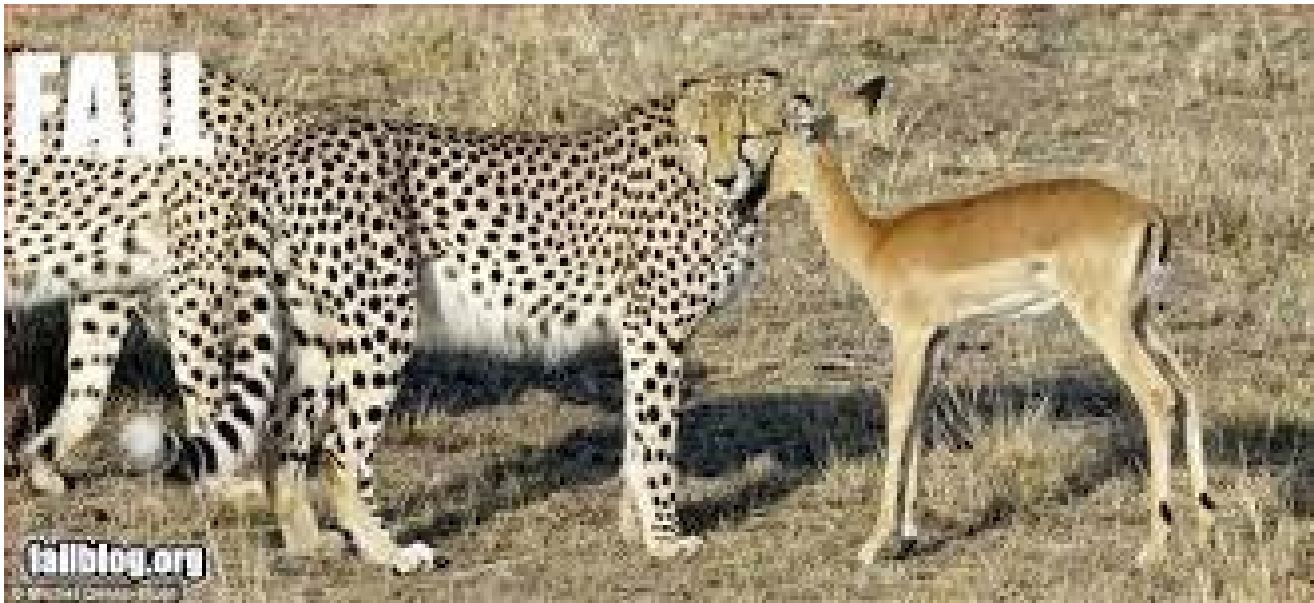


Factors Affecting Populations



S2-1-05 Investigate and discuss various limiting factors that influence population dynamics. *Include: density dependant and density independent factors.*

Factors Affecting Populations

As was discussed during the carrying capacity section, the size of a population **CANNOT** continue to increase indefinitely.

Many **ENVIRONMENTAL** factors **LIMIT** the growth of a population. For example, **RESOURCES** such as **FOOD** and **WATER** will affect the size of a population.

These factors can be broken down into two types:

1. **DENSITY DEPENDENT**
2. **DENSITY INDEPENDENT**

Here density refers to the size of a population in a certain area:

Example:

Japan has a very dense population compared to Canada:

Country	Population	Area (sq mi)
Japan	126,475,664	145,882
Canada	34,030,589	3,855,081

