Case Study: The Lesson of the Kaibab

*The environment may be altered by forces within the biotic community, as well as by relationships between organisms and the physical environment. The **carrying capacity** of an ecosystem is the maximum number of organisms that an area can support on a sustained basis. The 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. For instance, overgrazing of land may make the land unable to support the grazing of animals that lived there.*

OBJECTIVES
· Graph data on the Kaibab deer population of Arizona from 1905 to 1939.

· Analyze the methods responsible for the changes in the deer population.

· Propose a management plan for the Kaibab deer population.

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 a blue 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 a red pencil, graph the data in Table 1. (Line graph)

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."

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.

4. Using a green pencil, plot the data in Table 2 on your graph. (Line graph)

5. Answer Analysis questions 5-6.

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.

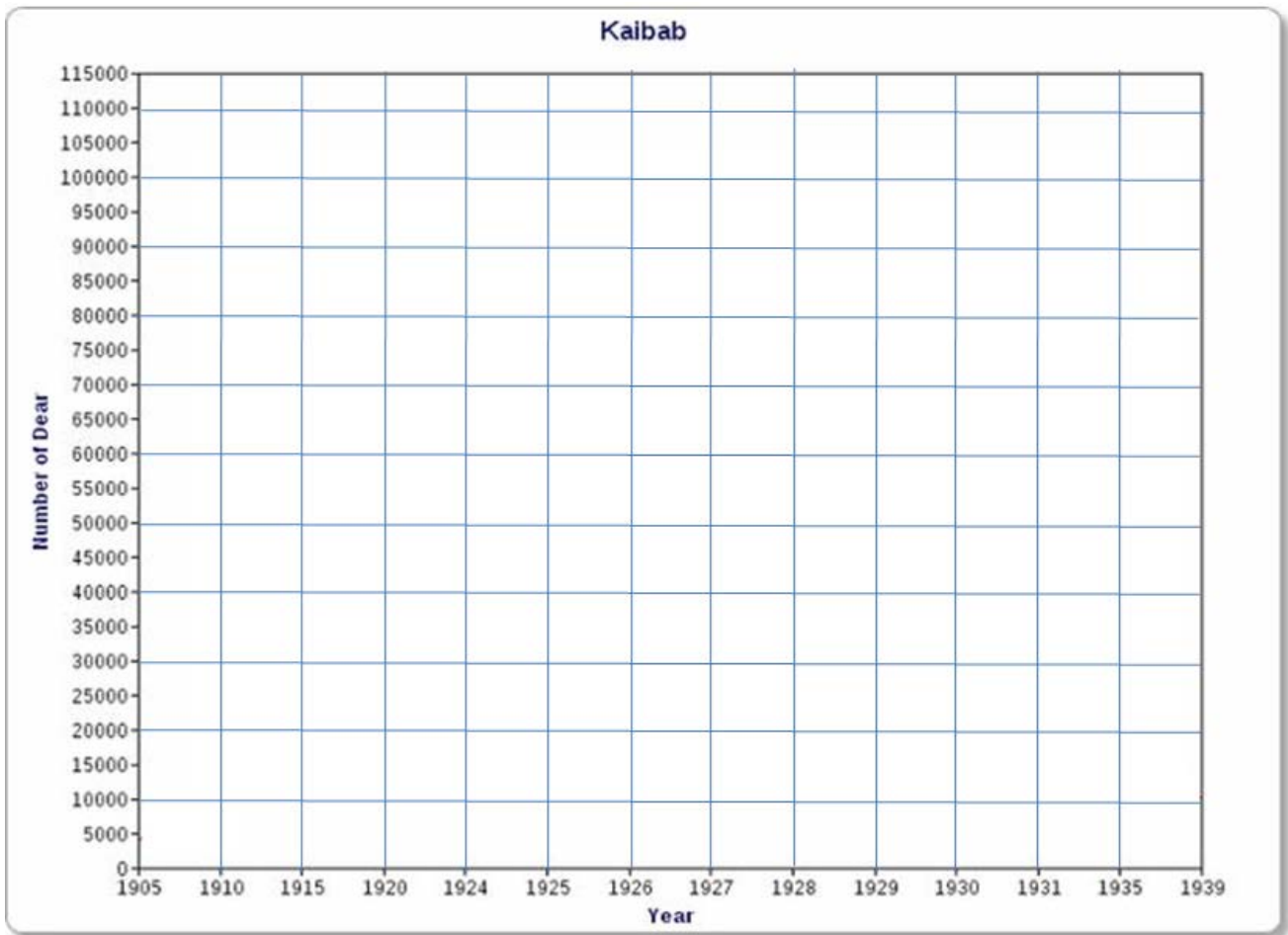**6.** Answer Analysis questions 7-11.

Table 1: Deer pop. 1905-1924

Year	Deer Population
1905	4,000
1910	9,000
1915	25,000
1920	65,000
1924	100,000

Table 2: Deer pop. 1925-1939

Year	Deer Population
1925	60,000
1926	40,000
1927	37,000
1928	35,000
1929	30,000
1930	25,000
1931	30,000
1935	18,000
1939	10,000

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3 pts

ANALYSIS

1. In 1906 and 1907, what 2 methods did the Forest Service decide to use to protect the Kaibab deer? (½ pt)

2. Were these methods successful? Use the data from your graph to support your answer. (1 pt)

3. How many **total predators** were removed from the preserve between 1907 and 1939? (½ pt)_____

4. What was the relationship of the **deer herd** to the **carrying capacity** of the range in the following years: (1 ½ pts)

   1915 -

   1920 -

   1924 -

5. Did the Forest Service program appear to be successful between 1905 and 1924? Explain your answer. (½ pt)

6. Why do you suppose the population of the deer declined in 1925 although the predators were being removed? (½ pt)

7. Why do you suppose the population of deer in 1900 was 4000 even though the range had an estimated carrying capacity of 30 000? (1 pt)

8. Without the well-meaning interference of humans, what do you think would have happened to the deer population after 1900? (½ pt)

9. What major lessons were learned from the Kaibab deer experience? (1pt)

11. If the lessons learned from the Kaibab deer studies had been known then, what recommendations would you have made in the year: (3 pts)

In the year 1915 I would recommend:

In the year 1923 I would recommend:

In the year 1939 I would recommend:

12. What future management plan would you suggest for the Kaibab deer herd? (1pt)