Objectives

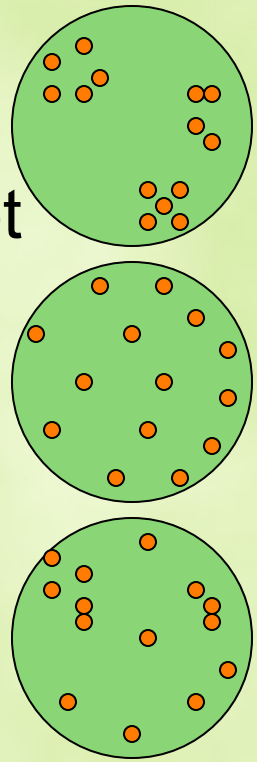
- Understand the terms population density, birth rate, death rate, and carrying capacity.
- Differentiate between density dependent and density independent environmental factors.
- Interpret a population graph.
- Predict changes in the environment based on population changes.

Population Density

- A **Population** is a group of organisms of the same species that shares a habitat.
- **Population density** is a measure of how crowded the population is.
- Population density is calculated by taking the total number of individuals divided by the area or volume of the habitat.\
  - **EXAMPLE:** 30 people per square kilometer.

Dispersion

- **Dispersion** refers to how "spread-out" a population is.
  - **Clumped Dispersion** is where the individuals live very closely to one another and much of the habitat is not used.
  - **Uniform Dispersion** is where the individuals are evenly spread throughout the habitat.
  - **Random Dispersion** is where organisms live randomly throughout an environment.



Population Dynamics

- Populations are dynamic meaning that they are constantly changing.
- To understand how populations change we must understand:
  - **Birth Rate**: The rate at which new individuals are produced.
  - **Death Rate** (or Mortality Rate): The rate at which individuals die.
  - **Life Expectancy**: The amount of time the average individual is expected to live.
  - **NOTE:** To calculate a rate, it is change divided by time.

So What?

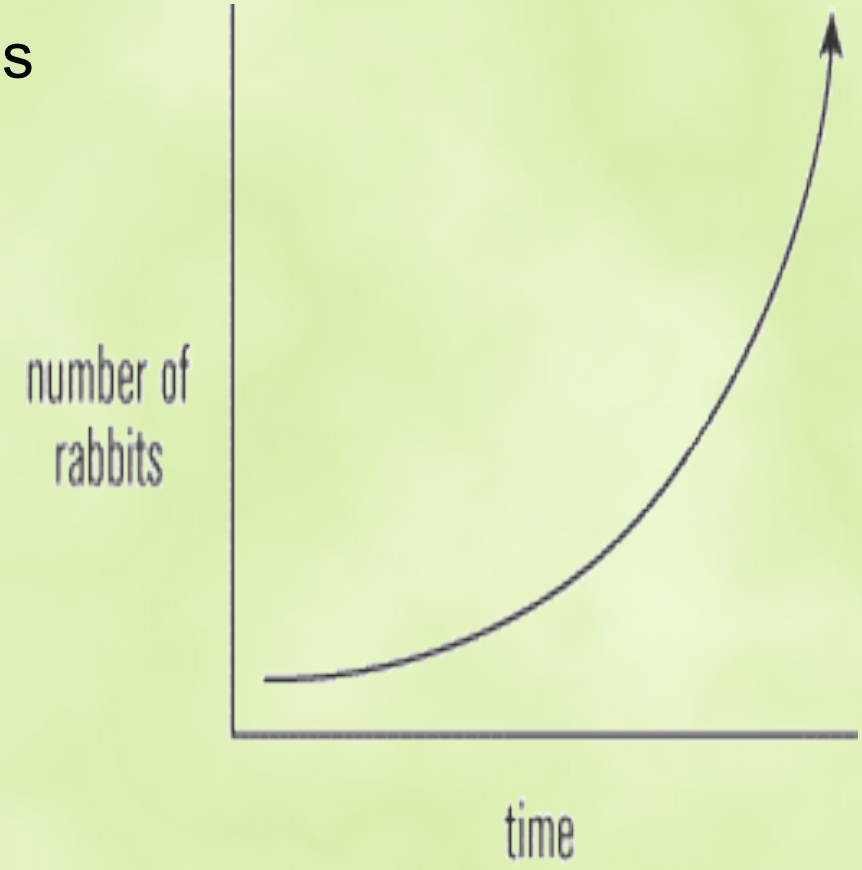
- Why is it important to study birth rates, death rates, and life expectancies of different species?
  - These things are all determined by environmental factors.
  - A sudden increase or decrease in one of these numbers indicates a drastic change in the environment.
    - An increase in the death rate may mean a decrease in food, increase in predators or introduction of some pollution.
    - An increase in the birth rate may mean a decrease in predators or and abundance of food.

