

## Oh Deer: Invasive Species & Data Variability Modifications (two class periods)

(Adapted originally from a Project WILD activity and Vital Signs Oh Deer: Invasive species style - <http://vitalsignsme.org/oh-deer-invasive-species-style>)

In this active and competitive game, students build background knowledge by experiencing how a community of native animals and plants changes in response to resource availability in their habitat. Students collect data during the game and then graph and analyze their data to answer the driving question, “How does the introduction of an invasive species to a habitat affect native species populations?”

**Learning Outcomes:** Students will be able to...

- Explain how invasive, native, and non-native species compete for resources within a model ecosystem.
- Determine the resources necessary for species survival within an ecosystem.
- Interpret data to determine the impact of resource availability and competition on native and invasive species populations within an ecosystem

### Standards Alignment

MLR	CCSS	NGSS
E2 – The Living Environment – Ecosystems: Examine how the characteristics of the physical, non-living (abiotic) environment, the types and behaviors of living (biotic) organisms, and the flow of matter and energy affect organisms and the ecosystem of which they are part.	CCSS.MATH-6.SP.B.5: Summarize numerical data sets in relation to their context.	MS-LS 2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
A2– Unifying Themes – Models: Use models to examine a variety of real-world phenomena from the physical setting, the living environment, and the technological world and compare advantages and disadvantages of various models.		MS-LS 2-3: Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem.

### Materials

Easel and flip-chart or dry-erase board and marker

Cones

If you are adding modifications to the game, you will need:

Nerf ball (predator modification)

Colored head bands or arm bands (2 colors, enough of each to outfit a class-non-native species modification)

Student notebook and glossary pages for the lesson (printed or shared electronically)

**Teacher preparation:**

1. Decide what native and invasive species you plan to model with the Oh Deer! game. Here are a few examples of habitat-specific species to use.

Stream	Native: Spinycheek crayfish Invasive: Rusty crayfish Optional - Non-native: European lobster
Upland	Native: Bluebird Invasive: Sparrow Optional - Non-native: Rock pigeon
Rocky intertidal	Native: Rock crab Invasive: Asian shore crab
Pond/ lake	Native: Wild brook trout Invasive: Smallmouth bass

2. Review the full instructions on how to play in the student activity description below. Watch this video to see the game in action - <https://youtu.be/sLGNWQztQE>

3. If you are unfamiliar with the distinctions between native, invasive, and non-native species, review the table, found here: <http://vitalsignsme.org/what-invasive-species>

4. Set up data tables on a white board, chart paper, or print out multiple copies like the one below. Use a different data table for each class, label it with the class name, and save for creating graphs of each class’s data in the following lesson.

	Native species	Invasive species	Habitat resources
Year 1			
Year 2			
Year 3			
Year 4			
Year 5			
Continue to year 15...			

5. Decide on where you will play this game. It is best played in a playing field, basketball court, or other open space. Set up your playing field ahead of time. Make a large rectangle with cones at the 4 corners set at least 20 m apart.

6. Set up a line graph on chart paper for each class with year on the x axis and number of individuals on the y axis.

7. Review and adapt the student notebook and glossary pages for the lesson.

## Lesson Sequence:

### Class 1: Playing Oh deer

#### *Activity 1: Introduction to the Game*

1. Prompt students to complete the “Do now.” Remind them that it is ok to guess!
2. Introduce the driving question for this activity: “*How are habitat resources, native, and invasive species related in an ecosystem?*” and the native species and habitat that you have chosen. Explain that in this game, students will experience how the populations of a community of native animals and plants changes over time in response to resource availability and other species in their habitat.
3. Challenge students to think about what living things need to survive. Give students a minute to generate ideas in pairs or small groups and then share ideas with the class.
4. Guide students towards naming food, water, shelter, and space as important habitat resources.

Note: Students typically need some prompting for “space.” It helps to give an example, such as lots of relatives at your dinner table, too many snakes in your classroom terrarium, or too many students in gym class.

5. Explain to students that they will play the roles of “habitat resource” and “native species” to see how populations change in response to available resources. Each “native species” will need to find a particular “habitat resource” in order to survive. As the game progresses, these roles will change as the ecosystem changes. Introduce the signals for the habitat resources:

- Food: Put hands over stomach
- Water: Put hands over mouth
- Shelter: Put hands over head
- Space: Put arms out to sides

6. Go over the directions in the student handout together.
7. Head to the site where you have set up the game.

#### *Activity 2: Modeling a Healthy Ecosystem*

1. Have the students count off by four.
2. Have the 1’s go to one end of the field and stand in a line about shoulder-width apart, facing away from the rest of the class. This group is the **native species**.
3. Have the 2’s, 3’s, and 4’s line up at the opposite end of the playing field, facing away from the native species. This group is the **habitat resources**.

4. Tell the students that before each round you will count the population of **native species** and **habitat resources** and record this number on the data table (remember to record each class's data in a different table).

