

I. Ecology

→the study of all relationships among organisms and their abiotic environment

A. Population

1. all the members of a particular species that live together in the same area at the same time

B. Community

1. all the populations of different species living in the same area
2. ecosystem
 - a. a community and its environment

C. Biosphere

1. global ecological system that comprises all the communities on Earth
2. includes interactions among all Earth's communities and the Earth's atmosphere, lithosphere, and hydrosphere

II. Population Ecology

→branch of biology that deals with the number of individuals of a particular species that are found in an area and how and why those numbers change over time

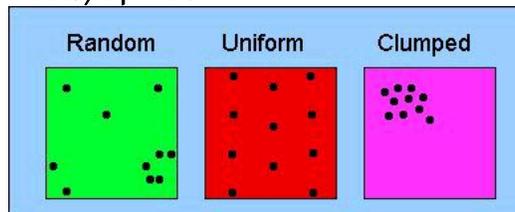
→populations have certain properties, such as birth rates and death rates, that individual organisms lack

A. Population density

1. the number of individuals of a species per unit of area or volume at a given time

B. Population dispersion (spacing) may be:

1. random
 - a. unpredictably spaced
2. clumped
 - a. clustered in specific parts of the habitat
3. uniform
 - a. evenly spaced



C. Population Size-affected by:

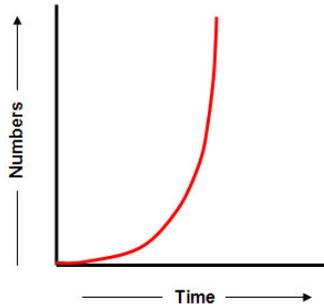
- number of births (b)
- number of deaths (d)
- immigrants (i)
- emigrants (e)
- 1. growth rate (r) of a population
 - a. its rate of change in size
 - b. $r = b - d$ (on a global scale, when migration is not a factor)

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2. populations increase in size as long as
 - a. birth rate (natality) is greater than death rate (mortality)
3. $r = (b - d) + (i - e)$ for a local population (where migration is a factor)

III. Biotic potential

- maximum rate at which a species or population could increase in number under ideal conditions
- exponential population growth
 - some populations exhibit
 - limited period of time
 - J-shaped curve
 - eventually growth rate decreases to around zero or becomes negative



A. Environmental resistance

- i. population size is modified by limits set by the environment

B. Carrying capacity (K) of the environment

- i. the largest population that can be maintained for an indefinite time by a particular environment
 - a. Earth for people-6 to 14 billion?

IV. Logistic population growth

- when graphed, shows an S-shaped curve

A. Initial lag phase

- i. population is small

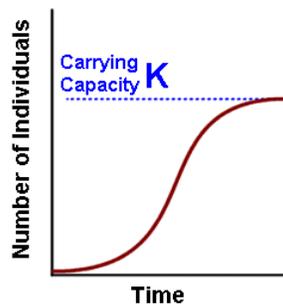
B. Exponential phase

- i. population increases rapidly

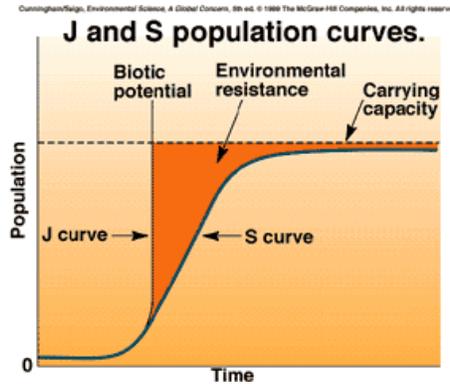
C. Leveling phase

- i. carrying capacity of environment is reached

- seldom do natural populations follow this growth curve



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V. Environmental factors limit population growth

A. Density-dependent factors

1. regulate population growth by affecting a larger proportion of the population as population density rises

a. ex: predation, disease, competition

B. Density-independent factors

1. limit population growth

2. not influenced by changes in population density

3. ex: hurricane, fires

VI. Life History strategies

A. r strategy

1. emphasizes high growth rate

2. organisms

a. small body sizes

b. high reproductive rate

c. short life spans

d. inhabit variable environments



B. K strategy

1. results in maintenance of a population near the carrying capacity of the environment

