

Population Dynamics Notes:

Book: Chapter 8 and 9

I. Population Dynamics: The changes in a population's size, age distribution, density, dispersion as a result of responding to environmental pressures.

- A. Size: total # of individuals
- B. Density: # of individuals/volume
- C. Dispersion: spatial pattern in a habitat: clumping vs. Uniformly dispersed vs. randomly dispersed
- D. Age Structure: % of population at a particular age.

II. Population Change = Births & Immigration – Deaths & Emigration

- A. Looking at zero population growth
- B. A balance of **biotic potential**: things that favor growth if unlimited resources and **environmental resistance**: limiting factors such as:
 - 1. density dependent variables
 - 2. density independent variable

Both biotic potential and environmental resistance determine the **carrying capacity**: k, the # of individuals in a species that can be supported in a given area.

- 3. Reproduction strategy: r-strategist (bugs) vs. k strategist (humans)
 - a. **R strategist**:
 - 1. many small offspring
 - 2. little or no parental care
 - 3. early reproductive age
 - 4. most offspring die early
 - 5. small adults
 - 6. adapted to unstable climates, environments: generalists
 - 7. high population growth rate
 - 8. population size fluctuates wildly with carrying capacity
 - 9. early successional species
 - 10. low ability to compete....i.e. environ changes can cause populations to crash so main way to survive is massive amounts of offspring.
 - b. **K Strategist**:
 - 1. the reverse of R strategis

4. Survivorship Curve Graph: r, k, constant survivorship

- C. Exponential growth is only if unlimited biotic potential. Really, logistic growth where it maxes out at the carrying capacity
- D. Cycles can be: **stable**: K, **irruptive**: random peaks based on random environmental pressures, **cyclic**: larger booms/busts

III. Conservation Biology

- A. Decrease habitat fragmentation: breaking up a habitat into smaller pieces. Bad because:
 - 1. decrease in habitat
 - 2. increase in density: limit in density dependent variable
 - 3. susceptible to human degradation
 - 4. decrease ability to reproduce because of isolating populations
- B. Increase corridors that lead from one fragmented habitat to another

IV. Human Population

- A. Zero population Growth difficult....even if replacement of slightly higher than 2 kids per parents, population momentum keeps the global growth increasing: large number of individuals entering childbearing age.
- B. Total fertility rate: average number of children/woman.
 - 1. Developing countries: high as 6
 - 2. Developed countries: under 2
 - a. education
 - b. affluence
 - c. importance of children in labor force
 - d. urbanization
- C. Death rate:
 - 1. infant mortality
- D. Age Structure Diagrams
- E. Demographic Transition Graph
 - 1. As country becomes industrialized, death rate declines, then birth rates.
 - a. Pre-industrial: BR and DR high. Little population growth. Ex. Africa, Asia, Latin America
 - b. Transitional stage: begin of industrialization. $BR > DR$. Population grows rapidly. Ex:
 - c. Industrial: BR decreases to almost equal DR. Slow population growth.
 - d. Postindustrial: $BR = DR$ then $BR < DR$. Population slowly decreases.

V. Practice Problems:

- A. A country called San Ramos is tracking population. 1822, population was 800,000 with an annual growth rate of 0.8%. The crude birth rate was 35 per 1000. Immigration was at 5 people per 1000. There was no net emigration. What was the death rate?
- B. On an island called Ramoawaii, the population growth rate was 0.7%. The birth rate was 42/1000 and the death rate was 38/1000. Was there net immigration or emigration? By how much?
- C. Sketch a transitional population graph. Label BR, DR, overall population. Also indicate the four different transitional phases for human populations.
- D. For the graph above, list 4 factors that cause BR and DR to be high in preindustrialized countries. For the graph above, list 4 factors that cause BR and DR to be high in preindustrialized countries. For the graph above, list 3 factors that cause DR to decrease in transitional and industrial countries. For the graph above, list 3 factors that cause BR and DR to be low in postindustrial countries.
- E. List a country for each of the four different demographic phases mentioned above.
- F. If a population has a death rate was 41 per 1000 and a birth rate of 37 per 1000 people, how long will it take for the population to double?
- G. If it takes a country 40 years to double its population, what is its annual growth rate?
- H. If it takes a country 10 years to double its population, what is its annual growth rate?
- I. In 1922 the BR for the country of Ramostan to 37 per 1000 and the death rate to 12 per 1000. The population was 2.5 million. Determine what the population size of this country would be today if it continues to grow at the annual rate established in 1922.
- J. A country called Ramosville is tracking population. 1845, population was 1.2 million, the crude birth rate of 50 per 1000. The death rate was 45 per 1000. In 1870 the population grew rapidly as the BR remained at its 1845 level while the crude DR dropped to 30, 1000. Population growth continued until the late 1800's even though the BR began to decline slowly. In 1885 the BR dropped to 42 and the death rate to 19/1000. In 1885 the population was 2.5 million. By 1950 population growth gradually began to decline as the DR remained at its 1885 level while the BR continued to decline to 22 per 1000. In 1977 stats revealed the DR was 10/1000 and the population growth had slowed to 1.2%. the BR = DR.