Oh Deer: Invasive Species Style

Overview

In this Rock-Paper-Scissor style game, students play out different scenarios to model how native species are impacted by environmental conditions, such as the introduction of predators and invasive species. Students have the opportunity to create novel scenarios. Students will collect data each round that they can use to graph and visualize the effects of each habitat change.

This game assumes your students have a basic understanding of native and invasive species. If they are unfamiliar with these terms, you can find a quick invasive species overview in the **Introduction** to the Washington Pest Watch Lesson Plans and in the following videos:

- TedED "Attack of the Killer Algae" https://youtu.be/Vd4rgN6MYtg
- TedED "The Threat of Invasive Species" https://youtu.be/spTWwqVP_2s

Standards Addressed

- **MS-LS2-1:** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-2:** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- **MS-LS2-4**: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- **MS-LS2-5:** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- **SL.6-8.1:** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade-appropriate topics, texts, and issues, building on others' ideas and expressing their own clearly.
- **SL.6-8.4:** Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Learning Objectives

- Practice basics modeling
- Understand that populations fluctuate based upon environmental factors, such as invasive species
- Gather and graph data
- Compare and contrast data

Grade Levels

- 6, 7, 8

Materials

- Clipboard
- Data sheet
- Writing utensil
- Colored band or other unique identifier to distinguish roles (two colors recommended)
- Cones (optional)
- Soft Nerf ball (optional

Time Needed

- 30 minutes minimum (time varies depending on number of rounds and length of discussion)

Activity Procedure

1) Ask your students to define "habitat." Habitat: where something lives, ideally contains all that the organism needs to survive.

2) Ask your students to tell you the four essential habitat components, which are food, water, shelter, and space.

3) Explain to your students that they are going to play a game to better understand how different factors in a habitat, such as resource availability and the introduction of invasive species, impact native species populations.

4) This game is a type of model. A model is a way for us to answer questions about processes that would be difficult to observe naturally. For example, it would take too long for us to observe the impacts of invasive species on native species in real time. A model allows us to make and test predictions in a quick, controlled fashion. Models may take the form of mathematical equations, computer simulations, and games like the one you will play today.

5) Models are made up of different factors that you can measure and change, called variables. Scientists change variables to see if and how that affects the outcome of their models. In this game, students may choose what questions they would like to answer using the model. They also will choose which variable to change to try to answer their questions.

    - Note: Students often want to change multiple variables at once. Ask your students why they should change only one variable each time they run a model.
        - You only want to change one variable each time you run a model, otherwise you won't be able to determine which variable caused your outcome.

6) Using either cones or natural landmarks, define the playing field for your students.

7) Ask the students to count off in fours. All the 1s are Native Species**.** All the 2s, 3s, and 4s are Habitat**.**

8) During each round of the activity, each Native Species is trying to gather each of the four basic resources needed. To gather these resources, the Native Species students must approach the Habitat students and engage in a modified version of Rock-Paper-Scissors. Each student will go through the classic, Rock-Paper-Scissors hand motions, but on the final beat, they will make a resource motion instead of rock, paper, or scissor.

9) The resource motions are:

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

    Demonstrate these motions to your class and have them practice along with you.

    If a Native Species and Habitat student play a match of Rock-Paper-Scissors ("Rock, Paper, Scissors, RESOURCE"), and are making the same resource motion at the end, then the Native Species gets the resource it needed and will move on to another Habitat student to play again and try to gather the other resources it still needs.

If a Native Species and Habitat student play a match of Rock-Paper-Scissors ("Rock, paper, scissors, RESOURCE"), and are NOT making matching resource motions at the end, the Native Species does not receive that resource and must move on to another Habitat student and play again.

Habitat students are not depleted if they match up with a Native Species**;** they keep playing for the whole round.

10) Habitat students may change which resource they are each time they play Rock-Paper-Scissors with a new partner. The Native Species also may change with each match of Rock-Paper-Scissors, and will want to choose strategically and play for whichever of the four resources they still need.

11) Before each round, count the number of Native Species, Habitat, and any other variables your students may choose to add later (ex: Invasive Species; Other Predators; First Detectors) and make a note of this number on your data sheet. These data will be useful for class discussions and graphing after the activity.

12) Have the Habitat students (2s, 3s, and 4s) spread out on the playing field. After starting the timer for that round, have the Native Species (1s) begin approaching different Habitat students and starting their Rock-Paper-Scissor rounds.

13) The Native Species will have 1 minute in which to collect all four resources. In this model, 1 minute represents 1 year in the life of this native species population. If a Native Species does not collect all four resources within that minute, they die and come back as Habitat in the next round. This illustrates how when plants and animals die, they decompose and are added back into the ecosystem.

14) At the end of each round, for every two Native Species that survive, they get to select one Habitat student to join them and become a Native Species. This represents how animals who successfully gather all the resources they need can reproduce and increase their population.

15) **Play Round 1 without any additional variables.** Tell the students that this represented 1 year in the life of this native species populations and ask what happened. Most of the native species should have found what they needed and successfully reproduced. This will result in an increase in the Native Species population.

16) Count the number of Native Species and record it in the table for the start of the next round.

17) After capturing four to six rounds of "normal" population data (or fewer if you're pressed for time), start the activity from the beginning and ask the students what questions they would like to answer using the model.

18) Have students:

    - Pose the question they want to answer
    - Explain which variable to change in order to answer that question
    - Hypothesize what they think will happen and why

If your students are stumped, here are a few possible modifications:

What would happen to our Native Species population if we add Predators?