**Modifications:**

Students who are not able to participate in an active game may take on modified roles, such as a species that does not move (i.e., part of the ecosystem), reporters that record a running commentary or play-by-play of the game, or data collectors.

5. Explain that at the beginning of each round, while their backs are turned, each **native species** will decide to look for any one of its four basic resources. Review the signals introduced in class. A native species may *not* change what it is looking for until the next round.

6. At the same time, while their backs are turned towards the native species, each student that represents **habitat resources** will decide which habitat resource he or she wishes to represent and will indicate their choice using the same signals. Like the native species, the habitat students may *not* change within the round, but can change the following round.

7. Make sure the two groups (native species and habitat resources) keep their backs turned from each other until the start of each round. Tell each student to make their signal.

8. Give the directions for each round/year:

a. When you say, "Go," students will all turn around and face each other while continuing to hold their signals.

b. **Native species** should walk/run toward the habitat resource that matches what they are looking for. The **habitat resource** students should stay in their places.

c. Any **native species** that finds the resources they need will survive and reproduce. They will take their habitat resource back to the starting place to become a native species.

d. **Native species** that do not find the resource they need, die and become part of the habitat (representing natural population flux).

e. If more than one native species tries to get the same habitat component, the one to get there first survives.

9. Go through one round/year with the students. Explain that this represented one year in the life of this native species population and discuss what happened. Most of the native species should have found what they needed and successfully reproduced. This would result in an increase in the native species population.

10. Count the number of **native species** and **habitat resources** and record it in the table.

11. Continue with 3 to 5 more rounds. As the population changes, invite students to share reasons behind the changes. Begin using the term “fluctuation” to describe these natural ups and downs and “competition” over resources.

**Modifications:**

Introduce a **predator**. The predator may move along the sidelines, stalking the native species. Each round, the predator may throw a Nerf ball at the native species. If the Nerf ball hits a native species, it dies and returns in the next round as habitat or as another predator. If you allow the predator population to increase, keep data records on this population as well. You may want to limit the number of throwing attempts a predator has each round (depending on the demeanor and accuracy of your predator!).

After a few “normal rounds”, introduce a **non-native species**. Distinguish the non-native species and the native species with different colored headbands, armbands, tags, etc. The non-native species has come from a different place, has no predators, and has different habitat needs:

- a. Food: Hands on hips
- b. Shelter: Hands waving wildly above head
- c. Space: Hands on knees
- d. Water: Arms making wave motions

At the end of a round, none of these non-native species will have found the resources they need in this new habitat and will not survive here. Take a few minutes here to discuss what happened to this species and why. The non-native species is adapted to a different type of habitat and has different resource needs. **Note:** Make sure the habitat students understand that they must stick to the original habitat resource signs, and *not* these new ones needed by the non-native species.

*Activity 3: Modelling the Introduction of an Invasive Species*

1. Once students get the hang of the activity, introduce an invasive species.
  - a. If students are not familiar with invasive species, explain that a new species has been brought into the ecosystem that has an advantage (maybe it is faster or lives closer to the resources).
  - b. Make sure you note when a new species is introduced on the chart. This will help students interpret their data in the next lesson.
  - c. Identify 3 to 4 students as invasives.
  - d. Instead of starting in line with native species, have the invasives start half the distance to the line of habitat resources, (mimicking their ecological advantage).
  - e. When the invasives get their habitat resources, have those resources go back and join the invasive group at the halfway line (just as they would go back with the native species in previous rounds).

2. Continue going through a total of at least 10 rounds, recording the number of native species. See modification ideas below if you'd like to add more variables.

3. Bring students back inside to debrief the activity.

#### *Activity 4: Oh Deer! Debrief*

1. Gather initial observations of the game. Use the following questions to prompt discussion:

- In what years does the native population increase/decrease most dramatically?
- Why do you think the population crashed in Year \_\_\_?
- How would you describe the amount of resources leading up to that year?
- What was the population of the invasive species in that year?
- How does the population of the native species relate to the amount of habitat resources?
- How does the population of the native species relate to the population of the invasive?
- How do you think the game compares to what happens to species populations in nature?
- Why did the invasive start closer to the habitat resources? What did that represent?
- Why do you think we call invasive species "invasive"?

2. Use the experience from the game to define *ecosystem*. They just modeled an ecosystem because the living and non-living factors in the game were all connected and all affected each other. An ecosystem is a network of connected abiotic and biotic factors.

3. Invite students to share examples of invasive species that they have heard of and challenge students to use their experience to define invasive species. A strong definition includes:

- species that has been brought into a new environment
- a species that has some advantage that allows it to take over the ecosystem

4. Direct students to the analogy map their handout. Explain the table:

a. In the first column, students should write what happened in the game.

b. In the second column, students write what happens in the real world that is like the game.

c. The last column is for explaining how the part of the game listed in column one is supposed to represent the part of the real world listed in column two.

5. Go through the example filled in the table with students, and challenge the class to generate another example all together.

