

Out of Control: Instructor Guide

Title:

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Discipline:

Biological Sciences

Target Audience

Introductory, majors

Keywords

Communities, ecosystem, interspecific interactions, population dynamics, survivorship curve

Length of Time/Staging

One class period

Abstract

The population of Lesser Snow Geese is growing exponentially in the US and Canada. Growth curves, survivorship curves, and interspecific interactions are considered, as well as the effects of this population on US and Canadian ecosystems.



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Format of Delivery

This is a two page (two-stage) problem. It is designed to be completed in one class period. A slide or two to three minute videoclip of snow geese is shown when students arrive in class, then they are given page one. As each group completes page one, those students can move on to page two.

Student Learning Objectives

1. Population dynamics - growth curve of an exponentially growing population
2. Effect of carrying capacity
3. Survivorship curves
4. Examples of interspecific relationships in communities
5. Differences in ecosystems of different biomes (tundra versus cultivated grasslands in US)

Student Resources

Students will use their text (a text for biology majors), as well as their notes. In addition, students could be given the assignment (before problem day) to search for information about snow geese on the internet, or from other sources.

Instructor Resources

1. Drew, L. & Madson, C. (1997). Out of control! Exploding numbers of snow geese are bad news for Midwest farmers and an entire Far North ecosystem. *National Wildlife*, 35(1), 26.
2. Krajick, K. (1997). Rise of the snow geese: Thriving snow geese are destroying Canadian tundra and creating a dilemma for wildlife biologists. *Audubon*, 99(3), 70.
3. Rockwell, R., Abraham, K., & Jeffries, R. (1996). Tundra under siege. *Natural History*, 105(11), 20.
4. [Environment Canada](#)
 - a. [Lesser Snow Geese](#)
 - b. [Overabundant Snow Goose Populations](#)
 - c. [Arctic Habitats Threatened by Snow Geese](#)
5. Search for resources on ecosystems in the Pacific and Yukon region
 - a. Environmental Indicator - Lesser Snow Geese
6. [U.S. Fish and Wildlife Service](#)



- a. [Snow Geese](#)
- 7. [International Goose Research Group](#)
 - a. [GooseRef Bibliography System](#)

Author's Teaching Notes

My course is a combination of lecturing and problem analysis by groups. This problem, the first graded one of the semester, is used after 2 lectures have been given—one on populations, and one on communities.

To implement the problem, peer facilitators may be used. Otherwise, a brief discussion can be held after selected questions. I usually have the students work on this problem for the whole period. If a group is finishing early, we break out for a discussion. If not, we discuss the problem at the next class period, and summarize the principles of ecology that it illustrated. I then usually distribute a newspaper article about the snow geese problem in the US.

Assessment Strategies

Students, as groups, are required to answer questions in the problem. These must be turned in at end of class (one set of answers per group). I will read them, grade them, and then return and discuss them at the next class. One or more questions related to the problem will be used on the next exam.

Solution Notes

For question one, students should consider different ways to estimate the size of a population like this one. They may consider counting the number of actual geese in randomly selected areas, counting the nests, or determining numbers by the amount of bird droppings.

Question two is addressed by comments on page two of the problem.

The next few questions (three and four) should be answered by considering logarithmic (exponential) growth of a population and what the growth curve looks like. The carrying capacity (K) in early 1900s, when geese were restricted to marshes around gulf, probably limited growth, but K increased with agriculture providing additional food. The death rate decreased with hunting restrictions imposed. With K raised, females probably had enough resources for successful reproduction, and with d decreased, growth may have gotten closer to r max. Since goslings can walk far, K is not limiting (yet) in summer feeding grounds. If they could not walk, then K of the salt marshes would limit growth of the population.

For question five, students should discuss what combination of survivorship curves these geese display. (50% die in first few weeks, then ~30% each year thereafter). Students must be sure to understand difference between what a survivorship curve shows and what a growth curve shows.

For interspecific relationships, students should include herbivory in both summer and winter feeding grounds (a +/- relationship), competition with other birds for food and nesting sites in summer feeding grounds (this is a -/- relationship), and amensalism (for example, birds trampling on grass, a 0/- relationship).

For questions about effect on ecosystems, students should discuss the relative effects on the winter feeding grounds (farms) versus the summer feeding grounds (salt marshes and tundra). They will have to consider the characteristics of the tundra biome and its ability to recover from disturbance. They will probably discuss the impact of human activities in throwing an ecosystem out of balance. In considering the grazing by cattle versus the "grazing" by geese, students should think about the result of geese eating roots and rhizomes compared to cattle eating the leaves of grass.

For solutions to the goose population explosion, students might consider relaxing the hunting restrictions in the US and collecting goose eggs in Canada.