

Limits to Growth

THINK – PAIR – SHARE

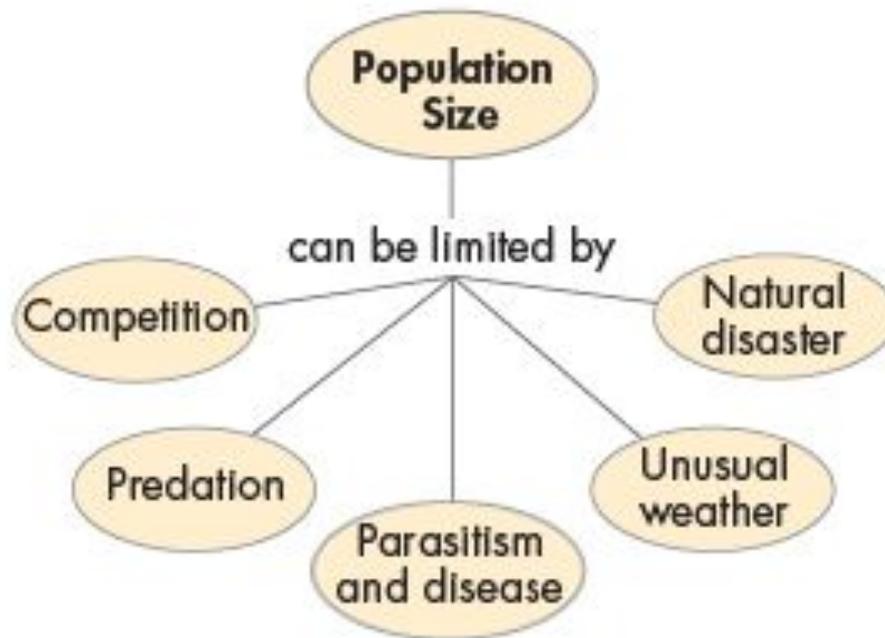
What determines the carrying capacity of an environment for a particular species?



Students, write your response!

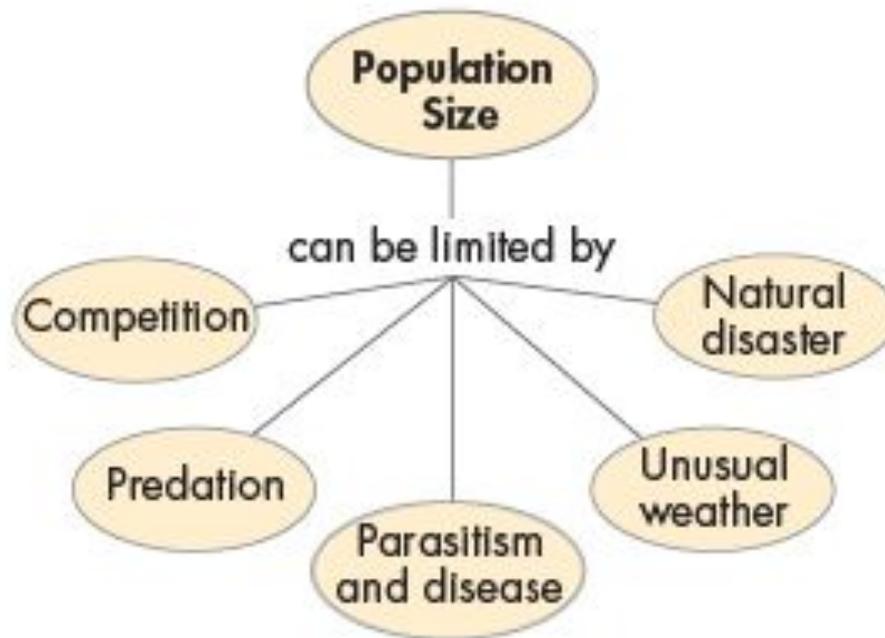
Limiting Factors

A **limiting factor** is a factor that controls the growth of a population.



