



Activity Description and Estimated Class Time

Throughout the guide teaching tips are in red.

In this two-day activity students play the role of a deer population. The number of deer in the population fluctuates throughout the activity based on availability of resources in the habitat. Students will graph results and discuss factors that affect populations in nature.

Objectives

Students will develop an understanding of the following ideas and content:

- Identify and describe food, water, and shelter as three essential components of habitat;
- Describe the importance of good habitat for animals;
- Define “limiting factors” and give examples;
- Recognize that some fluctuations in wildlife populations are natural as ecological systems undergo constant change.

Correlations to North Carolina Science Standards

8.L.3 Understand how organisms interact with and respond to the biotic and abiotic components of their environment.

8.L.3.1 Explain how factors such as food, water, shelter, and space affect populations in an ecosystem.

8.L.3.2 Summarize the relationships among producers, consumers, and decomposers including the positive and negative consequences of such interactions including:

- Coexistence and cooperation
- Competition (predator/prey)
- Parasitism
- Mutualism

Note: Within standard 8.L.3.2, this activity only addresses competition.

Brief Science Background

A variety of factors affects the ability of wildlife to successfully reproduce and maintain their populations over time. Disease, predator/prey relationships, varying impacts of weather conditions from season to season (e.g., early freezing, heavy snows, flooding, and drought), accidents, environmental pollution, habitat destruction, and degradation are among these factors.

The number of individuals of a particular species that a habitat can support over time is called the carrying capacity. This is dynamic and changing, not static. Both naturally-caused and human-caused factors prevent wildlife populations from reproducing in numbers greater than their habitat can support. An excess of such limiting factors, however, can threaten, endanger, or eliminate whole species.

The most fundamental of life’s necessities for any animal are food, water, shelter and space in a suitable arrangement. Without these, populations of animals do not maintain their numbers.



This activity is designed for students to learn that:

- Good habitat is the key to wildlife survival;
- A population will continue to increase in size until some limiting factors are imposed;
- Limiting factors contribute to fluctuations in wildlife populations; and
- Nature is never in “balance,” but is constantly changing.

Wildlife populations are not static. They continually fluctuate in response to a variety of stimulating and limiting factors. We tend to speak of limiting factors as applying to a single species, although one factor may affect many species. Natural limiting factors, or those modeled after factors in natural systems, tend to maintain populations of species at levels within predictable ranges. In this kind of “balance in nature,” populations go up and down, something like a teeter-totter. Some species fluctuate or cycle annually. Quail, for example, may start with a population of 100 pairs in early spring; grow to a population of 1200 birds by late spring; and decline slowly to a winter population of 100 pairs again. This cycle appears to be almost totally controlled by the habitat components of food, water, shelter and space, which are also limiting factors. Habitat components are the most fundamental and critical limiting factors in most natural settings.

The purpose of this activity is for students to understand the importance of habitat as well as factors that affect wildlife populations. This activity is a simple but powerful way for students to learn how things in natural systems are interrelated; that elements of the environment continually affect populations; and that populations of animals do not stay at the same number year after year, but that their numbers continually change.

Part 1 – Oh Deer! (50 minutes)

Materials for the whole class

- Large area—either indoors or outdoors—large enough for students to run, e.g., a playing field or football field. Establish two lines about 20 yards apart (see Figure 1). Be sure this is done prior to the activity.

Materials and Preparation

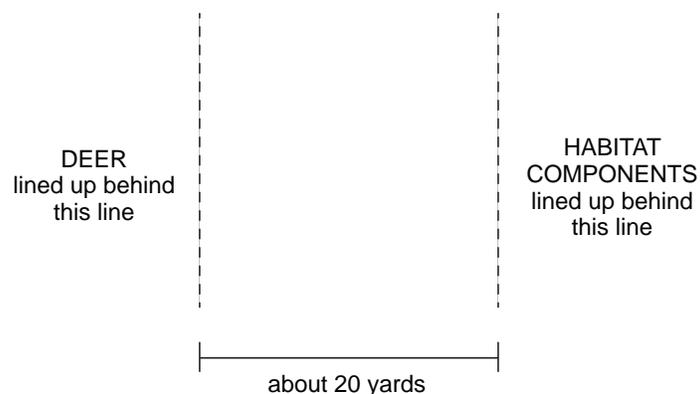


Figure 1.



