Populations

Chapter 5
• Vocabulary
  • Carrying capacity
  • Exponential Growth
  • Logistic Growth
  • Density-dependent
  • Density-independent

• Key Concepts
  • How do populations grow?
  • What factors affect population growth?
Background

• There is a balance that must be met in an ecosystem in order to have a stable population

• If a population is too small, then it is hard to find a mate and the gene pool can become unhealthy

• If a population is too large, then resources in the environment will be exhausted.
  • There will be strong competition for resources such as food, water, shelter, and mates
Describing a Population in Nature

• Geographic distribution
  • Description of the area inhabited by a population

• Density
  • Number of individuals per unit of area
  • Varies

• Growth Rate

• Age Structure (demographics)
POPULATION GROWTH

• Definition of population: group of organisms that all belong to the same species & that live in a given area

• population growth is measured by examining three things...
What influences population growth?

1. Number of births (B)
2. Number of deaths (D)
3. Number of individuals entering/leaving the population
   - Immigration (into) (I)
   - EX: Animals in search of food arrive
   - Emigration (out of) (E)
   - EX: Not enough food—animals leave in search

Change in Population Size = (B –D) + (I –E)
Consider this....

• A population of moose had 100 individuals. Over the course of the year, there were 29 births and 34 deaths. Also, 5 moved into the area while 15 left the area. What was the change in the population that year? How many moose are left in the population?
• B = 29 \hspace{1cm} D = 35
• I = 5 \hspace{1cm} E = 15

• Remember the equation \((B-D) + (I-E)\)
• \((29-35) + (5-15) = -6 + -10 = -16\)

• So how much of the original population is left? 
  \[100-16 = 84\] moose

• Did the population increase, decrease, or stayed the same? 
  decreased
What happens to the population size if...

• If more organism are born than die…
  • Population grows
• If birth rate=death rate…
  • Population is stable
• Death rate exceeds birthrate…
  • Population declines
Exponential Growth

- Occurs when there are **ideal conditions, unlimited resources**
  - Lots of food, space
  - Lack of predators, disease
- Population size increases
- Individuals can reproduce at a **constant rate**
• if nothing stops a population from growing, it is undergoing exponential growth
• a natural population cannot continue with exponential growth for long
  • **WHY?** → there are limiting factors to continuous growth such as **space**, **food**, & **competition**
Exponential Growth
Logistic Growth vs. Exponential Growth

- Exponential growth = **J** shaped curve
- Logistic growth = **S** shaped curve
- **Logistic growth occurs when a populations growth stops/slow**s after a **period of exponential growth**
Figure 7: Wisconsin Wolf Population Growth if Carrying Capacity is 500 Wolves
Logistic Growth

- What causes a population growth to stop/slow?
  - Resources
- Each environment has a **carrying capacity** where the population is held steady
  - # of individuals that the environment can support
FACTORS THAT CONTROL POPULATION GROWTH

• natural populations are kept **between** extinction & overpopulation by:
  • competition
  • predation
  • parasitism
  • crowding & stress
• Limiting Factors
  • Biotic and abiotic factors
  • Two types of limiting factors:
    1. Density-dependent factors
      • Limiting factors that have an increasing effect as populations increase
      • Examples: disease, competition, food, parasites
2. Density-independent Factors

- factors that affect populations no matter the size of the population
- examples: temperature, storms, floods, habitat disruption, drought, etc…
HUMAN POPULATION GROWTH

- Demography: study of human population growth characteristics
  - Growth rate
  - Age structure
  - Geographic structure
• Human Population Growth is an exception to what we consider a "natural population"

• the human population, like other populations, has increased over the course of time

• about 500 years ago, the world's population started growing exponentially
  • Sanitation, better health care—increased longevity of people
• as of 2001, the human population is over 6 billion; this is double what it was 40 years ago!!!!
• It took over 10,000 years for human population to increase to 1 billion people

• A little over a century to reach 2 billion

• Only 30 years to reach 3 billion
Since the early 1800’s, the human population on Earth has been growing exponentially.

• The primary cause
  • little to do with an increase in birth rate
  • main cause = *decrease in the death rate*
  • improved medicine, agriculture, and *living conditions*
  • people have begun to live longer and healthier lives
    • they produce more children that are more likely to survive to adulthood
    • produce even more children
• On average, each person in the United States uses over 3 times the amount of the world's resources than a person from another country…think about it, is this fair????
When will the Earth reach its carrying capacity for humans and what will happen when it does?