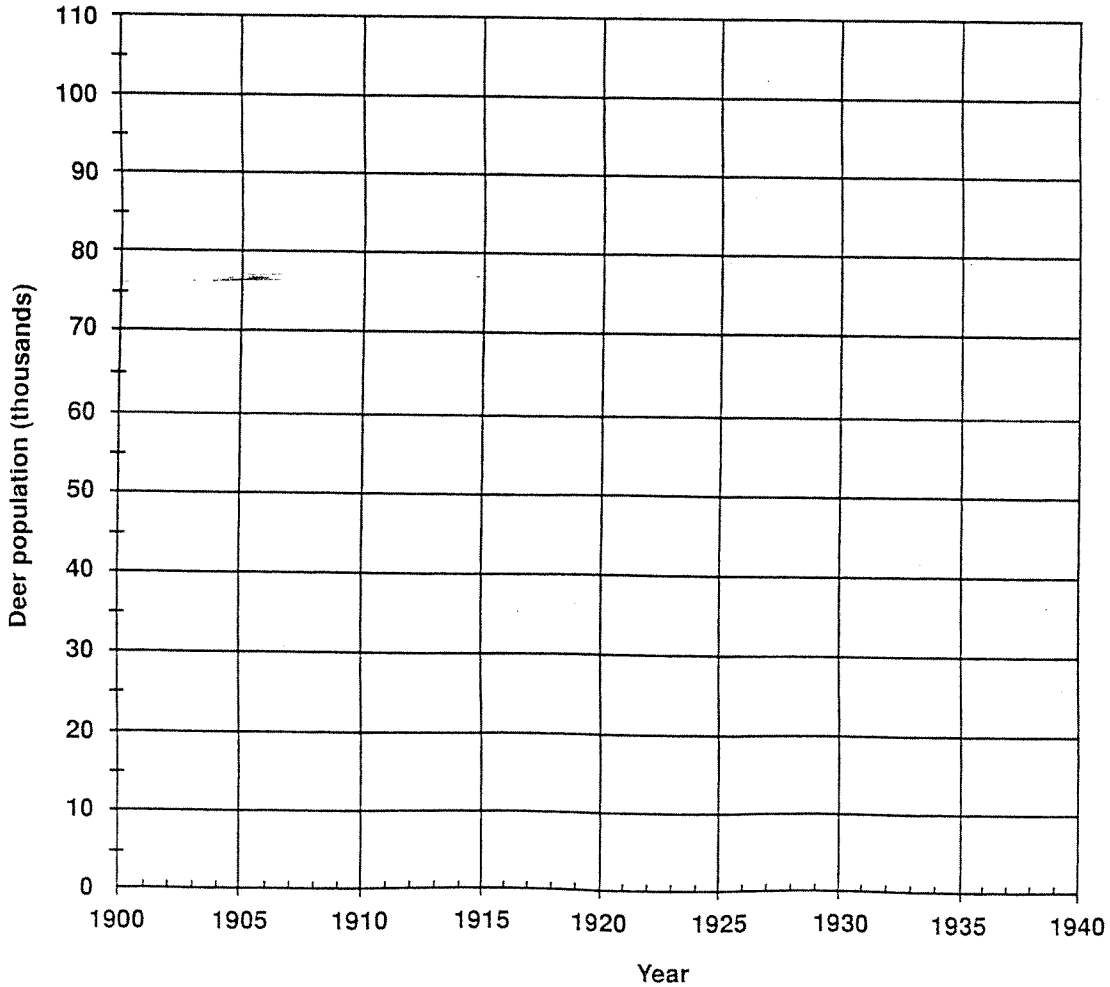
Today, the Arizona Game Commission carefully manages the Kaibab area with regulations geared to specific local needs. Hunting permits are issued to keep the deer in balance with their range. Predators are protected to help keep herds in balance with food supplies. Tragic winter losses can be checked only by keeping the number of deer near the carrying capacity of the range.

6. Answer Analysis questions 7–11.

**Table 2**

| Deer Population from 1925 to 1939 | |
|---|---|
| **Year** | **Deer population** |
| 1925 | 60 000 |
| 1926 | 40 000 |
| 1927 | 37 000 |
| 1928 | 35 000 |
| 1929 | 30 000 |
| 1930 | 25 000 |
| 1931 | 20 000 |
| 1935 | 18 000 |
| 1939 | 10 000 |

## DATA AND OBSERVATIONS



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## Analysis

1. In 1906 and 1907, what two methods did the Forest Service decide to use to protect the Kaibab deer?

2. How many total predators were removed from the preserve between 1907 and 1939?

3. What was the relationship of the deer herd to the carrying capacity of the range:

   in 1915? _____

   in 1920? _____

   in 1924? _____

4. Did the Forest Service program appear to be successful between 1905 and 1924? Explain your answer.

5. Why do you suppose the population of the deer declined in 1925 although the predators were being removed?

6. Do you think any changes had occurred in the carrying capacity of the range from 1900 to 1940? Explain your answer.

7. Why do you suppose the population of deer in 1905 was 4000 when the range had an estimated carrying capacity of 30 000?

8. Without the well-meaning interference of humans, what do you think would have happened to the deer population after 1905?

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# The Lesson of the Kaibab

## ANALYSIS continued

**9.** What major lessons were learned from the Kaibab deer experience?

**10.** If the lessons learned from the Kaibab deer studies had been known then, what recommendations would you have made in 1915?

in 1923?

in 1939?

**11.** What future management plan would you suggest for the Kaibab deer herd?

## FURTHER EXPLORATIONS

1. Many forests have been endangered by gypsy moth caterpillars. Research how they came to the United States and the methods that have been proposed to control them.
2. Mosquitoes are a great annoyance to many people. Obtain some books from your teacher or librarian that contain information on mosquitoes. Decide whether or not you would try to eliminate them. Justify your answer.