- 60 each of green, blue, and brown construction paper cut into squares approximately 3"x 3", to represent food, water, and shelter respectively. Thirty squares of all 3 colors should be placed in each of 2 boxes, one box for the deer students behind their line on their end of the field and one box for the habitat components students on their end.
- Surveyor flags (to help mark the lines)
- String
- 1 copy of Black Line Masters (BLM-1) "Tally Sheet for *Oh Deer!*" for each class

Materials for each student

- 1 sheet of graph paper or 1 copy of Black Line Masters (BLM-2) "*Oh Deer!* - Graph, blank"

TEACHER TIP - Inform students the day before that you are planning an outdoor activity that will require some running so that students can dress appropriately.

Procedure

1. Begin by telling students that they are about to participate in an activity that emphasizes the most essential things that animals need in order to survive. Review the essential components of habitat with the students: food, water, shelter, and space in a suitable arrangement. This activity emphasizes three of those habitat components—food, water and shelter—but the students should not forget the importance of the animals having sufficient space in which to live, and that all the components have to be in a suitable arrangement or the animals will die.
2. Take the students to the area where they will play the game.
3. Ask students to count off in fours. Ask all the 1's to line up behind one line, and the 2's, 3's, and 4's to line up behind the other line.
4. The 1's are "deer." Explain that deer need a good habitat to survive. Again ask the students what the essential components of habitat are: food, water, shelter and space in a suitable arrangement. For this activity, assume that the deer have enough space. This activity will emphasize food, water and shelter. The deer (the 1's) need to find food, water and shelter in order to survive.
5. The 2's, 3's and 4's represent the food, water and shelter, components of the habitat. At the beginning of each round, each of these students chooses which component he or she will be during that round.
6. The habitat students take one card out of the box (green, blue or brown). This card represents a habitat component (green = food, blue = water, and brown = shelter). The deer students take one card out of the box, designating the habitat component they need in order to survive. The activity starts with all players lined up behind their respective lines (deer on one side; habitat components on the other side), and with their backs to the students at the other line.
7. When the students are ready, count: "One. . . two. . . three." At the count of three, each deer and each habitat student turns to face the opposite group and shows their card. At this time the deer will run toward the habitat trying to find the habitat component they need in order to survive. The habitat students will not move.



- Each deer that reaches its necessary habitat component takes the food, water, or shelter person back to the deer side of the line. The habitat person now becomes a member of the deer population. This is to represent the deer's successfully meeting its needs, and successfully reproducing as a result. Any deer that fails to find its food, water, or shelter dies and becomes part of the habitat. That is, in the next round, the deer that died becomes a habitat component and so is available as food, water, or shelter.

NOTE: When more than one deer reaches a habitat component, the student who gets there first survives. Habitat components stay in place on their line until a deer needs them. If no deer needs a particular habitat component during a round, the habitat component just stays where it is in the habitat. The habitat person can, however, change which component it is from round to round.

- The teacher, as facilitator, keeps track of how many deer there are at the beginning of the activity, and records how many are still alive at the end of each round using BLM-1. Continue the activity for approximately 15 rounds. Each round represents one year. Keep the pace brisk and the students will thoroughly enjoy it.
- At about round 8 or 9, go to the habitat group and quietly ask all of them to choose shelter cards just for this one round (after this, they should return to choosing at random). This represents a drought with no food or water available. The deer population should crash but will rebound over the next rounds.
- At the end of the 15 rounds, return to the classroom to discuss the activity.

Extension Opportunity- Predator/Prey competition

Before returning to the classroom, select one student from the habitat to play the role of predator, a wolf. Continue to play the game and have the wolf roam in the middle of the playing area. As the deer students move toward the habitat, the wolf can capture one deer per round. The captured deer will now become a wolf. This represents a successful year for the wolf that results in the wolf reproducing. Do this for only a few rounds after you have completed and recorded the first 15 rounds. Use this experience to lead a discussion on how predator/prey populations are interdependent.

- Encourage the class to talk about what they experienced and saw. For example, they saw a small herd of deer (seven students in a class size of 28) begin by finding more than enough of its habitat needs. The population of deer expanded over two to three rounds of the activity until the habitat was depleted when too little food, water and shelter remained for all the members of the herd. At that point, deer starved or died of thirst or lack of shelter. Such things also happen in nature.

