Ecology: Population

Growth is a feature common to all populations of living organisms.

Outline

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Key Concepts:

1. Natural populations have the potential to grow exponentially.
2. Both density dependent and density independent factors affect population growth.
3. Human population growth has accelerated in the last century.
Population growth

- **Population**: individuals of a given species that occur together at one place and time
- **Population change**: growth rate = births - deaths
- **Exponential growth**: rapid, requires ideal conditions
- **Carrying capacity**: the number of individuals an environment can support

Growth is a feature common to all populations of living organisms. While we have a perception that growth implies an increase, populations may exhibit **positive growth** and grow larger, or... they may show **negative growth** and grow smaller.

Populations may even remain the same size and exhibit what is known as **zero growth**.

Populations which experience positive growth exhibit one of two growth patterns.

**Exponential**:

In exponential growth, the time required to double the size of the population becomes shorter and shorter. When plotted as a graph of numbers vs. time, this produces a characteristic **J-shaped** growth curve.
Exponential Growth

Logistical Growth

Obviously, there is some limit to the growth of a natural population. Some combination of factors which will limit a population’s size.

This set of factors represents the carrying capacity of a given environment and the affects are illustrated with a S-curve.
Limiting Factors on Growth

- Limiting factor
  - Essential resources
    - Food
    - Minerals
    - Water
    - Space
  - Carrying capacity

What contributes to the growth of a population?

Growth is the result of the difference between the number of births and deaths for a population during a given period of time.

Mortality and survivorship

Mortality and survivorship

Population growth rate depends on the ages of the organisms in it

**Mortality:** death rate

**Survivorship:** proportion of an original population that survives to a certain age

**Survival curves:** shapes vary with type of population, number of young, sexual or asexual reproduction, level of care for young
What contributes to the growth of a population?

Also contributing to growth are the new individuals joining the population from Other populations. This is immigration.

Just as immigration can have an impact on the size of a population, so can individuals leaving the population, or emigration.

Population density

Population density (the number of organisms per unit of area) influences its survival.
Regulation of population size

Density-independent limiting factors: soil nutrients, weather, physical features

Density-dependent limiting factors:
- competition for resources
- accumulation of poisonous wastes

Demography

- Statistical study of human populations
  - predicts how population size will change
- Age structure: bar graph
  - shows current composition of population by age and gender
  - can be used to predict future size based on number of females and birth rate

Age Structure Diagram U.S.

http://www.census.gov/ipc/www/idbpyr.html
Exponential increase began in 19th Century: industrial revolution, better nutrition, advances in medicine, etc.
- lowered death rate, increased birth rate
- Carrying capacity has been increased by human technology
- Current increases in population are higher in developing countries
Estimating Earth’s carrying capacity for humans is a complex problem

Predictions of the human population vary from 7.3 to 10.7 billion people by the year 2050.

Will the earth be overpopulated by this time?

http://www.mnsu.edu/emuseum/information/population/
http://www.ibiblio.org/lunarbin/worldpop

Key Terms

- Population density
- Survivorship curve
- Exponential population growth
- Logistic population growth
- Density-dependent factor
- Density-independent factor
- Birth rate
- Death rate
- Age structure
- Demography

In Conclusion

- A population is a group of individuals of the same species occupying a given area
- The growth rate can be determined by calculating the rate of birth, death, immigration, and emigration
- Carrying capacity is the maximum number of individuals in a population that can be sustained in an environment
In Conclusion

- The availability of sustainable resources dictates population size
- Limiting factors such as competition for resources, disease and predation are density-dependent
- Patterns of reproduction, death, and migration vary over the life span for a species

In Conclusion

- The availability of sustainable resources dictates population size
- The human population growth rate varies in various parts of the world
- Rapid growth of human population occurred
- We have the unique opportunity (responsibility?) to decide our fate and the fate of the rest of the biosphere