Limiting Factors

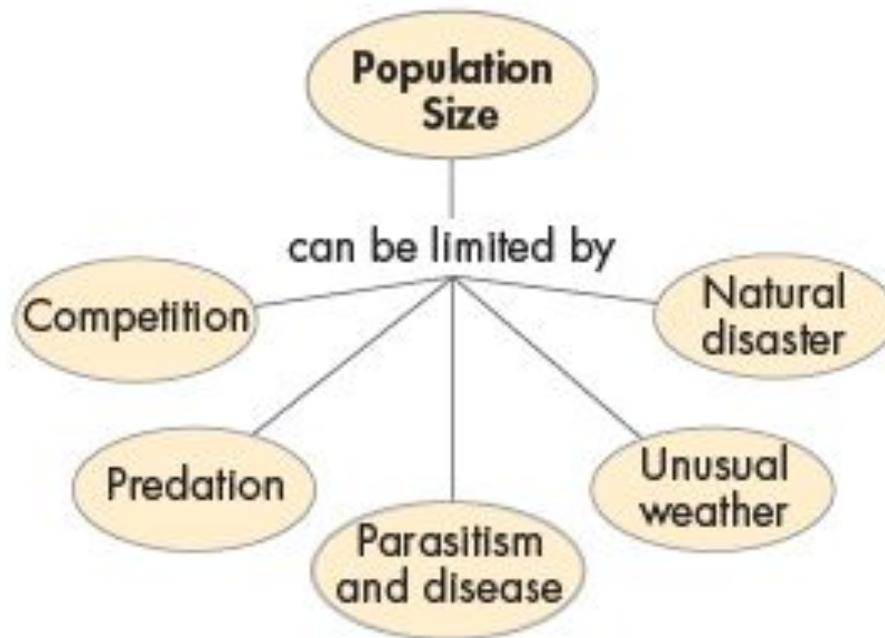
Which of the limiting factors depend on population density?



Students, draw anywhere on this slide!

Limiting Factors

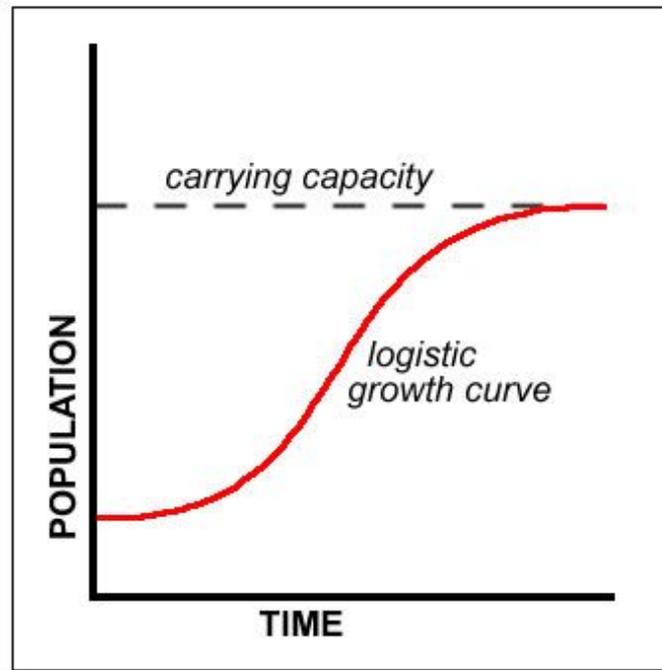
Which of the limiting factors do NOT depend on population density?



Students, draw anywhere on this slide!

Limiting Factors

Acting separately or together, **limiting factors** determine the **carrying capacity** of an environment for a species.

