

# Deer Dilemma

Grade: 10<sup>th</sup> Grade Biology

Rationale: Students are often exposed to news about populations and the populations of other countries. They often do not understand the ramifications of large populations and the reproductive capacities or carrying capacities of these populations. These lessons seek to introduce students to concepts related to populations and the ecological ramifications of changing populations.

Michigan Merit Curriculum – Biology

B3.2C – Draw the flow of energy through an ecosystem. Predict changes in the food web when one or more organisms are removed.

B3.5A – Graph changes in population growth, given a data table.

B3.5B – Explain the influences that affect population growth.

B3.5C – Predict the consequences of an invading organism on the survival of other organisms.

B3.5e – Recognize that and describe how the physical or chemical environment may influence the rate, extent, and nature of population dynamics within ecosystems.

B3.5f – Graph an example of exponential growth. Then show the population leveling off at the carrying capacity of the environment.

Objectives:

1. Students will demonstrate the concept of exponential population growth based on a resource unlimited deer population on an island.
2. Students will develop a management strategy to develop a carrying capacity of a deer population.
3. Students will explain the concept of population dynamics and reproductive capacity based on their deer island explorations.

Key Concepts

Exponential growth	Ecosystem stability
Carrying capacity	Consumer
Population dynamics	Producer
Reproductive capacity	Flow of energy
Equilibrium of ecosystems	

Materials:

1. One die for each group of three students. Die are modified with sides which are marked with 0.6, 0.7, 0.75, 0.8, 0.85, 0.9 on the six sides.
2. Maps of the island
3. Deer Reproduction Data Sheet
4. Deer Food Needs Data Sheet

Start of Class – normal classroom activities (attendance, etc)

### ***Engage***

Ask if anyone has ever gone to a small island. What kinds of things did you notice on the island? What about the plants and animals? Today you are going to be the managers of a new island deer preserve. You will be working as a team on your island and its management. *Split class into groups of three students, if it does not divide equally go for smaller groups of two than groups of four. Pass out maps of the island.* Have students take a look at their island. Ask them about the ecological qualities of the island. What kinds of ecosystems are on the island?

### ***Explore***

Explain that their preserve is going to start with four deer. Your investors have decided that for the first ten years they don't want to touch the deer population. Is this a good idea? Using your data sheet and die you will be determining what your deer population will be after 10 years. For each year you will roll the dice to determine how many offspring your deer will have that year. After you have completed the data table use the graph paper to graph the change in your deer population over the 10 year period.

*Questions to Ask as Students are Exploring:*

1. What is happening with your deer population?
2. Is this in line with your prediction?
3. (As exponential growth kicks in) Why is it going up so fast now? (trying to get them to see ideas behind reproductive potential).

### ***Explain***

After the completion of this activity, have the students explain what they discovered about their deer population. Make sure that they back up their observations with data. What do their graphs look like? Do they think that their deer population could survive on their island? Why or why not? What do they think will happen if they continue to allow their deer population to grow without any intervention?

Using ideas from the students' explanations introduce the concepts of exponential growth, reproductive capacity and populations dynamics.

### ***Explore***

After this discussion, ask students about their deer population after 10 years and if they think that their island could support this number of deer? Why or why not? Could they allow the population to continue to grow? What do they need to determine first? (How many deer the island can support). Using the supplied data, have student determine the number of deer that the island can support and how many deer they think the island should have on it.

*Questions to Ask as Students are Exploring:*

1. If they ate everything, what would they eat next year?
2. Are deer the only thing that you want to live on your island?

***Explain***

Have students justify how many deer they want to have on their island. Why not go for the maximum number?

Introduce the concept of **carrying capacity** and how resources will only allow for a population to grow to a certain size.

***Elaborate***

Now what are they going to do with the excess deer on the island to bring it into a balanced carrying capacity?

Ideas that might come up:

1. Hunting – what if not enough are hunted off the island. Safety to hunt that many?
2. Removal – impact on tranquilizing them and moving (90% mortality)
3. Introduction of Predator – how will you control its population. If it eats everything then do you have a new problem?

