

Human Population Growth

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How is this situation similar to that of humans on Earth?

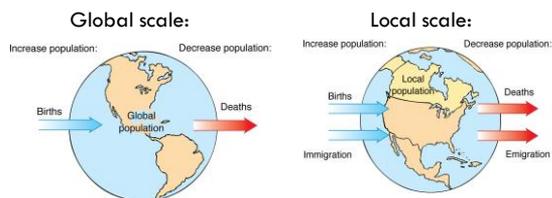
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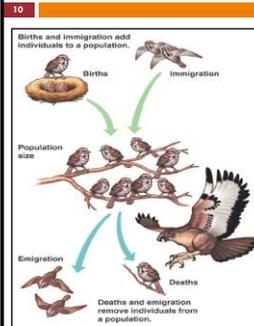
## Population Ecology

- The study of how populations respond to their environments and how they increase or decrease with time is known as population ecology.

## Population Change



## Population Change



4 factors determine how a population changes:

1. Natality (birth rate)
2. Mortality (death rate)
3. Immigration (individuals moving into a population)
4. Emigration (individuals moving out of a population)

## Population Change

- Population change can be calculated as:

$$\text{Birth rate} - \text{death rate} + \text{immigration} - \text{emigration}$$

## Population Change

- Example: In a given year, a herd of free-roaming bison experiences 8 births and 3 deaths. No animals left the herd but 1 animal immigrated.
- Solution:  
Birth rate – death rate + immigration - emigration

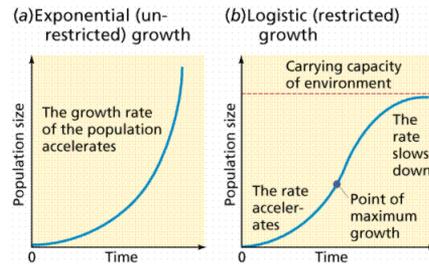
## Population Change

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- Solution:  
 $\text{Birth rate} - \text{death rate} + \text{immigration} - \text{emigration}$   
 $= 8 - 3 + 1 - 0$   
 $= 6$  bison The population grew by 6 bison this year.

## Population Growth Curves

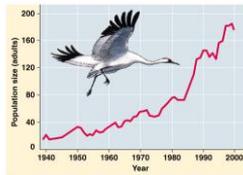
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## (a) Exponential Growth

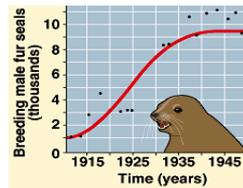
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- describes an idealized population in an unlimited environment
- J shaped curve
- Occurs as long as there is a plentiful supply of the resources it needs



## (a) Logistic Growth

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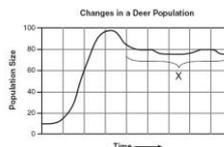
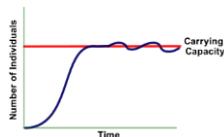


- S shaped curve
- Typically, resources in an ecosystem are limited - no population can grow forever!
- This results in a maximum number of organisms that an ecosystem can support – called the CARRYING CAPACITY.

## Carrying Capacity

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- If the number of organisms in a population is below the ecosystem's carrying capacity, births exceed deaths and the population grows.
- If the number of organisms rises above the carrying capacity, the deaths will exceed the births. This pattern will continue until the population is once again at or under the carrying capacity.



## Lesson Learned ...



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- Real populations grow exponentially for a short period of time and then they stop growing!

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- Real populations grow exponentially for a short period of time and then they stop growing!
- Why? There is a carrying capacity – a maximum number of individuals that the environment can support.

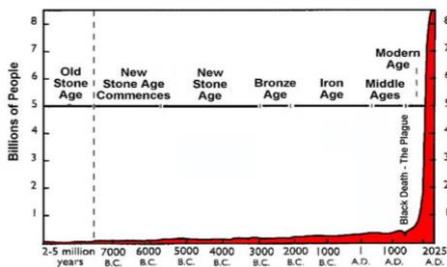
### Human Population

- The size of the human population is at the core of many of Earth's environmental problems.
- Understanding human population change is crucial to devising solutions to these problems.
- The study of human population size, density, distribution, movement, and birth and death rates is called demography.

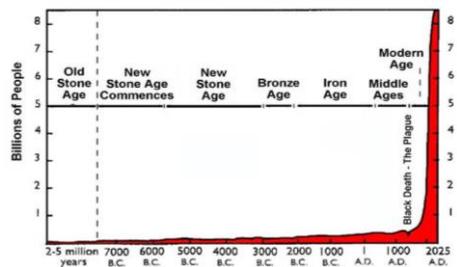
### Human Population

- For thousands of years, the human population has remained relatively stable...until recently!
- In 1804, the population was estimated at 1 billion people. By 1999, we had reached 6 billion.
- As of January 2016, we are at 7.3 billion and are growing by 82 million people each year!

World Population Growth Through History



World Population Growth Through History



There has been more growth in the last 50-100 years than the previous 2 million years that humans have existed.

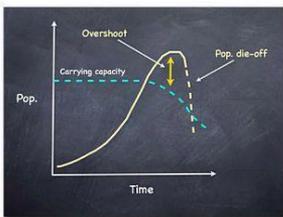
## Human Population

- This exponential increase is NOT due to a rise in natality.
  - The world birth rate has actually declined slightly in the last 200 years.
- The population growth is instead due to a dramatic decrease in mortality!
  - due to greater food production, better medical care, and improvements in water quality and sanitation

## Limits to Human Population Growth

- For Earth, there is an upper limit for population size that the earth can support.
- This carrying capacity limits growth as a result of:
  - the amount of food, water, space, and energy that is needed
  - increased disease
  - climatic variations (i.e. drought, flooding).

## Earth's Carrying Capacity



- 9-10 billion people; based on food availability but scientists don't know or all agree

## Earth's Carrying Capacity

- Humans have learned to alter the environment in ways that appear to have changed its carrying capacity.



## Earth's Carrying Capacity

- Highly developed nations have used technology to raise the carrying capacity of their environments.
  - agriculture and domestication of animals have increased the human food supply
  - technological advances and medicines have improved chance of survival due to death by parasites and disease
  - improvements in shelter have made humans less vulnerable to climatic variation

## Earth's Carrying Capacity



- Many developing nations have reached or exceeded their carrying capacity for their environments.
- An increase in population growth puts stress on environmental life-support systems.

## Result...?