Teacher Tip - This is a good stopping point if time does not allow for conclusion of the activity.

- Project the data recorded during the activity. The number of deer at the beginning of the activity and at the end of each round represents the number of deer in a series of years. That is, the beginning of the activity is year one; each round is an additional year.
- Give each student a sheet of graph paper or a copy of BLM-2 and have them create a graph to represent the data.



15. The students will see this visual reminder of what they experienced during the activity: the deer population fluctuated over a period of years. This is a natural process as long as factors limiting the population do not reach the point where the animals cannot successfully reproduce. Wildlife populations tend to peak, decline, and rebuild, peak, decline, and rebuild—as long as there is good habitat and sufficient numbers of animals to reproduce successfully.
16. After students construct their graphs, lead a reflection/discussion. Some suggested discussion questions:
- What do animals need to survive?
 - What are some of the “limiting factors” that affect their survival?
 - How did it feel when you were in a small population of deer with an abundance of habitat available?
 - How did it feel when you were in a large population of deer with a limited amount of habitat available?
 - Are wildlife populations static (unchanging) or dynamic (constantly fluctuating) over time? What evidence do you have to support your claim?
17. If possible, show graphs from the other classes to compare to their class graph.

Part 2 – Wildlife Biologist Scenarios (50 minutes)

Materials and Preparation

This activity requires the ability to project several black line masters:

- Black Line Master (BLM-3) “Deer Population 1”
- Black Line Master (BLM-4) “Deer Population 2”
- Black Line Master (BLM-5) “Actual Population”
- Black Line Master (BLM-6) “Actual Population - with dates”

Materials for the whole class

- Project BLM-2 “Carson County”

Materials for each student

- Graph paper

Procedure

1. Review populations and factors which cause them to fluctuate over time.
2. Inform the class that they will be asked to play the role of “Wildlife Biologist.” They will be presented with different population graphs and asked to speculate on them.
3. Project Black Line Master (BLM-3) “Deer Population 1.”
4. Ask students to evaluate the health of this deer population. Have students speculate on causes of increases and decreases. Populations that increase after a decrease are considered healthy.



Procedure
continued

Possible responses:

- Increases can be the result of:
 - Very few deer with lots of resources
 - New hunting restrictions
 - New green spaces
 - Less predation or disease
- Decreases can be the result of:
 - An increase in human developments (homes, roads, shopping centers, parking lots, etc.)
 - More predation or disease
 - Forest fires
 - Drought
 - Increased hunting
- Decreases might be followed by increases, since after a decrease there might be more resources available for fewer animals.
- Increases could be followed by decreases because of population crashes due to limiting resources

The population in Deer Population 1 is probably not 'healthy,' since it seems to be in steady decline.

5. Project Black Line Master (BLM-4) "Deer Population 2."
6. Ask students to evaluate the health of this deer population. Have students speculate on causes of increases and decreases.
7. Why was the decrease followed by an increase?

Possible explanations:

- Urban sprawl caused the decrease. Then people decided to set aside parkland and limit the sprawl.
- The decrease could have been caused by drought followed by forest fires that destroyed the habitat. Then the deer slowly recovered as the habitat grew back.
- Perhaps the population has actually overshoot the carrying capacity and will decrease again in the future.

This population looks like it was stressed for awhile, but then has rebounded. It seems healthy again in that it has increased to its original level.

8. Project Black Line Master (BLM-5) "Actual Population."
9. Explain to the class that this graph represents an actual population of real organisms.
10. Ask students what they notice.

Possible responses:

- Very slow population growth from year A through year H.
- Modest increase shortly after year H.
- Small downward blip followed by a very rapid increase.



Procedure
continued

11. Ask students what they think will happen in the future.

Possible responses:

- The population may stabilize at a high level (perhaps with small fluctuations).
- The population may decrease and then stabilize at some lower level.
- The population may 'crash' and perhaps even go extinct. (This is less likely, since some individuals usually survive a population crash.)

