OE Lesson: Oh Deer!

Objectives and Summary: Students learn about population dynamics by simulating a deer population, the resources they need to survive, and the predators and environmental challenges they face. Students will learn:

- To identify and describe the essential components of habitat (space, water, food and shelter)
- Predator-prey relationships
- The consequences of human impacts
- Basic terms and mechanisms associated with population ecology, such as limiting factors and carrying capacity
- That fluctuations within an ecosystem are natural (dynamic equilibrium).
- That humans are a part of the ecosystem as well, and that sustainable living and conservation are keys to minimizing detrimental impacts.

Background

Carrying Capacity: The maximum population size of a particular species a habitat can sustain for a period of time. This is based on a dynamic balance between the availability of habitat components and the number of animals the habitat can support.

Ecosystem: All of the living (biotic) and nonliving (abiotic) members of an ecological system.

Population: a group of organisms of the same species within a designated area.

Dynamic Equilibrium: Dynamic (changing) equilibrium refers to the pattern of a population going above and below the carrying capacity, but more or less remaining stable. Most healthy populations are constantly changing due to limiting factors in the ecosystem. Often students confuse *stable* with *static,* thinking that a healthy population needs to either remain the same or be increasing in size.

Limiting Factors: Factors within an ecosystem that limit a population. In this game the limiting factors are 3 of the aspects of habitat described below. One limiting factor may affect many species.

Habitat: A place that supports a population. For this simulation, a good habitat includes: food, water, and shelter.

Extirpation v. Extinction: Extinction is the global death of a species, whereas extirpation is the local death of a species from a certain region. Often in this game, a species will be extirpated from a region, but that does not mean they are extinct.

Materials

- White board with dry erase markers
- Oh Deer data chart and graph
- Bandanas ties into balls (for hunters)

Location and Duration: This activity can be done on the field on a nice day, or in the barn when it is raining. It lasts between 60 and 90 minutes.

HS Leader Role: There are many opportunities to include the high school leaders during this activity. During the introduction, leaders will make sure students are quietly paying attention. During the activity they will make sure students are being safe and following rules. Especially in Round 2, they can fill in as anthropogenic impacts such as highways, hunters and angry farmers.

Procedure

Introduction: Introduce the word simulation and explain that we are doing a simulation instead of a game. This way students don't need to win (and don't feel the need to cheat). In simulations, the numbers serve as data, so it is very important to follow all the rules so that we can learn something from it. This doesn't mean it won't be fun!

1. Introduce the concept of a ***limiting factor.*** Introduce 3 of the components of habitat and explain that without one of these things, the habitat would not be suitable for the deer population. They are:
    a. **Food**: deer are ***herbivorous***, meaning they eat only plants. This includes: grasses, shrubs, acorns, nuts, berries, etc.
    b. **Water**: identify some water sources in the area, such as the river.
    c. **Shelter**: this is important to protect the deer from weather, but also give them places to hide from predators.
2. Introduce the three motions for the 3 resources we are focusing on in the game (shelter, water, and food).
3. Explain how the game is played using the whiteboard for a visual. Number students 1 through 4. 4s will go line up on one end of the field and be deer. 1s through 3s will be resources and line up on the opposite end of the field. Both resources and deer will face away from each other. Deer will decide what resource they will "need" that round and begin making the motion (shelter, water, or food). Resources will decide what they want to "be" that round and make the motion as well. On the count of 3, the Outdoor Educator will yell "Oh Deer!" and both resources and deer will spin around to face each other. Deer will then need to either run (outdoors), or speed walk (in the barn) toward a resource that matches their needs. The first deer to tag a resource will link arms with that resource as they both return to the deer line. This symbolizes the deer surviving long enough to reproduce. Any deer that failed to tag a resource will decompose and come back as resources in the next season. It is INCREDIBLY important that deer do not switch resources within a season, and that they only take one resource. There should always be an even number of deer. A good way to reinforce understanding is to have 2 volunteers in front of the group act out a season (one resource and one deer) and ask students to tell them what happens next. Once everyone is clear, it's time to play!

Lesson/Activity

Round 1: Split up the deer and the resources and begin playing. After each season, record the changes in the deer population, using the provided chart.

After 5-6 seasons, you can introduce a predator. Explain that the healthy deer population has attracted a mountain lion from a nearby valley. The mountain lion (a mature student or HS leader) can only eat one deer per round. If they don't catch a deer, they decompose and become a resource. Deer act as resources for the mountain lions, so a deer that gets caught becomes a mountain lion the next season. Possible pitfalls: The mountain lion population can grow out of control, and the game can easily turn into a tag game. Some ideas to prevent this are located within the **Extension** section.