6. Have students finish the table in groups or on their own.

*Activity 4: Contextualizing the Data*

1. Project or hang up the data collected during the game, so that all students can see it.
2. Explain to students that their task is to make sense of the data from the game.
3. Direct students to the “Oh Deer! Data and Explanation Chart” in the student handout. Explain that first they will create an explanation of the changes in abundance from year to year.
4. Model how to use the data to produce an explanation, using the example explanation chart below. Emphasize that they are providing an explanation of what could have happened, if this data represented an actual ecosystem.

**Example Data and Sample Explanations:**

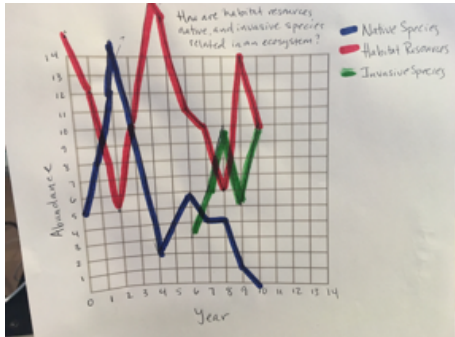
Year	# of Native Species	# of Invasive Species	# of Habitat Rsrces	Explanation of data
0	5	0	15	
1	8	0	12	The abundance of the native species increased. They got the food, water, and shelter that they needed to survive and reproduce.
2	15	0	5	The native species population thrived again this year. They got what they needed to survive and reproduce.
3	10	0	10	There were not enough habitat resources (food, water, shelter) to support the native species and the abundance declined.
4	2	0	18	The native species abundance went way, way down, possibly due to disease, fire, bad weather, competition with another species, or maybe another factor
5	4	0	16	The native species population slowly increased. The few remaining got what they needed to survive and reproduce.
6	6	3	11	The native species abundance slowly increased. They got what they needed to survive and reproduce. An invasive species was introduced!
7	4	6	10	The invasive species were able to get the resources they needed faster, and they reproduced. Not all the natives found resources.
8	4	10	6	The invasive species is getting more of the resources and their abundance is increasing!
9	1	5	14	Both the native and invasive species populations declined due to lack of resources.
10	0	10	10	The native species was eliminated because it could not get the resources that it needed.

5. Assign students to groups of two to three and divide the years of data so that each group is only responsible for the explanation of three to five years.

6. Have student groups discuss what happened in their years and then record a short summary in the Oh Deer Data and Explanation table.

7. Call on student groups to explain the changes in abundance of the native species from beginning to end of the game, pointing to the data table as they go.

### Activity 5: Graphing the Data



1. Explain that you are going to work together to create a graph of the data. Have the students create the graph in their handout as you model the process.

2. Have a student volunteer write the question for the activity of at the top of the graph “How are habitat resources, native, and invasive species related in an ecosystem?”

3. Explain that you want to be able to see increases and decreases over the span, and a line graph is the best way to show that.

4. Invite student ideas for how to label the x and y axes. Label and scale the axes on the graph.

5. Explain that they will be graphing the abundances of native, invasive, and habitat resources, all on the same graph. Have students share ideas for how to distinguish the data points for each of these categories. Show how to use a different color, plotting each dataset one at a time and creating a legend.

### Activity 6: Interpreting the Data

1. Give students time to look over their graphs in pairs. Have them discuss what the notice about the graphs and work together to the questions in their handout.

2. Have students report on their conversations. As they do, look for the following:

- Students are likely to notice a lot of “ups and downs.” Explain that these are called “fluctuations” and encourage students to use this vocabulary. Ask students about the causes of fluctuations. Did these happen in all classes or

#### Modifications:

If graphing all three data sets is too much, only have students graph the native species population. Then, draw a line to indicate the year when the invasive species was introduced. Use this modified graph for data analysis.

Depending on students’ skills and experience in graphing, give them more independence in this process, allowing them to choose their own type of graph and construct the graph on their own.

If you have multiple classes, display the graphs that each class created side-by-side. Have students compare the datasets. What are some reasons for the differences that they see in the data? Do they notice any similar trends across datasets?



just one? Did they occur both before and after the introduction of the invasive? Help students to identify population fluctuations as a part of any normal ecosystem.

- Have students compare the abundance of the native species before and after the introduction of the invasive. Even though there are fluctuations in the data sets, can they see any kind of trend?

3. Go back to the question for the activity, “*How are habitat resources, native, and invasive species related in an ecosystem?*” In pairs, have students make a claim in response to the question. Tell students they will need to use evidence from the game to support their answer.

4. Call on a few students to report on their answers. Collect evidence from multiple teams, until the class can come to a consensus on the answer. Prompt students to point to specific evidence from the graphs that support their answer.

5. Have students review the scoring criteria and circle their highest level of achievement.

**Extension Idea:** For more support with interpreting line graphs to tell the story of the data, see this Vital Signs Mystery Graph lesson using purple loosestrife data: <http://vitalsignsme.org/mystery-graph-purple-loosestrife-lythrum-salicaria-galerucella-beetle>  
Also, look to your Math teacher colleagues for additional practices with line graphing and choices in graphing.