12. Project Black Line Master (BLM-6) "Actual Population - with dates"

13. Explain that this is a graph of the population of human beings on Earth.

14. Ask students what they notice.

Possible responses:

- For most of the existence of humans on Earth, the population size was fairly stable and was maintained at a low level.
- Around the time of the 1st century of the Common Era, the population began to grow more quickly.
- The downward blip shows the population crash that occurred during the Bubonic Plague (Black Plague) in the 14th century. Some estimates claim that 30% of the population of Europe (perhaps 25 million people) died between 1347 and 1352—from a high of 75 million to about 50 million.
- The population then began to grow at an extremely high rate and has continued this growth to the present day.
- Based on their predictions from BLM-5, they may infer that the human population might:
 - o Stabilize at a high level,
 - o decrease and stabilize at a lower level, or
 - o crash and perhaps go to extinction.

15. Finally, ask students, "If you were in a position of some authority, what suggestions would you provide to the world to deal with this situation?"

Teacher tip - These are obviously controversial ethical issues. This is a good chance to talk through these kinds of issues with students.

Possible responses:

- Limit the number of childbirths.
- Don't cure all diseases.
- Don't intervene in famine.

What has human experience shown?

- Have governmental regulations limiting the number of children in China been effective in reducing population growth?

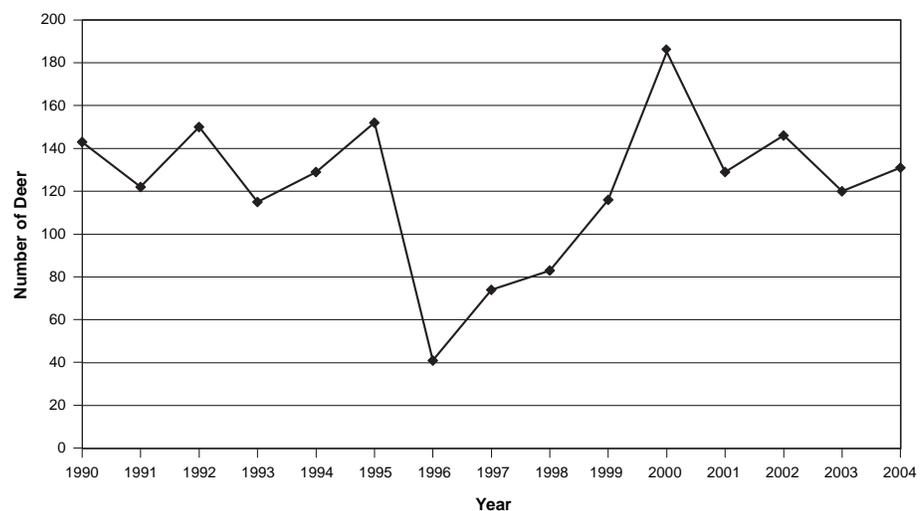


Assessment

- Is population growth faster in countries where human disease control is effective or in countries where disease control is poor?
- Is population growth faster in countries where human famine is common or in countries where famine is rare?

1. Hand each student a copy of BLM-7 and a sheet of graph paper or a copy of BLM-2.
2. Have them complete the assignment.

Oh Deer Assessment—Possible Answers:



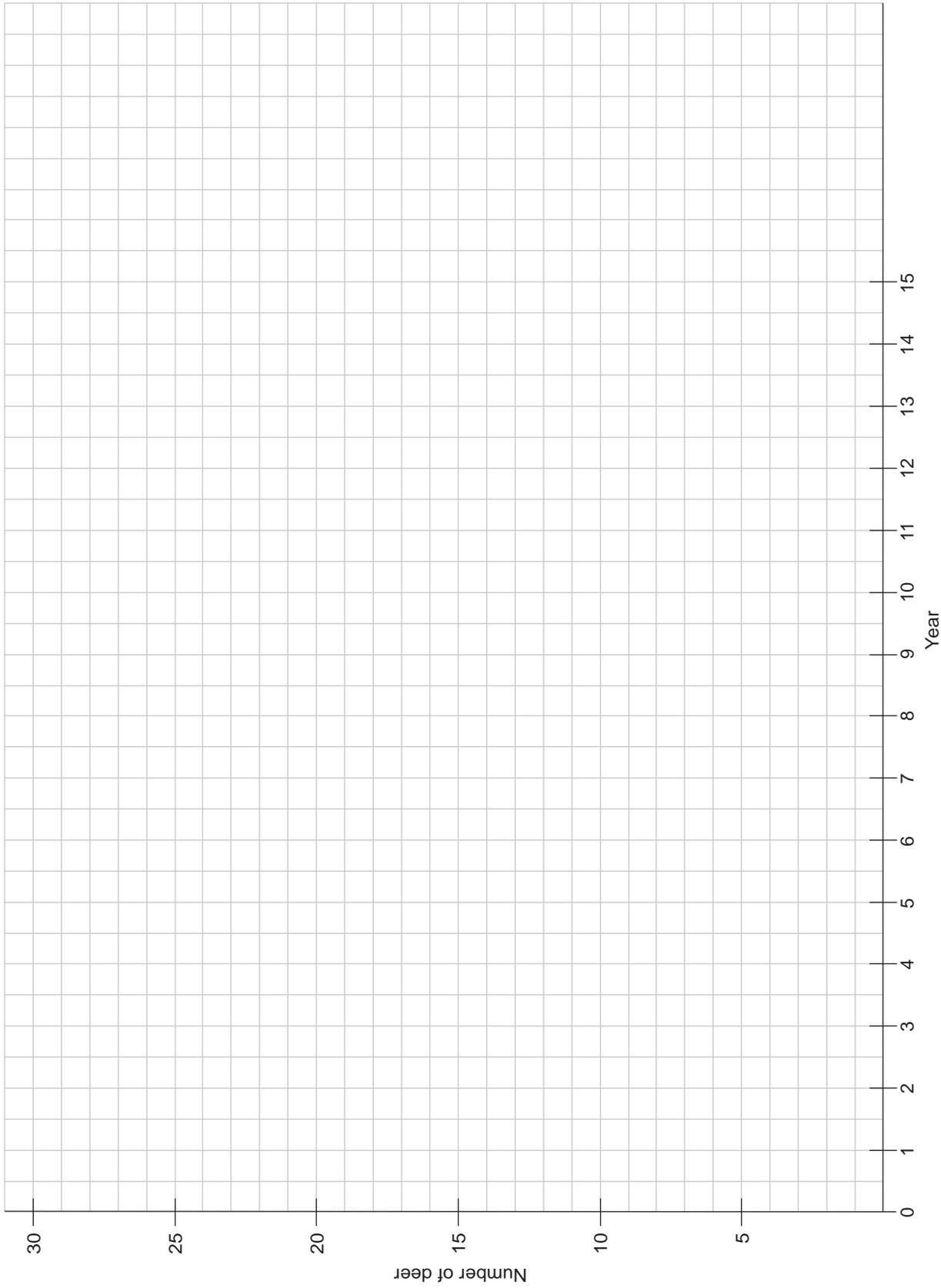
Some possible responses:

- This is probably a healthy population, with fairly regular decreases followed by increases.
- Students should have some reasonable explanation for the sharp decrease between 1995-1996. For example,
 - o Drought.
 - o Disease.
 - o Forest fire.
- Evidence of long-term health is that the population rebounded so quickly after 1996.