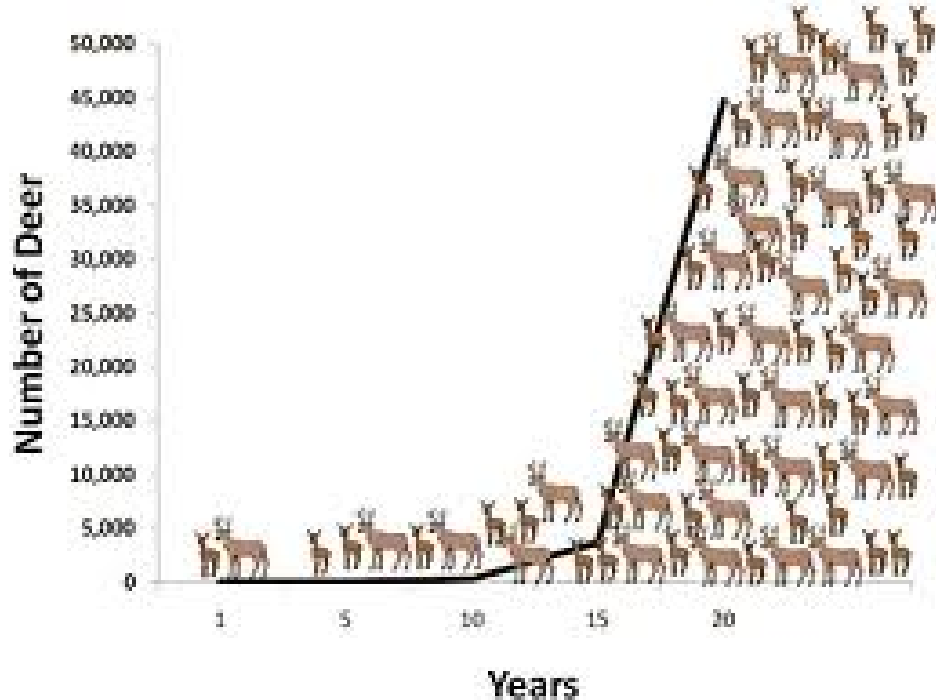
Density-Dependent Factors

Are factors that effect a POPULATION when it is LARGE and CROWDED.

If the population DENSITY of a species becomes TOO HIGH, these factors begin to LIMIT the population of that species.

These limiting factors include:

- COMPETITION
- PREDATION
- DISEASE
- STRESS



• Density-dependent factors DECREASE the SIZE of a population by INCREASING the DEATH RATE and DECREASING the BIRTH RATE.

Density-Dependent Factors



A. Competition

All living things require certain **RESOURCES** for **SURVIVAL**.

- Animals require **FOOD**, **WATER**, **SHELTER** and **LIVING SPACE**.
- Plants require **WATER**, **SUNLIGHT** and **LIVING SPACE**.

As the size of a population **INCREASES**, the organisms in the population are forced to **COMPETE** to obtain **ENOUGH** resources to **SURVIVE**.

Example: Herd of cattle

- As the number of cows in a pasture **INCREASES**, there may no longer be enough **GRASS** to support all the cattle.
- They will begin to struggle to find enough grass to eat.
- They may begin to lose weight, and some may die of **STARVATION**.

Density-Dependent Factors



B. Predation

PREDATION occurs when one organism (the **PREY**) serves as food for another (the **PREDATOR**).

One **PREDATOR-PREY** relationship in Manitoba is polar bears feeding on seals:

- If a group of seals in an area has had plenty of food, the **SEAL POPULATION** will begin to **INCREASE**.
- Because polar bears prey on seals, the number of **POLAR BEARS** in the area will also **INCREASE** because there is lots of food.
- More polar bears (predators) will eat more seals (prey). So the number of **SEALS** will **DECLINE**.
- With fewer seals to eat the **POLAR BEARS** will begin to starve, and their numbers will begin to **DECLINE**.
- When only a **FEW** polar **BEARS** are left, the **SEALS** have a greater chance of **SURVIVING**, and once again their numbers will begin to **RISE**.

Density-Dependent Factors

C. Disease

When the population is large and crowded, there is **LESS SPACE** between **SPECIES** causing **DISEASES** to be transmitted **FASTER** and more **EASILY**.

Example: Dutch elm disease

- If an elm tree gets infected with the fungus that causes Dutch elm disease, it will eventually die.
- If there are **LOTS** of other elms **NEARBY**, the fungus can easily **SPREAD** and kill more elms.
- If the trees are more widely **SEPARATED**, the disease **CANNOT** spread as easily and as fast.



Density-Dependent Factors

D. Stress

All organisms require a certain amount of LIVING SPACE.

In some animals, OVERCROWDING can lead to INCREASED AGGRESSION and FIGHTS over territory, resulting in INJURIES and STRESS. Adults may be WOUNDED, and their offspring may be NEGLECTED or ORPHANED.

In other animals, stress can cause PREGNANT females to MISCARRY, or STOP producing eggs. In any case, more animals in the populations will die, and their numbers will decrease.



Density-Independent Factors

Density-independent factors affect a population **REGARDLESS** its size.

These limiting factors include:

- **NATURAL** occurrences
- **HUMAN** activity.

Density-dependent factors also act to **DECREASE** the size of a population by **INCREASING** the **DEATH RATE** and **DECREASING** the **BIRTH RATE**.



