

SNC1D/1P Sustainable Ecosystems/ Sustainable Ecosystems and Human Activity

Student Activity: Predators in Control

Topics	Timing
predator and prey keystone species	preparation: 5 min activity: 25 min

Specific Expectations

SNC1D

A1.6 gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams

B3.3 describe the limiting factors of ecosystems (e.g., nutrients, space, water, energy, predators), and explain how these factors affect the carrying capacity of an ecosystem (e.g., the effect of an increase in the moose population on the wolf population in the same ecosystem)

SNC1P

A1.6 gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams

B2.2 investigate the characteristics and interactions of biotic and abiotic components of a terrestrial or aquatic ecosystem, and describe the importance of these components in a sustainable ecosystem [PR, AI, C]

B3.4 identify the major limiting factors of ecosystems (e.g., nutrients, space, water, predators), and explain how these factors are related to the carrying capacity of an ecosystem (e.g., how an increase in the moose population in an ecosystem affects the wolf population in the same ecosystem)

Introduction

Predator–prey relationships are one of the most important biotic relationships in the sustainability of an ecosystem. Predators are the natural controls in an ecosystem, limiting the size of a prey population. Many studies have illustrated that the long-term sustainability of an ecosystem is severely affected if top predators are eliminated. Prey populations increase as a result of the loss of their natural predators and they overgraze the vegetation resulting in ecosystem collapse.

Top predators—including wolves, grizzly bears, sea otters, and alligators—are referred to as keystone species. They are crucial in maintaining and sustaining ecosystem function. For example, on the west coast of Canada the loss of sea otters, a keystone species, has led to an increase in populations of sea urchins and other shellfish which are overgrazing on the underwater kelp forests and destroying the habitat of many different organisms.

This game models the interrelated effects of predator (fox) and prey (rabbit) populations over several generations.

rabbits to reproduce. Soon after that, the increase in the rabbit population slows until it remains stable and then starts to decline. Over many generations, the fox population will increase as the rabbit population increases and then decrease as the rabbit population decreases.

How does it work?

The fox (predator population) needs to have enough prey to survive and reproduce, and therefore the prey population limits the number of predators. Initially the fox is not able to survive and reproduce because the rabbit population is too low. Once the rabbit population has doubled for 3 to 5 generations, there will be enough prey to support some foxes. As the rabbit population continues to increase, more foxes will survive and eventually the rabbit population will decrease due to increased predation. In the generation after the decrease in rabbit population the fox population will decrease because there is less prey. Now with fewer foxes surviving the number of rabbits will again increase, followed by an increase in the fox population. This cycle of increases and then decreases in rabbit and fox populations will continue through the generations.

Teaching Suggestions/Hints

1. You could provide students with wide, shallow boxes in which to play the game.
2. The description of an increase–decrease–increase cycle of rabbit and fox populations (outlined in the “How does it work?” section) does not always occur because of randomness in the tossing of the rabbits and foxes. If there is time, and to produce a better graph, each group could tally their results in a chart on the front board and the average (rabbit and fox) populations for each generation could be used.
3. When students add rabbits to the forest they should be tossed in randomly. When the fox hunts in the forest, however, it should be “smart” in its hunting strategies: it should be thrown carefully in an attempt to catch at least 3 rabbits.

Next Steps

An invasive species could be introduced into generation 8. Its population doubles plus two more each generation and it is not prey for the fox. In addition, for every 5 members of the invasive species, 1 rabbit dies from starvation.

Watch the National Geographic video (see Additional Resources below) and discuss the importance of predators to the overall sustainability of ecosystems.

Additional Resources

1. Strange Days on Planet Earth: a National Geographic video that details the effects on ecosystems when predators are wiped out - <http://www.youtube.com/watch?v=SIXAytRvDQ0>