Ecosystems: How Do Predator and Prey Populations Interact?

An interaction between a species (predator) that feeds on another species (prey) is called a *predator–prey relationship*. For example, when snowshoe hares are abundant in a given area, the lynx population in the area is well fed and the survival rate of their offspring high. As a result, the lynx population grows as well. As the number of lynx increases, a larger number of snowshoe hares are eaten—resulting in a hare population decrease. As the population of hares decreases, the lynx population begins to decline as well.

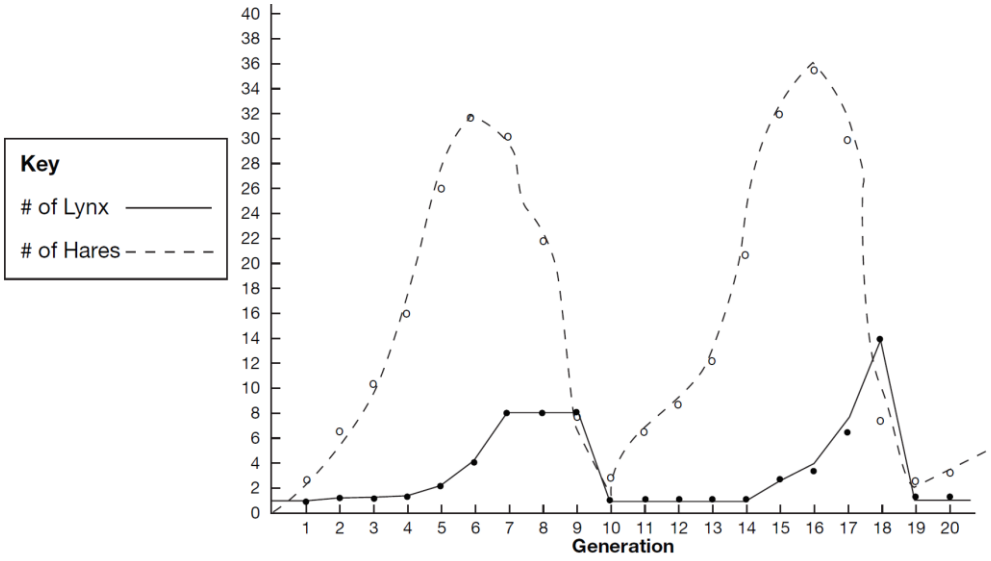
The predator–prey relationship is an example of a *density-dependent limiting factor*. A density-dependent limiting factor affects the population density (number of organisms per a given area) when it reaches a certain level. Other examples of density-dependent limiting factors are competition, parasitism, and disease. As a population grows beyond the maximum population size that a particular environment will support (known as the *carrying capacity*), limiting factors act to reduce the population. The size of the population shrinks, then grows again, and so on. The resulting cycle of population changes may be repeated indefinitely.

In this activity, you will explore inter-dependencies in ecosystems by examining several predator-prey relationships.

Watch Video 1

Observe 1

Based on the data shown in **Video 1** (provided below) what do you think would happen to the hare population if the lynx population became extinct? What would happen to the lynx population if the hare population became extinct?



When the hare population is high, the lynx population begins to grow as well. This causes the hare population to decline. As the hare population declines, so does the lynx population. Thus, it makes sense that if the lynx population became extinct, the hare population would grow very rapidly and would probably reach its carrying capacity and eventually crash. If the hare population became extinct, the lynx population would most likely become decimated as well.

Watch Video 2

Observe 2

How is the situation that **Video 2** describes more complex than the dynamic described in **Video 1**?

The situation described in Video 2 details a three-component relationship. In Video 2, the cheetah population is indirectly impacted by drought because the drought decreases the impala population which in turn leads to a decrease in the cheetah population. The causal chain is longer in Video 2 than in Video 1, which describes a two-component system.

Identify an Experimental Design Flaw

Describe two challenges you think might be associated with studies of predator-prey relationships in complex ecosystems.

One challenge is that these studies likely take many years to yield useful data. Also, it is hard to directly assess the relationship between predator and prey populations in ecosystems where there are other, confounding factors such as drought, disease, etc.

Refine/Expand the Experiment

Describe at least three other factors that may influence the lynx and hare populations.

Some other factors that may influence the lynx and hare populations are hunting, trapping, extreme weather conditions, and disease.

Practice Scientific Reasoning

Consider a home that has an increasing mouse population. In an effort to decrease the mouse population the homeowner brings a cat into the house and also places mouse poison throughout the house. In this scenario, is the homeowner able to determine which is more effective at reducing the mouse population, the poison or the cat? Explain.

It would be difficult to determine which intervention is more effective because decreases in the mouse population could be due to the poison or the cat. In other words, there are two independent variables.

Connect to Your World

Yellowstone National Park is a complex ecosystem with many inter-dependencies. For example, there is a complex dynamic between beavers, wolves, and elk that has been studied for many years. Prior to 1995, there was only one beaver colony in the park. After the reintroduction of grey wolves into the park the number of beaver colonies increased to nine. Why do you think the reintroduction of wolves into Yellowstone influenced the Elk population? How does the Elk population, in turn, exerted an indirect impact on the Beaver population?

Wolves exert predatory pressure on elk. In the absence of wolves, the elk population increases and the large number of elk puts decreases the number of willow trees available to beavers, because the elk are able to spend a lot of time in single locations and browse heavily. The reintroduction of wolves put predatory pressure on the elk and freed up willow trees for beavers. This ecosystem is described in more detail at the following site: https://www.yellowstonepark.com/things-to-do/wolf-reintroduction-changes-ecosystem

Learn More by Exploring These Links

The decades long study of wolves and moose at Isle Royale provides a real-life example of population trends: www.isleroyalewolf.org

At-Home Extension

The following is a link to a card game that you can use to simulate the lynx-hare relationship: https://www.flinnsci.com/products/biology/evolution--ecology/lynx-eats-the-hare-study-kit-and-card-deck/

In School

If you would like to combine this activity with an in-school experience, try the following laboratory kit: https://www.flinnsci.com/habitat-hold-em---super-value-game/fb1805/