Population Growth Limits

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Learning Objectives

- Give examples of limiting factors to population growth.
- Explain how limiting factors affect population growth.

What happened during the Irish Potato Famine?

In the 1800s, a disease called potato blight destroyed much of the potato crop in Ireland. Since many Irish people depended on potatoes as their staple food, mass starvation and emigration resulted. This caused Ireland’s population to dramatically decrease. Lack of food is one factor that can limit population growth.
Limiting Factors to Population Growth

For a population to be healthy, factors such as food, nutrients, water and space, must be available. What happens when there are not resources to support the population? Limiting factors are resources or other factors in the environment that can lower the population growth rate. Limiting factors include a low food supply and lack of space. Limiting factors can lower birth rates, increase death rates, or lead to emigration.

When organisms face limiting factors, they show logistic growth (S-shaped curve, curve B: Figure 1.1). Competition for resources like food and space cause the growth rate to stop increasing, so the population levels off. This flat upper line on a growth curve is the carrying capacity. The carrying capacity (K) is the maximum population size that can be supported in a particular area without destroying the habitat. Limiting factors determine the carrying capacity of a population. Recall that when there are no limiting factors, the population grows exponentially. In exponential growth (J-shaped curve, curve A: Figure 1.1), as the population size increases, the growth rate also increases.

Food Supply as Limiting Factor

If there are 12 hamburgers at a lunch table and 24 people sit down at a lunch table, will everyone be able to eat? At first, maybe you will split hamburgers in half, but if more and more people keep coming to sit at the lunch table, you will not be able to feed everyone. This is what happens in nature. But in nature, organisms that cannot get food will die or find a new place to live. It is possible for any resource to be a limiting factor, however, a resource such as food can have dramatic consequences on a population.

In nature, when the population size is small, there is usually plenty of food and other resources for each individual. When there is plenty of food and other resources, organisms can easily reproduce, so the birth rate is high. As the population increases, the food supply, or the supply of another necessary resource, may decrease. When necessary resources, such as food, decrease, some individuals will die. Overall, the population cannot reproduce at the same rate, so the birth rates drop. This will cause the population growth rate to decrease.

When the population decreases to a certain level where every individual can get enough food and other resources, and the birth and death rates become stable, the population has leveled off at its carrying capacity.
Other Limiting Factors

Other limiting factors include light, water, nutrients or minerals, oxygen, the ability of an ecosystem to recycle nutrients and/or waste, disease and/or parasites, temperature, space, and predation. Can you think of some other factors that limit populations?

Weather can also be a limiting factor. Whereas most plants like rain, an individual cactus-like Agave americana plant actually likes to grow when it is dry. Rainfall limits reproduction of this plant which, in turn, limits growth rate. Can you think of some other factors like this?

Human activities can also limit the growth of populations. Such activities include use of pesticides, such as DDT, use of herbicides, and habitat destruction.

Summary

- Limiting factors, or things in the environment that can lower the population growth rate, include low food supply and lack of space.
- When organisms face limiting factors, they show logistic type of growth (S-curve).

Explore More

Use the resource below to answer the questions that follow.

- **Biotic Potential** at [http://www.youtube.com/watch?v=BSVbdaubxxg](http://www.youtube.com/watch?v=BSVbdaubxxg) (2:58)

1. What type of growth is characterized by a consistent increase in growth rate? How often is this type of growth actually seen in nature?
2. What factors keep populations from reaching their carrying capacity?
3. How do you think the length of an organism’s life span will affect the species’ ability to reach carrying capacity?
4. What would the growth equation look like for sessile populations (i.e. populations where individuals are fixed in space)?

Review

1. What is a limiting factor?
2. What are three examples of limiting factors?
3. When organisms face limiting factors, what type of growth do they show?
References

1. Hana Zavadska. Organisms show exponential growth in the absence of limiting factors, while they show logistic growth in the presence of limiting factors. CC BY-NC 3.0