Density-Independent Factors

A. Natural Occurrences

These are events that occur WITHOUT HUMAN intervention. Usually WEATHER-RELATED events

For example:

- a LIGHTNING STRIKE in a forest can cause a fire that kills most of the plants and animals in an area
- a FROST will wipe out many insects and annual plants
- a winter with HEAVY SNOWFALL may make it difficult for deer to obtain enough grass to survive (conversely, a warm winter with little snowfall may cause deer populations to increase)



Density-Independent Factors

B. Human Activity

Humans can have a significant impact on the populations of other organisms.

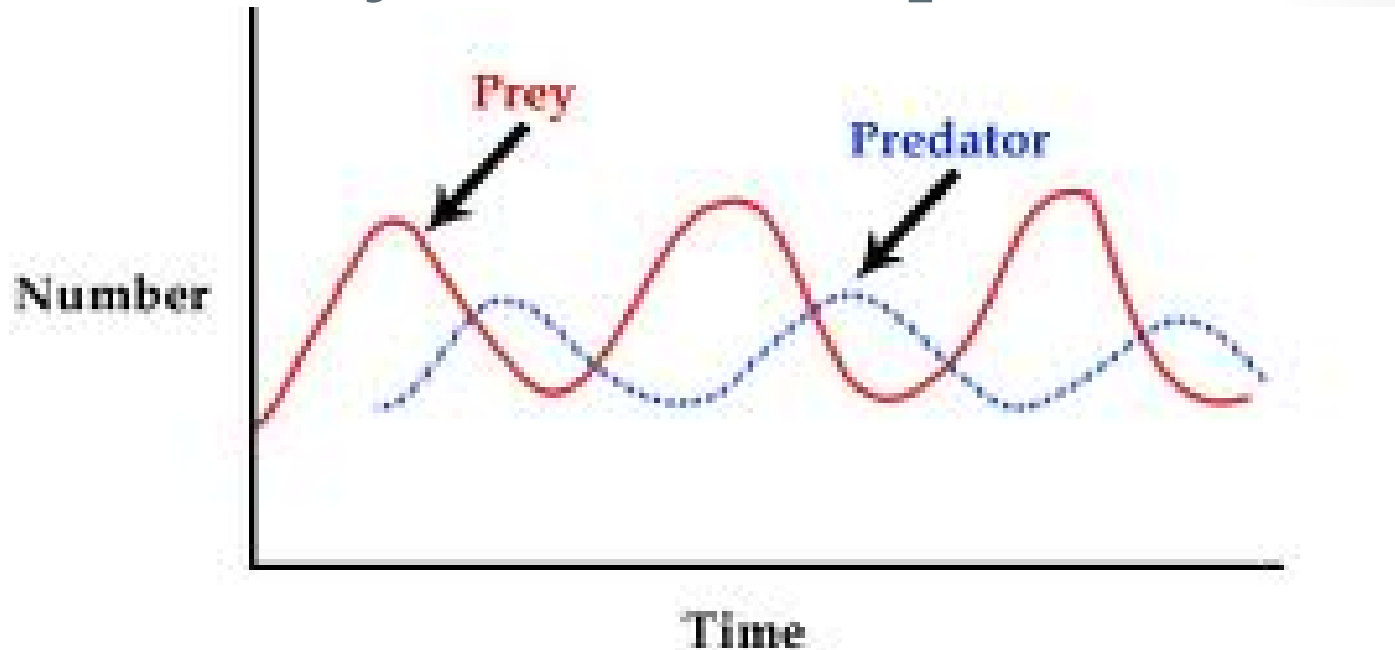
For example:

- a forest may be **CLEAR-CUT**, reducing the number of trees in an area
- marshes may be **DRAINED**, resulting in the loss of habitat for plant, small mammals and birds.
- Areas that were home to a variety of plants and animals may become housing **DEVELOPMENTS** and **SHOPPING MALLS**



On the other hand, human interventions such as **STOCKING** deer and bird **FEEDERS**, and **CONSTRUCTING** nesting boxes may result in higher survival rates.

