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How Can Wolves Change A River?

Is the team making a clear argument?

1. What evidence have they provided?
2. Does it support the type of causal relationship the team is describing?
3. Do other teams' conclusions differ from those of your own team? Why might this be?
4. Did the other team offer evidence to support their conclusion that was different from the evidence your team presented?

Questions to Ask the Teams

1. What is the EcoMUVE forest? What were the research roles and what data did you collect about the organisms?
2. What problem are you trying to solve?
3. What is your claim? What evidence do you have to support your claim?
4. What was your solution to the problem?
5. What does the technology allow you to do?
6. How did you create the habitat and organisms being used in your Scratch & watercolor project?

Take-Home Messages

Bird Watcher

Patterns on Dover Island

The bird populations are primarily affected by changes in habitat. As the deer population increases over time, the deer consume many of the shrubs and preferred ground-cover species (trillium). This decline in shrub and ground cover habitat leads to a decline in hooded warbler and ovenbird populations because these two species rely on understory and ground cover habitat. On the other hand, cerulean warbler populations increase because these birds prefer living in forests with old trees and an open understory.

Patterns on Willis Island

The bird populations are primarily affected by changes in the number of predators, in this case the red-tailed hawks. The number of acorns produced varies a lot each year. In years when there are a lot of acorns, the small mammal population increases dramatically. In years after the small mammal population has been high one of their predators, the red-tailed hawk population, will go up. When the red-tailed hawk population is high (1995 and 2020), the population of songbirds will be low.

Public Health Intern

Disease Risk
- The Lyme disease risk is primarily tied to the number of deer ticks present on each island in each time period. Deer tick populations and whether they carry the Lyme disease bacterium are most strongly affected by the number of small mammals on the island.

Tick Life Cycle
- Deer tick life cycles take two years to complete. During the first year, the young ticks feed for a few days on a warm-blooded host. They detach from the host, molt, and search for another host. The tick will use three different hosts in its lifetime! The host for the larval or nymph stages is often a small mammal while the adult host is often a larger mammal like a deer or human. While deer and small mammals are both important hosts for the deer tick, the small mammals can serve as a reservoir for the bacteria that causes Lyme disease, while deer cannot.

Small Mammals
- The small mammal populations on the islands are primarily affected by the availability of food. Small mammals use many food sources, but the populations of small mammals tend to increase when there is an abundant supply of acorns.

Population Specialist - 1

Patterns of Changes:
- Deer populations on the two islands demonstrate different patterns of change: growth of a population without predators, and growth of a population of a predator and its prey.

Deer on Dover Island
- The deer population on Dover Island grows to reach its carrying capacity. Deer were introduced to the island in the early 1970s. Since then, the growth of the deer population has been restricted only by the food resources on the island. The deer population grows very quickly in the early years of the scenario and then growth slows as the population reaches its carrying capacity.

Deer and Wolves on Willis Island
- The deer population on Willis Island is kept in check by a population of wolves that also lives on the island. This is called a predator-prey cycle.

Population Specialist - 2

Vegetation on Dover

- Deer browsing on their prefered foods leads to a dramatic shift in the dominant tree species in the forest on Dover Island over time. Deer food preferences are covered in the botany section. The island starts with a mix of hemlock, maple, oak and beech, and by 2020 the forest community is dominated by beech trees with very little shrub or ground cover species diversity.

Vegetation on Willis

- In years when the deer population is highest, the effects of deer browsing show in the decrease of trillium and shrubs, but those populations return when the deer population decreases again. Generally, the deer population does not get high enough or for long enough to have a major effect on the trees populations on Willis.

Botanist - 1

Deer Browsing
- Deer browsing has a strong effect on the vegetation on the islands. Deer eating their prefered foods leads to a dramatic shift in the dominant plants and trees on Dover Island. The island starts with a mix of many species of plants, but since deer prefer to eat saplings of trees such as hemlock, and by 2020 the forest is dominated by beech trees with very little shrub or ground cover species diversity.

Forest Structure
- The forest can be thought of as composed of different layers. Different species are dominant in different layers and these layers provide different habitat characteristics that are used by different organisms.

Tree Population Dynamics
- While trees may seem static, students should recognize that there are a number of ways in which trees vary from year to year:
  - The number of seeds that a tree produces in a single year can vary, and this variation can have strong effects on other components of the ecosystem (e.g. acorns affect small mammal populations and Lyme disease risk).
  - Also, the Tree Ring Tool demonstrates that trees grow different amounts in different years. Tree rings can be used as a clue about the abiotic and biotic conditions in the environment surrounding the tree.

Botanist - 2

Plant Characteristics
- Differences in the population dynamics of different plant species can help students notice that some of these differences are caused by the unique life history traits of different organisms:
  - For example, trillium are relatively fast growing and edible. These characteristics mean that we can readily see changes (within a few years) in deer browsing by looking for changes in the trillium population.
  - Meanwhile, mature trees are slow growing and only their leaves may be edible. These characteristics mean that we might not detect an effect of deer browsing in the forest until the old trees have died and a new species of tree has grown up in its place – we only see these effects after decades of high deer populations.