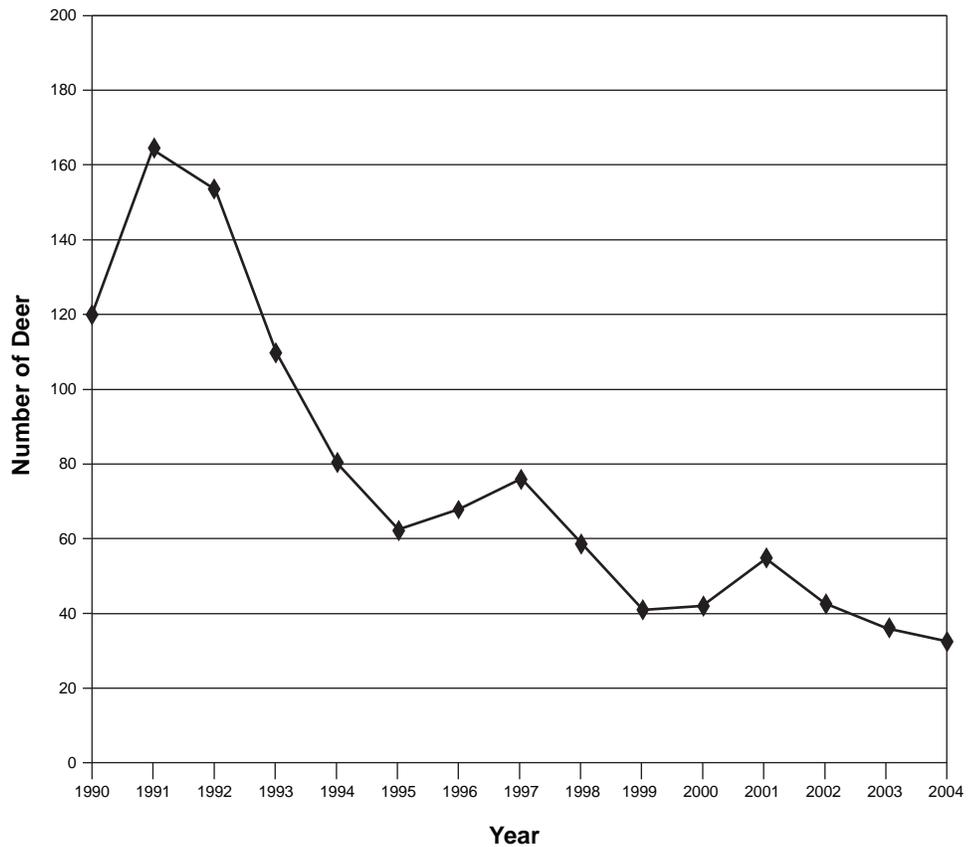
Acknowledgements

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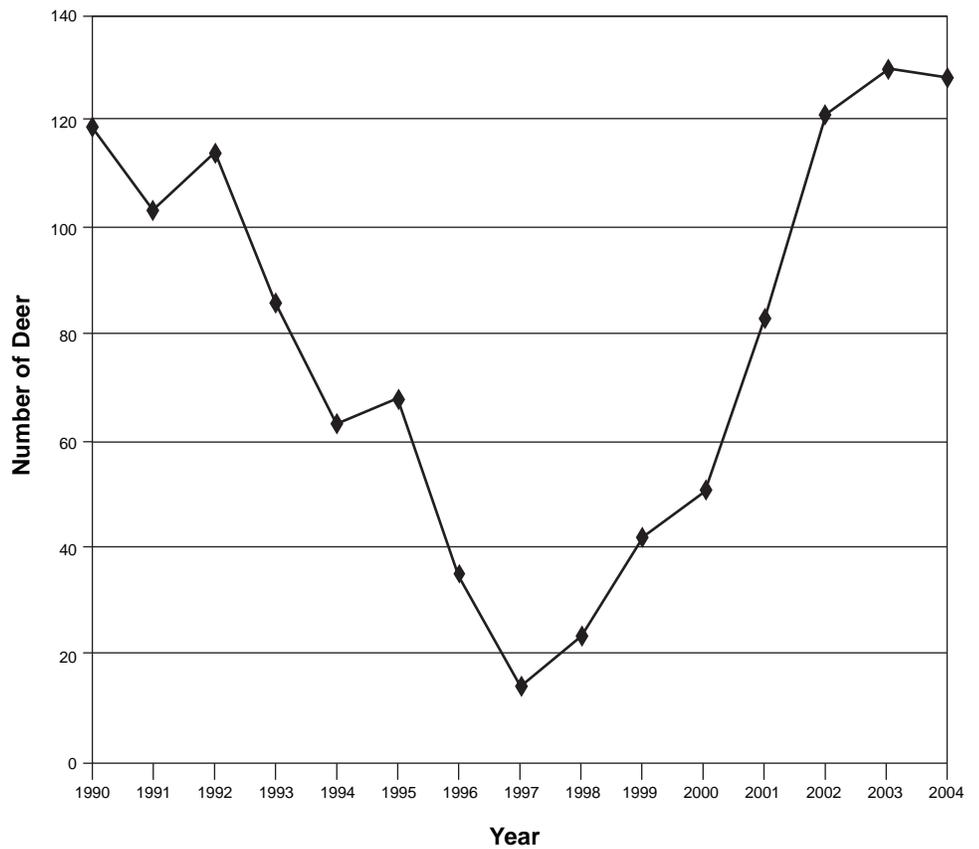
Year	Population
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