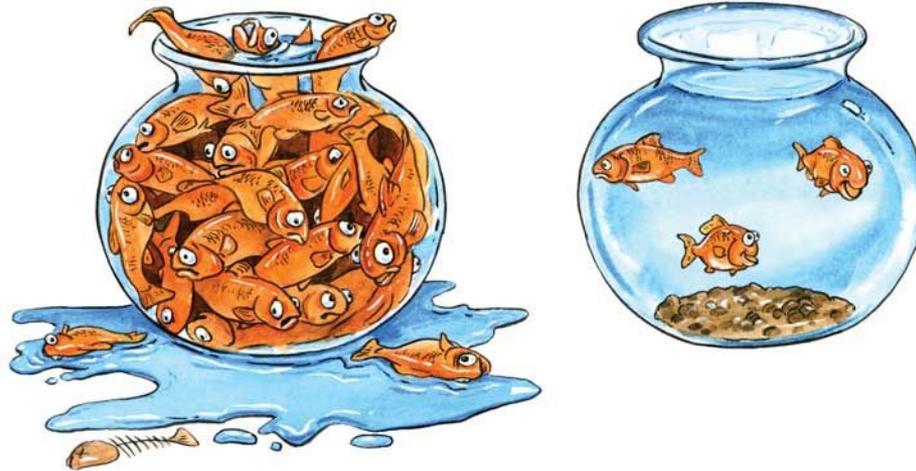


Density-Dependent Limiting Factors

- **Density-dependent limiting factors** operate strongly only when **population density is high**. (When organisms are living close together.)
- Density-dependent limiting factors include:
 - ✓ **Competition**
 - ✓ **Predation**
 - ✓ **Herbivory**
 - ✓ **Parasitism**
 - ✓ **Disease**
 - ✓ **Stress from overcrowding**

Competition

- When populations become crowded, individuals **compete** for food, water, space, sunlight, and other essentials.



Competition

- How can competition affect the birth rate of a population?



Students, write your response!

Competition

If competition results in individuals not obtaining enough resources to reproduce, **the birth rate of the population may decrease.**

Competition

- How can competition affect the death rate of a population?



Students, write your response!

Competition

If individuals cannot obtain enough resources to survive, **the death rate may increase.**

Competition

- How can competition affect the rates of immigration and emigration?



Students, write your response!

Competition

If there is not much competition for the resources in an ecosystem, individuals from other ecosystems may move in, **increasing immigration rate.**

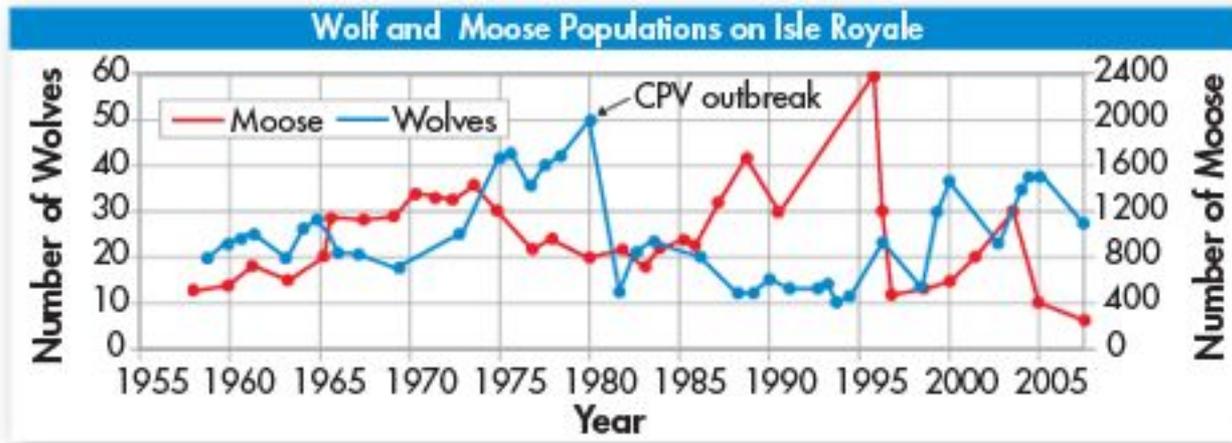
If competition for resources is severe, individuals will seek other ecosystems in which to live, **increasing the emigration rate.**

Predation and Herbivory

- The effects of **predators on prey** and the effects of **herbivores on plants** are two very important **density-dependent** population controls.

Predator-Prey Relationships

- This graph shows the fluctuations in wolf and moose populations on Isle Royale over the years.