# Deer Dilemma

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Names \_\_\_\_\_

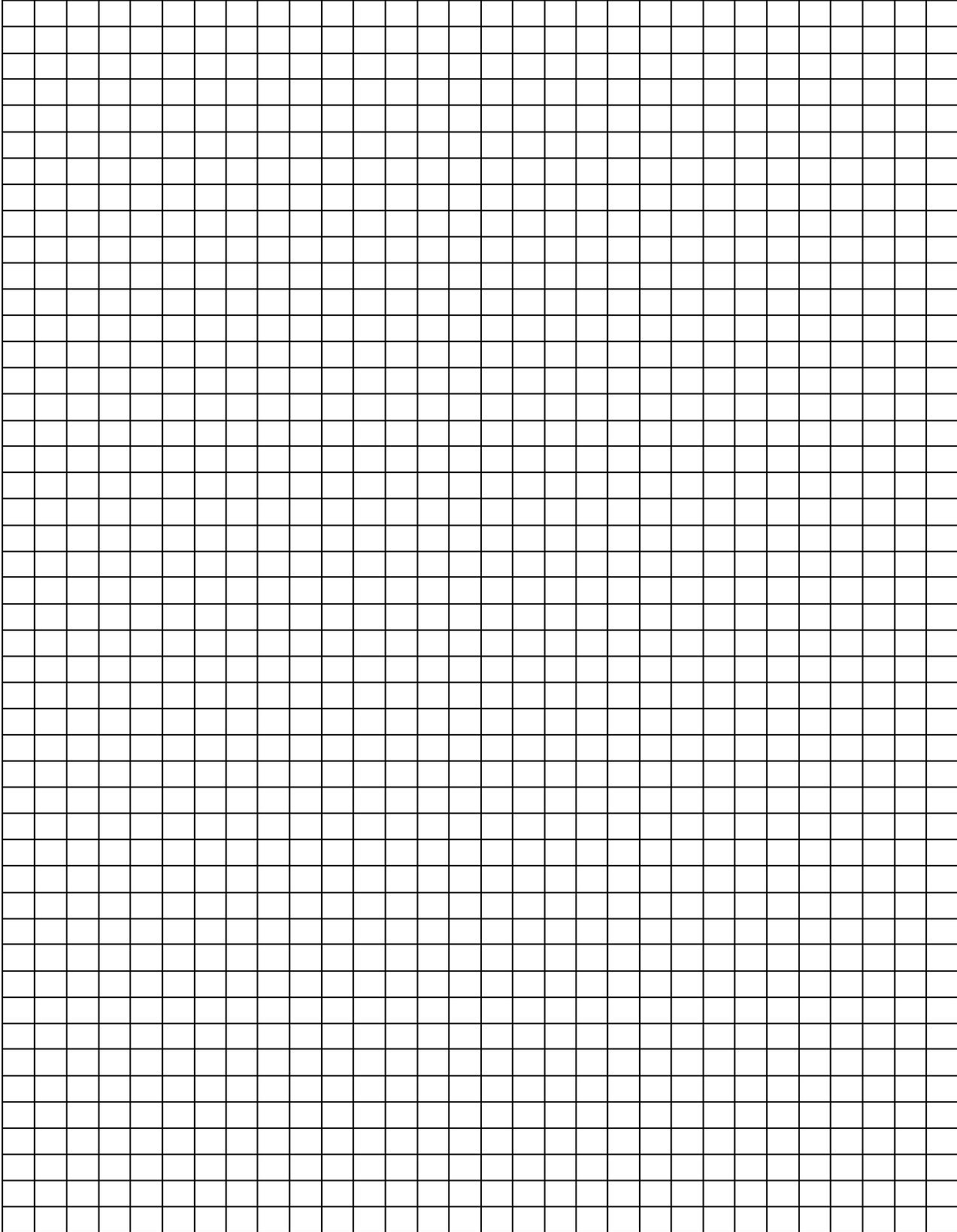
Use the data table to keep track of your island's deer population over time

Prediction of population in 10 years \_\_\_\_\_

	Start of Year	# of Offspring	New Population
Year		roll dice and multiply number x start of year number	Start of year + offspring put number in next start of year box
<b>1</b>	<b>4</b>		
<b>2</b>			
<b>3</b>			
<b>4</b>			
<b>5</b>			
<b>6</b>			
<b>7</b>			
<b>8</b>			
<b>9</b>			
<b>10</b>			

Use the graph paper on the back to graph your data. Don't forget to use labels on your graph.

Graph of the Deer Population on your island



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How many deer can your island support?

Your island is split into four different habitats. Each habitat can produce a certain amount of food for your deer.

Each square is 100 hectares (that's about 220 acres).

- For the field habitats, one hectare produces 563 kilograms of food each year.
- For the forest habitats, one hectare produces 113 kilograms of food each year.
- For the scrubby fields, one hectare produces 338 kilograms of food each year.
- For the dunes, one hectare produces 290 kilograms of food each year.

Each deer needs 1653 kilograms of food to survive the year.

Habitat Type	Number of hectares	Food per hectare	Total amount of food
Field			
Forest			
Scrubby Field			
Dunes			
Totals			

Number of deer your island can support:

Total Food  $\div$  1653 = \_\_\_\_\_

Is this a realistic number?

What about other animals that need the same food?

How many deer did you have at the end of your growth period? \_\_\_\_\_

What is the difference between what your island can support and the number now on your island?

\_\_\_\_\_

What are you going to do? How will you keep the deer from eating everything?