Predator-Prey Relationships

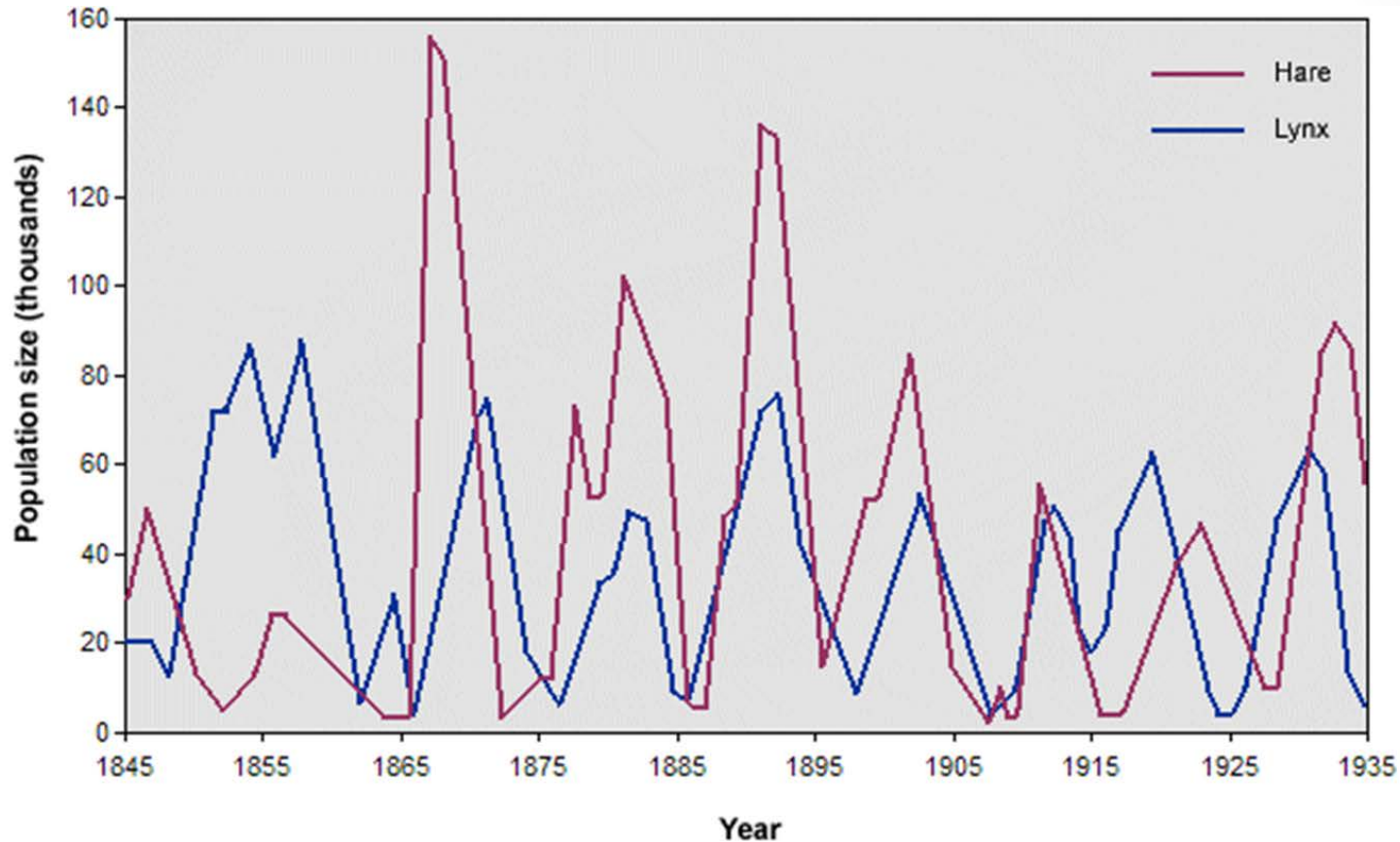


In a nutshell:

- the **PREY** population **INCREASES**, when there are **FEW PREDATORS** and lots of **FOOD**.
- Now the **PREDATOR** has lots of food, so its population will **INCREASE**
- As the predator population **INCREASES**, there is more **PREDATION** and **COMPETITION**, so the prey population **DECREASES**
- now the predators have **LESS** food so their population **DECREASES**
- The **CYCLE** begins to **REPEAT** itself as the prey population now begins to increase with fewer predators to eat them and more food available.

Predator-Prey Relationships

Example: Lynx and Hare



Notice that:

- The **TWO** population curves **FOLLOW** the same **SHAPE**.
- The peaks and valleys of the predator curve trail the peaks and valleys of the prey curve.