Round 2: this optional round can happen after the first graphing/debrief to show what effects humans have on the ecosystem. Possible additions:

1. I-90: Having 2 or 3 HS Leaders walking back and forth in a line across the field. If they "hit" a deer, the deer becomes a resource. Mountains lions are simply scared of the highway, and have to all stay on one side.
2. Farmer (HS leader + bandana ammo): thinks the mountain lions are killing his livestock. He can only hunt one mountain lion per season, and cannot hunt kittens. If they kill off all of the mountain lions, introduce the term *extirpated* (they have been removed from a region but are not extinct). Hunted predators become resources, not new farmers.
3. Deer hunter (HS Leader + bandana ammo): They can hunt 1 or 2 deer each season (your choice). A hunted deer becomes a resource in the next round, not another hunter.
4. Pollution: explain to a student or leader that they represent pollution. They give out high fives during the season, but don't explain why. Ask who got a high five at the end of the season, and explain that they were exposed to pollution. If a predator ate a deer that got a high five, they were exposed as well. You can explain that predators are more susceptible to pollution because it collects/accumulates as you go up the food chain (bioaccumulation/biomagnification).

Conclusion

1. Ask students to explain any trends they notice in the chart. If they don't, that's a great segue into graphing! Have students help you draw the graph by explaining what goes on the X (Seasons) and Y (Population) axis, as well having a volunteer graph the points for both populations over time. **Tip**: Ask students if they've seen a timeline, and whether it was going across or up and down. That's because it's just an x axis. It helps to draw each population with a different color.
2. Ask students to analyze the data. **Suggested summary:** *when deer populations got too high, they would then decrease due to lack of resources; predator and prey populations should be inversely proportional, meaning that when one increases, the other decreases; some seasons, when populations were close to a certain number, they didn't increase or decrease as dramatically.*
3. Explain carrying capacity (the line "k" in the graph below). One way to explain it is by using the metaphor of carrying logs. I can carry ten logs, if I go over that number, I'm going to drop some, and if I have less than ten, I'm going to pick up more. Ask students if they can see the carrying capacity on the graph for each population. Draw it as a dotted line running across the graph for each. If a population goes above that line (should be around the middle), "logs" will get dropped. If the population falls below that line, the habitat can support more, so the population will increase. Which population has a higher carrying capacity? (Should be deer).
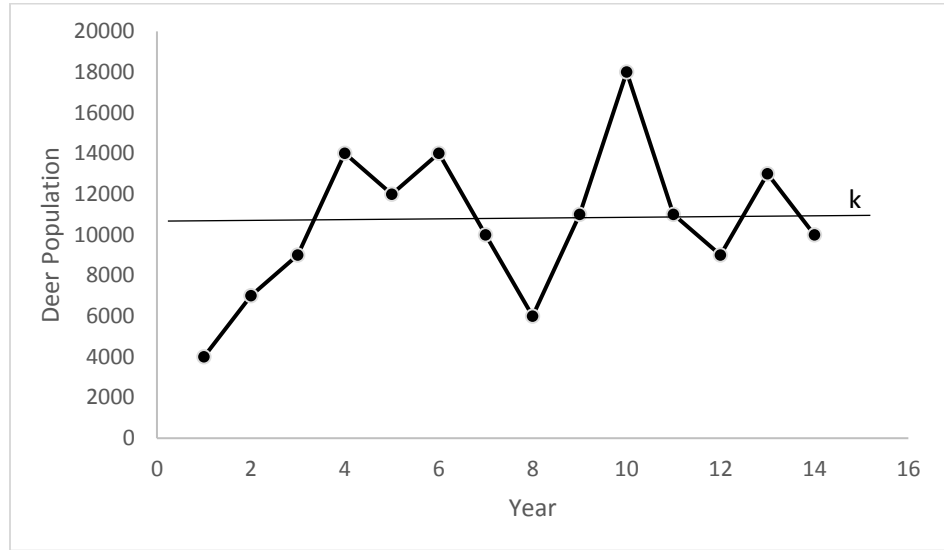
4. The populations go up and down, does that mean the ecosystem is not stable? Not necessarily, because they even out in the end. This is called ***dynamic equilibrium***. It means that the populations are changing, but they are still stable over time. A healthy population doesn't need to stay ***static*** or be steadily increasing. Fluctuations in population size are natural and expected.

Round 2 Debrief Questions: How did humans impact the populations? What if we had 30 hunters, or 7 highways?

Extension: If you need to control the predator population during the first round of the game, try these methods:

- New mountain lions (their first round) are just kittens and can't move around. They need to stay in one spot and stick together in the middle. If they don't catch a deer, they become a resource for the next season.
- The purpose of shelter is to give deer a chance to hide from predators. Any deer that chooses shelter is immune to mountain lions. However, there is no predicting what resources will be available to them, so they need to decide whether to protect themselves or eat/drink.

Addition Debrief Topic: Introduce the acronym HIPPO to talk about population decline:
Habitat destruction
Invasive Species
Pollution
Poaching
Overharvesting