Assign a few students to be Predators. Give these students a colored armband or other distinguishing marker. The Predators prey upon the Native Species as they try to gather resources. Depending on your students and available supplies, have Predators gently tag or gently underhand throw a soft Nerf ball at the Native Species. If they get tagged, the Native Species dies and comes back the next round as a Habitat**.** All other rules remain the same.

For the purposes of this game, we are assuming that these Predators are native to the area as well. As such, they are providing a vital ecosystem function by keeping other population sizes small enough that the habitat can support a diverse range of species, ensuring that no one species exhausts a limited resource.

For example, if there were no predators to keep the number of bunnies in area in check, the bunnies would breed exponentially and eat all the vegetation in their area. Eventually, their population would get too large for the habitat to support and the bunnies would start dying. Additionally, because the bunnies cleared out all the vegetation in the area, other animals such as deer, insects, and birds may suffer from a lack of food or habitat. Additionally, with the lack of vegetation, that is the perfect time for invasive plants to spread into this area. And, with no vegetation to hold down the soil, it could erode into nearby water bodies and negatively affect aquatic habitats.

The point is, while it's not fun to get tagged by a predator in this game, they are vital players in a healthy ecosystem.

Have students hypothesize what they think will happen when Predators are added to the model.

Possible discussion questions:

1) Was your hypothesis supported? Why or why not?
2) What happened to the Native Species population when we added Predators?
    - Compared to the original rounds without Predators, the Native Species population should not have grown as quickly (if at all, depending upon the voracity of your Predators!).
3) Why is it important to have predators in an ecosystem? For example, what would happen if there were no predators to manage the number of bunnies in a population?
4) What are some adaptations that may help the Native Species avoid predation?
    - Camouflage
    - Foraging in packs with look-outs
    - Foraging when the predators are asleep
    - Physical defenses: spikes, shells, poison glands, detachable appendages

What would happen to our native species if we add invasive species?

Select two to three students to be Invasive Species**.** Distinguish the Invasive Species with a different colored headbands, armbands, tags, etc. Invasive species are a problem because they are adapted to different habitats. They may breed earlier and more quickly than our Native Species. They also do not have predators in the habitats they get moved to, so there is nothing to keep their population in check. All of this gives the Invasive Species a competitive advantage over the Native Species.

Explain that the Invasive Species are able to out-compete the Native Species for food, water, shelter, and space. As such, the Invasive Species get a few advantages:

- Invasive Species get to start collecting the resources they need 30 seconds before the Native Species (Trait: breed early so their offspring often get earlier access to resources).
- If you have Predators from the earlier round, remind them that they do not prey upon the Invasive Species (Trait: no predators).
- For every two Invasive Species that obtain all four necessary resources, they get to select two Habitat students to join them as Invasive Species in the next round (Trait: have many offspring).

Have students hypothesize what they think will happen now that Invasive Species are added to the model.

Possible discussion questions:

1) Was your hypothesis supported? Why or why not?

2) What happened to the Native Species population when we added Invasive Species?

3) What are some things you think we could do to reduce the impact of Invasive Species?

    - **Introduce predators that prey upon the invasive species**; this is known as biocontrol. It can be tricky finding a predator that will prey upon the invasive species without the introduced predator then becoming an invasive species itself! Scientists do vigorous testing before adding anything into an ecosystem to try to prevent that from happening.
    - **Report invasive species.** Invasive species scientists rely on people making reports about any strange species they see so that we can stop the species before it spreads. In Washington, you may use the "WA Invasives" app or our Web site: https://invasivespecies.wa.gov/report-a-sighting/ to make reports.
    - **Prevent the introduction of invasive species in the first place!** Prevention is the cheapest and easiest way to combat invasive species. We can prevent introducing invasive species by taking simple actions such as cleaning our gear after playing outside, not releasing any non-native plants or animals into the wild, and more. You can check our Web site for a list of more ideas: https://invasivespecies.wa.gov/projects/.

4) What are some invasive species in your area? How might they be impacting native species?

Graph and Discuss

Break the class into groups and assign groups different scenarios to graph so the class can compare and contrast the various models you ran.

Have a representative from each group present their graph to the class and explain what the graph illustrates. Since you will be changing the number of native species between rounds as you assign students to different roles (e.g., predator or invasive species), you cannot do a direct comparison of the number of native species between scenarios, but you can compare the overall trends from the graphs. (*Ex: Our graph illustrates 10 years of a population of native species without predators or invasive species. The population grew quickly in the beginning, decreased as resources became scarcer, and then grew again.)*

Possible Discussion Questions

1) In which model were the Native Species most successful? How realistic was that model?
2) In which model were the Native Species least successful? How realistic was that model?
3) What are some things you learned about habitats and population by playing this game?
    - Populations change with resource availability and competition.
    - Habitats are delicately balanced.
    - When plants and animals die, they return to the ecosystem to become new resources for future plants and animals.
    - Invasive species can severely disrupt native species populations.
4) Were there scenarios you wanted to test but could not run with this particular model? What would you need to change in order to answer your question?

Original lesson plan by:

Project WILD- www.projectwild.org

Original Invasive species modifications by:

Sarah Morrisseau	Laura Seaver
Gulf of Maine Research Institute Vital Signs Program	Loranger Middle School Old Orchard Beach ME

Additional Invasive species modification by:

Pamela Kidder	Mike Nepean	Brianna Widner
Glover Middle School, Spokane, WA	Pacific Education Institute, Spokane, WA	Washington Invasive Species Council, Olympia, WA

“Oh Deer” Invasive Species Style Datasheet

Name(s):_____ **Date:** _____

Round #	Number of Native Species	Number of Habitat	Number of _____	Number of _____	Number of _____

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