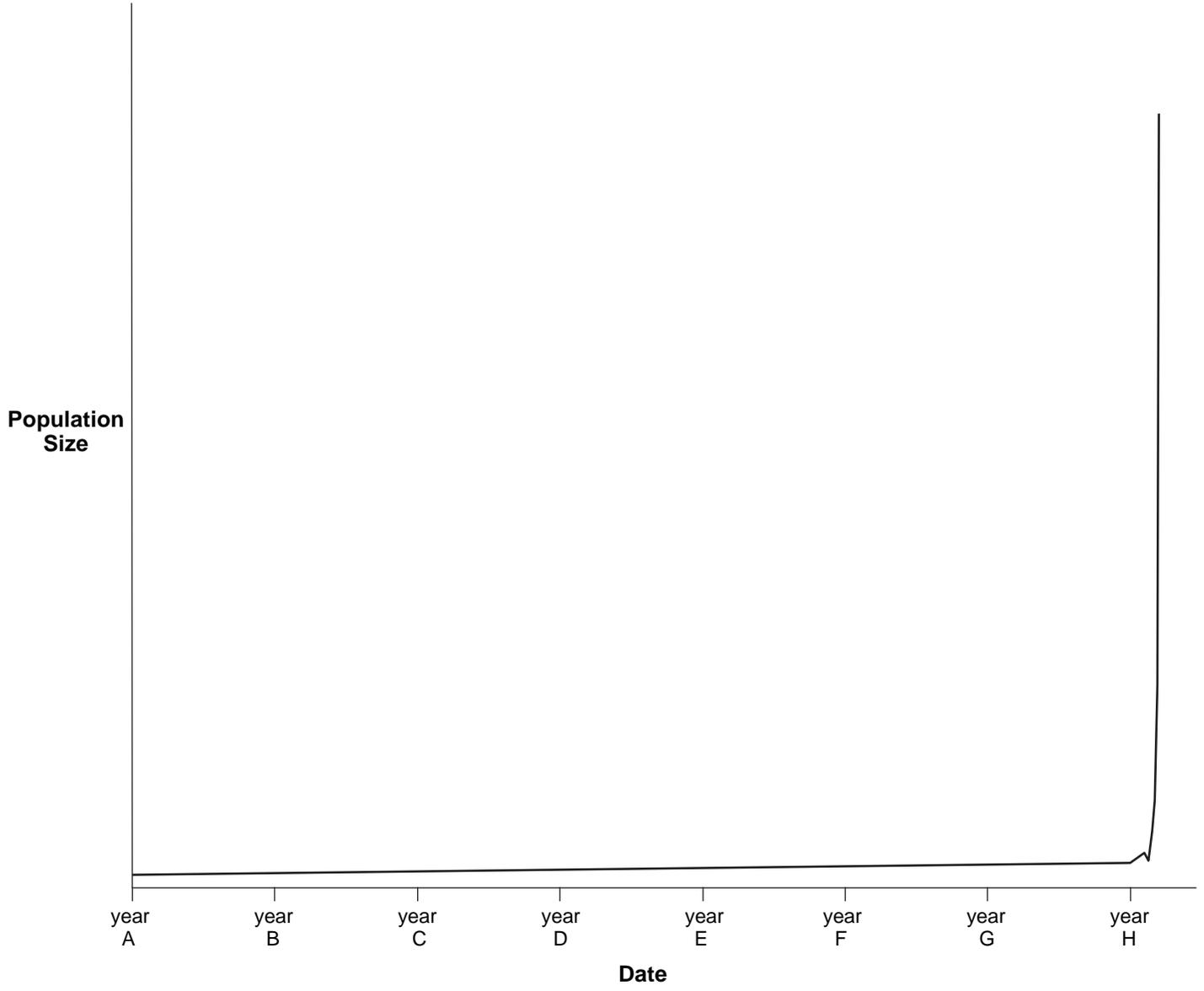


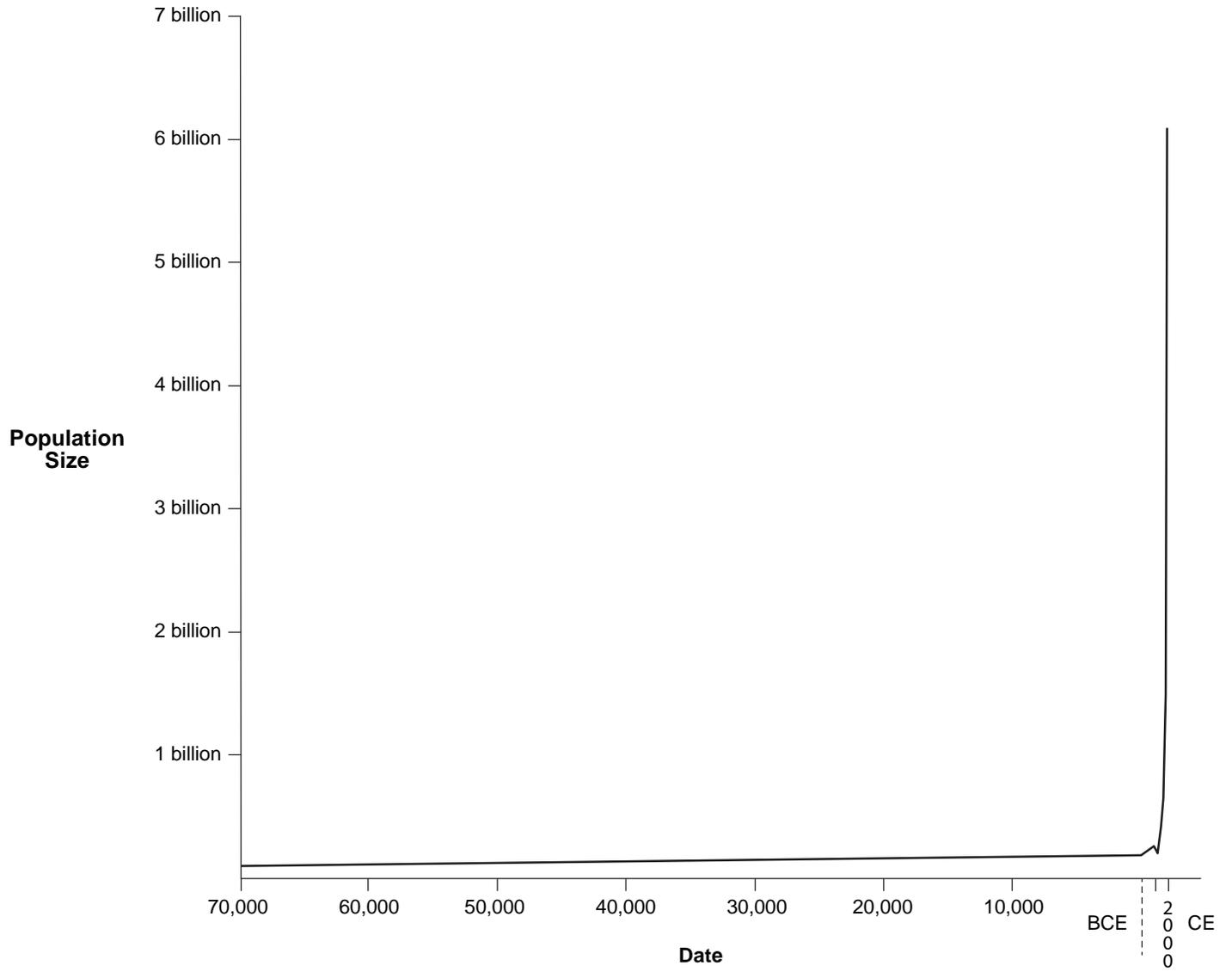
Year	Population
1990	121
1991	165
1992	154
1993	110
1994	81
1995	63
1996	68
1997	77
1998	59
1999	41
2000	42
2001	55
2002	43
2003	37
2004	33



Year	Population
1990	119
1991	103
1992	114
1993	86
1994	63
1995	68
1996	35
1997	14
1998	24
1999	42
2000	51
2001	83
2002	121
2003	130
2004	128







Carson County

You recently moved to Carson County as the new wildlife manager. You are presented with the following deer population data:

Year	Population
1990	143
1991	122
1992	150
1993	115
1994	129
1995	152
1996	41
1997	74
1998	83
1999	116
2000	185
2001	129
2002	146
2003	120
2004	131

Your job is to graph these data so you can learn about the deer population. You need to write a report and explain the “health” of the deer population. Your report should address the following issues:

- Look for any sudden population change and describe factors which could be responsible for the change.
- Determine the overall “health” of the deer population and provide evidence to support your decision.
- Identify any concerns you might have about the deer population.