Chapter 9: Applying population ecology: The human population and its impact

• What is the history of human population growth, and how many people are likely to be here by 2050?
• How is population size affected by birth, death, fertility, and migration rates?
• How is population size affected by the percentages of males and females at each age level?
• How can we slow population growth?
• What success have India and China had in slowing population growth?
• What are the major impacts of human activities on the world's natural ecosystems?
History of human population growth

- Initially, slow growth
- Last 20 years: exponential growth (J-curve)
  
  > Why?
History of human population growth

- 3 causes for rapid population growth
  > Humans developed ability to expand into diverse new habitats and different climate zones
  > Emergence of early and modern agriculture allowed more people to be fed per unit of land area
  > Developed sanitation systems, antibiotics, and vaccines to help control infectious disease. Resulted in decrease in death rates.
  > * tapped into concentrated sources of energy (fossil fuels)--alter and control nature
History of human population growth

- **Energy allows people to alter and control nature**
  - Fire-cook food, light/heat dwellings, used to stampede animals for hunting
  - Domesticated animals-muscle power to plow fields, transportation
  - Wind-pump water, transportation (ships)
  - Water-transportation (ships), power mills, produce electricity
  - Firewood-engines
  - Coal
  - Oil-internal combustion engine
  - Nuclear energy
History of human population growth

- 10,000 years ago (start agriculture): 5 million
- 1927: 2 billion
- 1974: 4 billion
- 1999: 6 billion
- 2013: 7.1 billion

What is the time in between each addition of 2 billion?
Human population growth today

"Rate" has slowed down but population continues to grow.

Annual World Population Change: 1950-2050

Source: U.S. Census Bureau, International Data Base, June 2011 Update.

World Population Growth Rates: 1950-2050

Source: U.S. Census Bureau, International Data Base, June 2012 Update.

The world population growth rate rose from about 1.5 percent per year from 1950-51 to a peak of over 2 percent in the early 1960s, fueled by reductions in mortality. Growth rates thereafter started to decline due to rising age at marriage as well as increasing availability of effective contraceptive methods. Note that changes in population growth have not always been steady. A dip in the growth rate, for instance, was due to the Great Leap Forward in China. During that time, both natural disasters and decreased agricultural output, as well as massive social reorganization caused China's death rate to rise sharply and its fertility rate to fall by almost half.

http://www.census.gov/population/international/data/worldpop/graph_growthrate.php
Human population growth today

- 1963: Peak growth rate, 69 million people added.
- 2006: 81 million people added
  > Adding 81 million people/year = NYC/month or Germany/year

Source: U.S. Census Bureau, International Data Base, June 2012 Update.

The world population growth rate rose from about 1.5 percent per year from 1950-51 to a peak of over 2 percent in the early 1960s due to reductions in mortality. Growth rates thereafter started to decline due to rising age at marriage as well as increasing availability and use of effective contraceptive methods. A dip in the growth rate from 1959-1960, for instance, was due to the Great Leap Forward in China. By this time, both natural disasters and increased agricultural output in the wake of massive social reorganization caused China’s death rate to rise sharply and its fertility rate to fall by almost half.

http://www.census.gov/population/international/data/worldpop/graph_growthrate.php
Human population growth today

- Difference between growth rates in developed and developing countries.
  - Developing countries growing at much greater rate.
  - 2006: 0.1% in developed countries v. 1.5% in developing

Human population growth today

• Causes of continued population growth:
  > Increasing life expectancy and reducing death rates (medicine, altering habitats for resources)

• Effects of continued population growth:
  > Continuing increase in resource consumption per person
  > Increased environmental degradation with increased human ecological footprint
Projections for world populations

- Carrying capacity for humans on earth?
- Thomas Malthus:
  > Exponential population growth, linear food supply growth?
- Regardless of projections, humans degrading natural capital
- Sustainable population?
  > Optimum sustainable pop. = cultural carrying capacity?
Factors affecting human population sizes:
1. births
2. deaths
3. migration (immigration + emigration)

Population change = entrances - exits
Birth Rate and Death Rate

- **Crude birth rate**: Number of live births per 1,000 people in a population in a given year.

