

Directions: Please read the following text and complete the worksheet called “carrying capacity and population explosions”. Make sure you do not write on this sheet!

The maximum size of a population existing in an ecosystem at any given time without damaging the ecosystem is an ecosystem's **carrying capacity**. When a population grows larger than the carrying capacity of the ecosystem, and it uses up its resources faster than they can be replenished its population reduces. Remember that there are a number of factors that limit the ability of the ecosystem to support a species. In the absence of limiting factors, **population explosions** can occur.

Population explosions frequently occur when a new species is introduced to an ecosystem. The following two situations giving examples of population explosions have occurred due to human activity.

Situation #1: The European rabbit in Australia

When Thomas Austin immigrated to Australia from England, he missed the sport of hunting, so in 1859 he imported two dozen (24) rabbits and released them on his estate. Six years later 10,000 rabbits were destroying his grasslands. Even hired guns could not effectively reduce the population.

By 1995 the estimated population of rabbits in Australia was over 300 million. The rabbits are causing severe environmental damage and they compete with livestock for food. Because they eat plants close to the ground, they prevent the regeneration of native plants. This reduces the food supply available to the native birds and mammals. It also allows the area to be invaded by weeds and increases soil erosion. During the dry season they strip bark from trees. The department of Agriculture estimates the rabbits cost Australian agriculture \$600 million each year.

The European rabbit is one of the most destructive animal pests introduced to Australia. Why are rabbits a problem in Australia but not in England? In England there were both predators and diseases that controlled the rabbit population. When rabbits were introduced in Australia, they readily adapted to the new environment without natural predators or diseases.

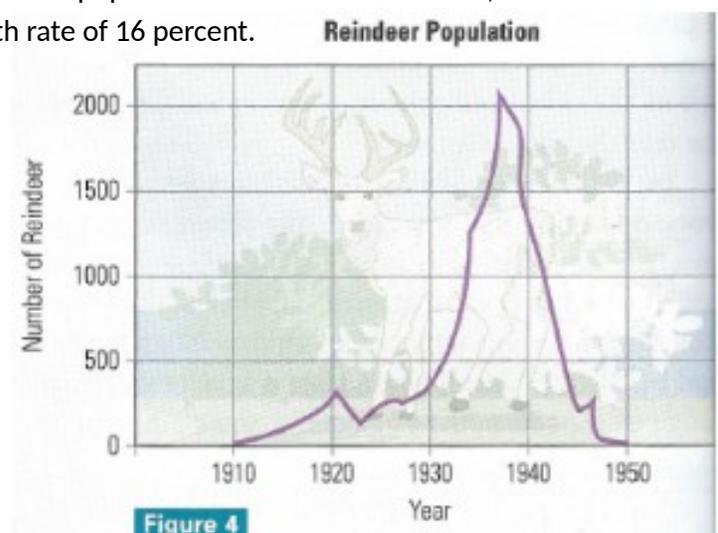
Two viral biological controls have been introduced to help control the rabbit population. Although the death rate from a virus may be initially as high as 90%, the population can quickly recover because surviving rabbits are immune to the virus. Successful control of rabbit populations requires persistent use of a combination of physical and biological control methods.

Situation #2: Reindeer Population on Pribilof Island, Alaska

A spectacular and well-studied example of a population exceeding carrying capacity occurred in the Pribilof Islands off the coast of Alaska in the first half of the twentieth century. In 1911, 26 reindeer (24 females and 2 males) were introduced to Saint Paul Island in an attempt to increase the local food supply for people. The introduction was to replace the native caribou which had been hunted to extinction.

Scientists monitored the size of the introduced population for the next 39 years. The reindeer found the small island very suitable. As you can see in the graph below, the reindeer population soared. There were 2,046 individuals in 1938 – this translates to an average annual growth rate of 16 percent.

The large population quickly over-grazed and trampled the island's food supply of lichens (the multicolored, flaky growths you see on the trees and rocks). Lichens grow slowly in the cold climate of the Pribilofs, so the reindeer's food supply could not recover from overconsumption. Short of food and unable to leave the island, the reindeer starved. By 1950, only eight reindeer were left on Saint Paul Island. The reindeer population did not die out, however. It began to grow again after 1950 and reached a stable size of about 250.



Works Cited

Pearson, J.L. *Environmental Science: How The World Works and Your Place in It*. Edmonton: J.M. LeBel Publishers, 2010.
Nelson. *Science 10* McGraw and Hill, 1985.