2. organisms

a. large body sizes

b. low reproductive rates

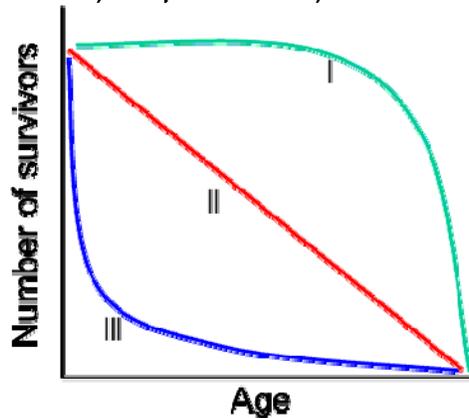
c. long life spans

d. typically inhabit stable environments



C. Survivorship curves

- I. Type I survivorship
 - a. mortality is greatest in old age
 - b. typical of K-selected species
2. Type III survivorship
 - a. mortality is greatest among the young
 - b. typical of r-selected species
3. Type II survivorship
 - a. mortality is spread evenly across all age groups



VII. Principles of population ecology and humans

A. World population

1. 7 billion (carrying capacity: 6 to 14 billion according to models)
2. near extinction 60,000 years ago-2,000 people

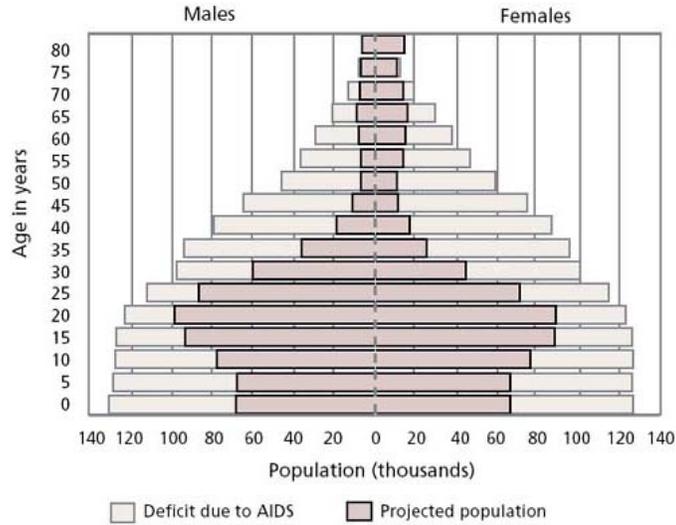
B. increasing by 80 million per year

- I. growth rate has declined
 - a. 1965 – 2% increase (peak)
 - b. 1998 – 1.4% increase

C. Demographers-scientists who study human population statistics

1. project world population will become stationary ($r = 0$) by end of 21st century
2. caveat: must empower women of the third world to take control of their bodies and use birth control
 - a. if don't population will be 11.5 billion in 100 years
3. AIDS
 - a. devastating the African continent
 - b. huge number of orphans
 - c. no parents
 - d. few grandparents
 - e. skewed pyramid

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D. Highly developed countries

1. lowest birth rates
2. lowest infant mortality rates
3. longest life expectancies
4. highest per capita GNPs

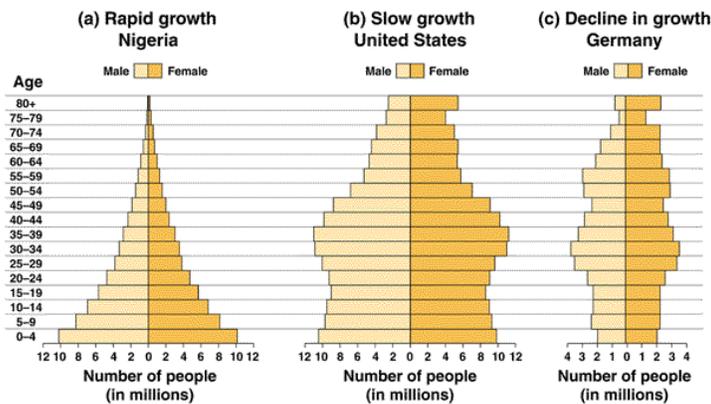
E. Developing countries

1. highest birth rates
2. highest infant mortality rates
3. shortest life expectancies
4. lowest per capita GNPs

F. Age structure

1. population greatly influences population dynamics
2. replacement-level fertility
 - a. still experience population growth, if largest percentage of population is in pre-reproductive years

Raven/Berg, Environment, 3/e
Figure 8.14



Harcourt, Inc.

VIII. Overpopulation

A. People

1. developing countries
2. population degrades environment
 - a. use few resources
 - b. land over-farmed
 - c. waste management
 - i. sewage in the streets

B. Consumption

1. developed countries
2. each individual consumes a large share of resources
 - a. result: environmental degradation
 - b. lots of garbage
 - i. landfills
 - ii. incineration
 - c. disposable societies
 - i. throw everything away