- **Crude death rate**: Number of deaths per 1,000 people in a population in a given year.
World's 10 most populous countries in 2006

- China: 1.3 billion (2006), 1.5 billion (2025)
- India: 1.1 billion (2006), 1.4 billion (2025)
- USA: 300 million (2006), 349 million (2025)
- Indonesia: 225 million (2006), 264 million (2025)
- Brazil: 187 million (2006), 229 million (2025)
- Pakistan: 166 million (2006), 229 million (2025)
- Bangladesh: 147 million (2006), 190 million (2025)
- Russia: 142 million (2006), 130 million (2025)
- Nigeria: 135 million (2006), 199 million (2025)
- Japan: 128 million (2006), 121 million (2025)
Fertility

- **Fertility:** # of children born to a woman during lifetime
- **Replacement-level fertility:** # children couple must bear to replace themselves
  > 2.1-2.5
- **Total fertility rate (TFR):** Average number of children a woman typically has during her reproductive years
  > 2006: 2.7/woman (1.6-2.9) *Still greater than replacement-level
  > 1995: 2.5-6.5
Case Study: US

- Decline in TRF but continued population growth
- In 2006, added 3.0 million people
  > 56% due to births > deaths
  > Rest: Immigration
- Only major developed country with a projected growing population through 2100.
What factors affect the birth rate, death rate, and migration rate?
Factors that affect fertility and birth rates:

1. Importance of children as part of the labor force
2. Cost of raising and educating children
3. Availability of private and public pension systems

*Which factors have the most impact? Which ones can be emphasized or improved to reduce global birth rates?

Factors that affect fertility and birth rates:

1. Importance of children as part of the labor force
2. Cost of raising and educating children
3. Availability of private and public pension systems
4. Urbanization-access to family planning services and lifestyle
5. Education and employment opp. of women

*Which factors have the most impact?
Which ones can be emphasized or improved to reduce global birth rates?
Factors that affect fertility and birth rates:

1. Importance of children as part of the labor force
2. Cost of raising and educating children
3. Availability of private and public pension systems
4. Urbanization-access to family planning services and lifestyle
5. Education and employment opp. of women
6. Infant mortality rate
7. Average age at marriage* (first child)

*Which factors have the most impact? Which ones can be emphasized or improved to reduce global birth rates?
Factors that affect fertility and birth rates:

1. Importance of children as part of the labor force
2. Cost of raising and educating children
3. Availability of private and public pension systems
4. Urbanization-access to family planning services and lifestyle
5. Education and employment opp. of women
6. Infant mortality rate
7. Average age at marriage* (first child)
8. Availability of legal abortions
9. Availability of reliable birth control methods
10. Religious beliefs, traditions, cultural norms

*Which factors have the most impact?
Which ones can be emphasized or improved to reduce global birth rates?
Factors that affect death rates:

1. Increased food and distribution
2. Better nutrition
3. Medical advances (immunizations and antibiotics)
4. Sanitation
5. Safer water supplies

The photo below shows an example of a daily ration that provides the required 2,100 Kilocalories (Kcal) of energy.

