Please Do Not Write on This Paper

The Lesson of the Kaibab

Introduction:
The environment may be altered by forces within the biotic (living) community, as well as by relationships between the organisms and 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 the population may produce such profound changes in the environment that the habitat becomes unsuitable for survival of that species. A great example is the overgrazing of the grasslands in an area that leaves the land unable to provide enough grass for the animals that lived there.

Background:
Before 1905, deer in the Kaibab Plateau were estimated to number about 4,000. The average carrying capacity of the ranges was then estimated to be about 30,000 deer. On November 28th, 1906, President Roosevelt created the Grand Canyon National Game Preserve to protect the "finest deer herd in America."

Unfortunately, by this time the forest area had already been overgrazed by sheep, cattle, and horses. Most of the tall 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, 7,388 coyotes and more than 500 bobcats were killed.

Signs that the deer population was out of control 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 edge of starvation and the range conditions were described as "deplorable."

The 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 in the fall of 1924, with hunters harvesting 675 deer. However, this number was about 1/10th of the number of deer born that previous spring. Over the next two winters, it is estimated that 60,000 deer starved to death.

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 by keeping the number of deer near the carrying capacity of the range.

Adapted from lesson at http://www.biologycorner.com/worksheets/kaibab.html

Activity #1 – **Graph** the population data of deer vs time. (time on "X" axis" Make sure the graph is well constructed. USE a FULL SHEET OF GRAPH PAPER for this graph

YEAR	DEER POPULATION
1905	4,000
1910	9,000
1915	25,000
1924	100,000
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

Activity #2

LABEL Significant EVENTS from the Reading on your graph at the appropriate point in time

Activity #3- Questions from the Reading: Answer on your own paper:

1. Describe the two methods used in 1906 and 1907 by the Forest Service to protect the deer population. Use specific data to support your answer.

2. Hypothesize :
   a) Why was the deer population at 3,000 deer in 1905 when the carrying capacity of the plateau is estimated to be 30,000?

   b) Why did the deer population decline in 1925?

3. Based on these lessons, design a MANAGEMENT Plan on how you would have managed the deer herds in the past and how you would manage the herd in the future.

   a) In 1915, I would have recommended to _____ because ___

   b) In 1923, I would have recommended to _____ because ___

   c) Starting today I would recommend to _____ because ___

4. It is a criticism of many population ecologists that the pattern of population increase and subsequent crash of the deer population would have occurred even if the bounty on predators

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had not been placed on the predators. Do you agree or disagree with this statement. EXPLAIN your reasoning.

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Predator Prey Relationships – Deer and Wolf Populations

Introduction:

In 1970, the deer population of *an island forest reserve* about 518 square kilometers in size was about 2,000 animals. Although the island had excellent vegetation of feeding, the food supply obviously had limitations. Thus the forest management officials feared that overgrazing might lead to mass starvation. Since the area was too remote for hunters, the wildlife service decided to introduce natural predators to the island. It was hoped that the predators would keep the population in balance and also eliminate the weaker members of the herd. In 1971, ten wolves were introduced to the island.

The results of the program are shown in the table. (**COMPLETE THE LAST COLUMN**)

Year	Wolf Population (beginning of year)	Deer Population (beginning of year)	Deer Offspring born	Predation Loss (deer)	Starvation Loss (deer)	Deer Population Change
1971	10	2000	800	400	100	+ 300
1972	12	2300	920	240	240	
1973	16		1000	640	500	
1974	22		944	880	180	
1975	28		996	1120	26	
1976	24		836	960	2	
1977	21		788	840	0	
1978	19		766	720	0	
1979	19		780	760	0	
1980	19		790	760	0	