Growth Rate

- A population's **growth rate** is how much a population is growing over time.
- There are 4 factors in calculating growth rate:
  - **Birth Rate**
  - **Death Rate**
  - **Emigration**: The movement of individuals OUT of a population.
  - **Immigration:** The movement of individuals INTO a population.

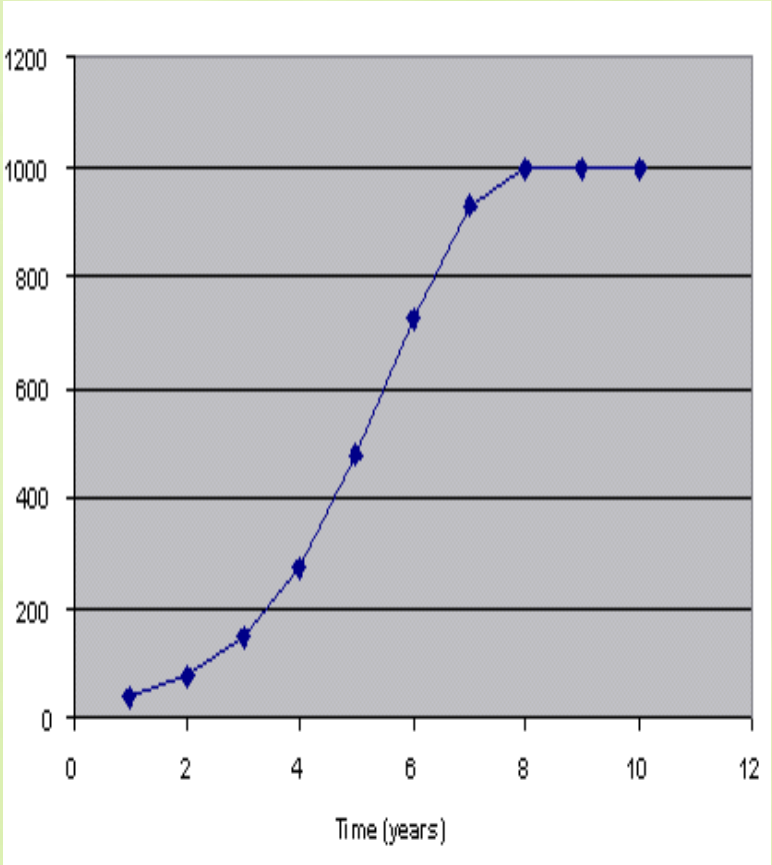
Graphing Growth, Exponential

- If the birth rate exceeds the death rate then populations will grow.
- The **exponential model** indicates a steadily increasing population and when graphed makes a "J-Shaped" curve.



Graphing Growth, Logistic

- There are some factors that limit exponential growth of populations.
- Studying population growth while considering the limiting factors is called the **logistic model**.
- Logistic models produce “S-Shaped” graphs.



Carrying Capacity

- The limiting factors put a cap on how high the population can grow.
- The number of individuals that an environment can sustain over a long period of time is called the **carrying capacity**.
- The carrying capacity is the point on the graph where the second curve occurs.

Limiting Factors

- There are two main types of limiting factors that regulate population growth:
  - **Density-Independent Factors**: These factors affect all populations in an environment equally without concern of population size.
    - EXAMPLES: Weather, flood, fire.
  - **Density-Dependent Factors**: These factors are determined by the current size of the population.
    - EXAMPLES: Amount of food, amount of water, shelter, number or predators.

So What?

- Density-Independent factors have an equal affect on all populations.
  - A fire will destroy trees and animals alike and it is not affected by the number of organisms that are destroyed.
- Density-dependent factors are controlled by the population itself.
  - The bigger a population gets the less room there is to live, the less food there is for everyone else.
  - Graphs can show how populations are interdependent on each other because as the population of prey goes up, the population of the predator goes up because his food source increases.

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