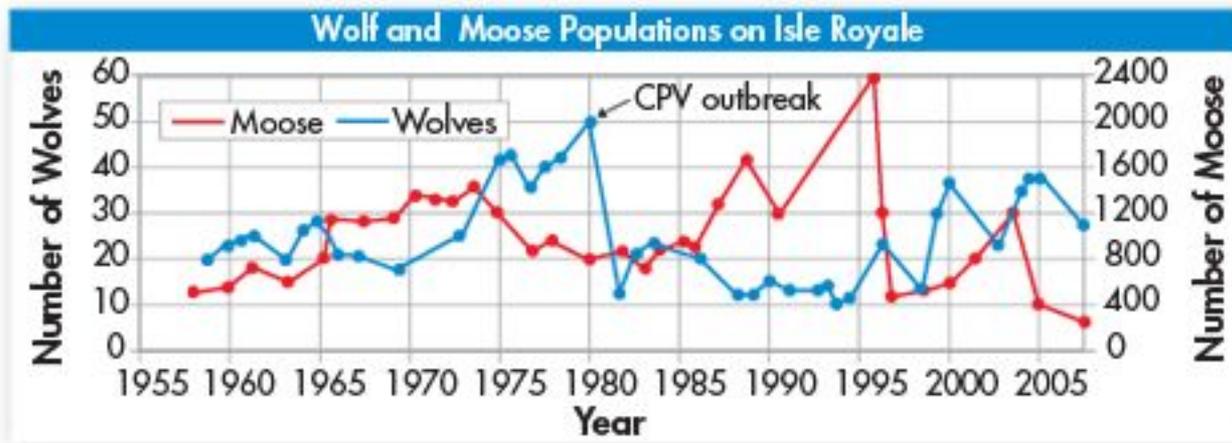
What general trends are shown in this graph?



Students, write your response!

Predator-Prey Relationships

What factors other than the predator-prey relationship affected the size of these populations during the time period represented in the graph?



Students, write your response!

Herbivore Effects

- Herbivory can contribute to changes in population numbers.
- From a plant's perspective, **herbivores are predators.**



Humans as Predators

- Human activity also **limits populations**.



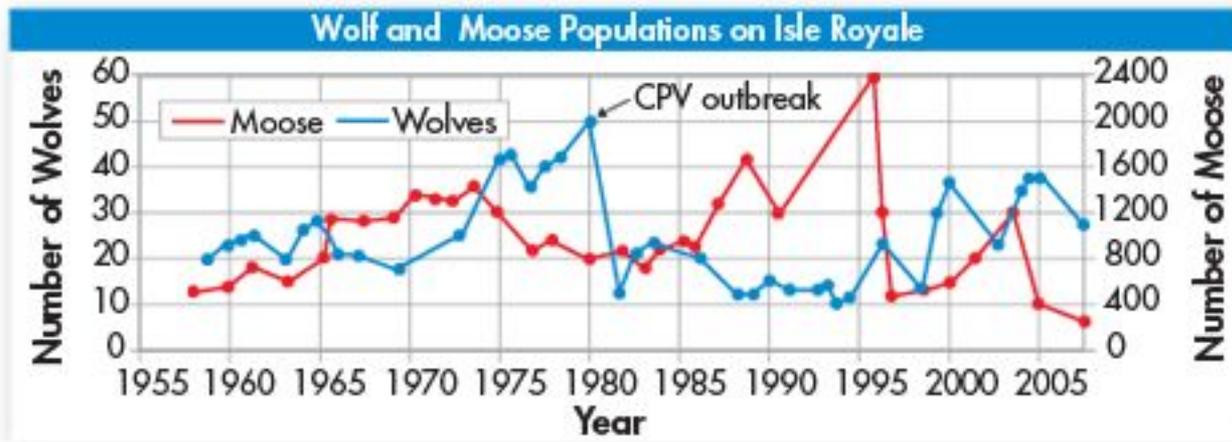
Parasitism and Disease

- Parasitism and disease are **density-dependent factors**, because the **denser** the host population, the **more easily** parasites can spread from one host to another.



Parasitism and Disease

- Canine parvovirus (CPV) Outbreak



Density-Independent Limiting Factors

- **Density-independent limiting factors** affect all populations in similar ways, **regardless** of population size and density.
- Density-independent limiting factors **decrease** the size of populations.

Density-Independent Limiting Factors

- Identify a density-independent limiting factor



Students, write your response!

Density-Independent Limiting Factors

- Density-independent limiting factors include:
 - ✓ **Weather**
 - hurricanes
 - droughts
 - floods
 - ✓ **Natural disasters**
 - wildfires
 - mudslides
 - avalanche

Population Limiting Factors

Density-Dependent

Density-Independent

Examples

Competition

Predation

Herbivory

Parasitism

Disease

Stress from Overcrowding

Weather

Natural Disasters

Examples

Examples

Hurricane

Drought

Flood

Wildfire

Mudslide

Avalanche