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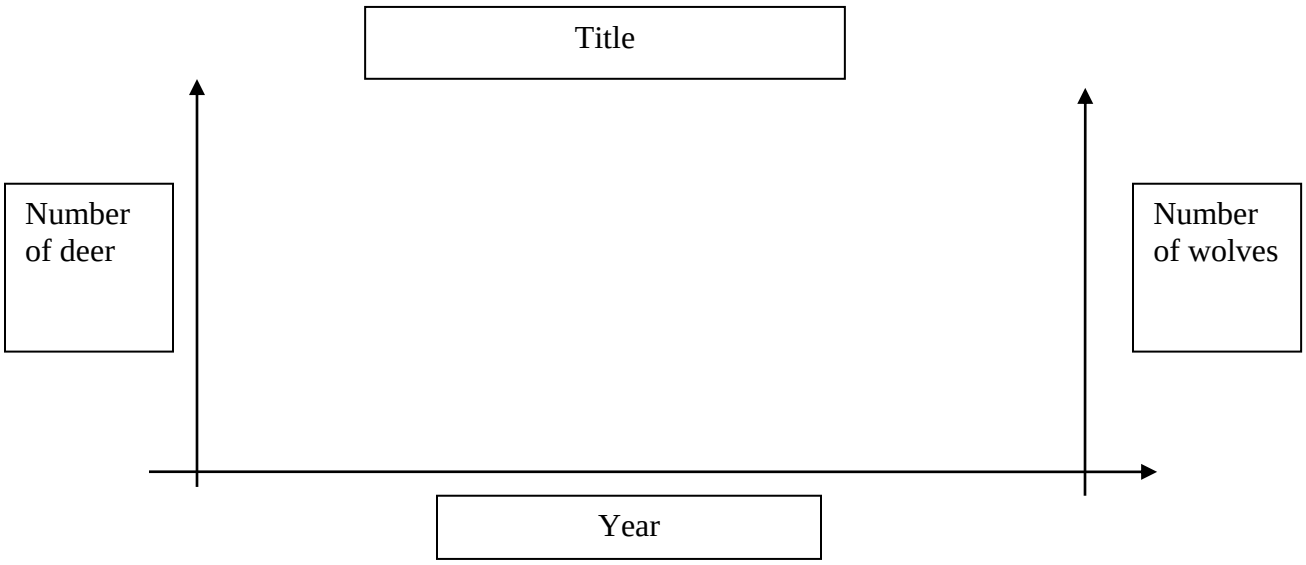
Make a Graph (On your own paper) using the following guidelines



Analysis: Answer the following questions in detail. (**again on your own paper**)

1. Describe the trend shown in the population of the deer and the wolf between 1971 and 1980.

2. What would have happened to the deer population if wolves were not introduced?

3. Most biology textbooks describe that predators and prey exist in a balance. This hypothesis has been criticized by some scientists because it suggests a relationship between the two is good and necessary. Opponents of this hypothesis propose the following questions:
   - Why is death by predator more natural or "right" compared to death by starvation?
   - How does one determine if an ecosystem is "balanced?"
   - Do predators really kill only the old and sick prey? Is there any evidence that supports this?

KEY QUESTION TO ANSWER: What is your opinion of the balance of nature hypothesis. Would the deer on the island be better off, worse off or about the same without the wolves? DEFEND your position.

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Assessment of Learning: Kaibab Deer Population: **NAME: _____**

Self Reflection:

1. Describe THREE things that you learned from this activity.

2. Fill out the following rubric regarding your work

	0	**1**	**2**	**3**	**4**	**5**
GRAPH						
Look Fors: One Number for the Graph Descriptive Title? Equal Increments on Scales? Labels? Accuracy? Neatness Clarity?						
Activity #2 – Graph has detailed events posted on it?						
Activity 3 Depth of Answer? Logical assumptions?						
Activity #3 – Management Plan						
Activity #3 – Agree/ Disagree Look fors: Position Statement Supported with Valid Reasoning						

Peer Evaluation:

	0	**1**	**2**	**3**	**4**
GRAPH					
Look Fors: One Number for the Graph Descriptive Title? Equal Increments on Scales? Labels? Accuracy? Neatness Clarity?					
Activity #2 – Graph has detailed events posted on it?					
Activity #3 Depth of Answer? Logical assumptions?					
Activity #3 – Management Plan					
Activity #3 – Agree/ Disagree Look fors: Position Statement Supported with Valid Reasoning					

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Learning From Each Other:

What makes an effective group?

What are general expectations of a group member?

Share with your group – 2 minutes per person—Discuss Answers 3 and 4

What is one new idea you learned from your group members?

AS A GROUP… reach consensus as to your answer for #3 a and b. Everyone in your group should be able to explain your answer and the reasoning behind it.

Share with Class

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