Ingredients
- 400g of cereal flour/rice/bulgur
- 60g of pulses
- 25 g of oil (vit. A fortified)
- 50 g of fortified blended foods (Corn Soya Blend)
- 15g of sugar
- 5g of iodized salt

Nutritional value
- Energy 2,100 Kcal
- Protein 58 g
- Fat 43g

http://www.wfp.org/nutrition/WFP-foodbasket
Factors that affect death rates:

• **Life expectancy**: average # of years infant can expect to live
• **Infant mortality rate**: # babies/1000 die before 1st birthday
  > Reflect's society's quality of life: nutrition + health care
  > High rate = under/malnutrition, infectious disease
• Between 1995 and 2006:
  > life expectancy increased from 48 to 67 years (77 in developed, 65 in developing)
  > Infant mortality rate fell from 20 to 6.3 in developed countries, and 118 to 59 in developing countries
• Still, 7.6 million infants die of preventable causes.
Infant Mortality in the United States

• Infant mortality rate declines from 165 (1900) to 6.7 (2006).
  > Still, 46 countries have a lower infant mortality rate.
  > Why is the infant mortality rate in the US still this high?
    – inadequate health care for poor women during pregnancy and for babies
    – drug addiction among pregnant women
    – high birth rate among teenagers
Migration in the United States

• Reasons for migration:
  > Jobs, economic improvements
  > religious persecution, political oppression
  > ethnic conflicts
  > war
  > environmental degradation
• 44% of population growth (legal and illegal immigration)
• Shift in demographics of migrants: Europe to Latin America and Asia

Fig. 9-8, p. 178
Migration in the United States

• Concerns:
  > Stabilizing population
  > Environmental impact of growing population
  > Discrimination if reduce illegal immigration
  > Historic role of US
  > Supply of workers
Why did immigration into the US peak in the 1990s?

- Good economy in US
Population Age Structure

• **Age structure:** Distribution of males and females in each age group in a population
Population Age Structure

- What do these structures tell us?
  - Distribution of ages and sex
  - Potential for population growth
  - Social and economic implications of population age structure
What are some issues with a youthful population?
*Unemployment crisis

May lead to:
• Social unrest
• Terrorism

What are some issues with rapidly growing populations?
• demand for resources
• political tensions
• conflict between new and "old" generation
United States: Baby Boomer generation

- **Baby boomers**: added 79 million people between 1946 and 1964. Today, dominate adults.
- Changing demand for goods/services
- Influence politics (voters!)
- As baby boomers retire, (in 2011, first boomer turns 65), work force shortage
- repercussions on baby-bust generation (supporting an aging population, availability of jobs, promotions)
- Retirement age
Rapid population decline from declining fertility rates

- "baby bust" or "birth death" -> sharp rise of proportion of older people
- Strains on government budget: less revenue, public deficits
- Labor shortage: who supports economy?
- Reduced technological development
- Slow economic growth

- Case study: US
  - To maintain current ratio of workers: retirees-need to absorb 10.8 million immigrants/year through 2050
  - 73% recent immigrants or descendants
Positive effects of aging population: Peace

- fewer young people available for military
- parents more reluctant to lose child to military
- cost of health care and pension reduces budget for military

*Based on medium fertility projection*
Population decline from a rising death rate caused by HIV/AIDS

- Population affected by HIV/AIDS causes very different kinds of changes in population structure than other kinds of death
- Hunger, malnutrition, disease v. HIV/AIDS
- Reduces workforce

- Solution to problem?
  > Education + health care
  > Financial assistance + social workers to replace workforce
Declining population size in Russia

- Historically: Communism, WWII, and then break up of USSR
- Today: longest period of population decline
- Low birth rates
  > abortion
  > short life span of men (59 years) compared to women (72 years): not inclined to have offspring
- High death rates
  > alcohol related deaths (WHO)
  > Shock therapy (economics: privatization of state industries)
  > violence
  > Rise in CVD
Demographic Transition

As countries become industrialized
- Death rates decline
- Birth rates decline
Demographic Transition

- **Preindustrial stage**: Little population growth, high birth and death rate.
- **Transitional**: Industrialization begins. More food, health care.
  > Birth rate high
  > Death rate drops
Demographic Transition

- **Industrial stage**: industrialization, medical advances, modernization
  - Birth rate drops and approaches death rate
  - Population growth is slow, fluctuates with economic conditions
  - Most developed countries
Demographic Transition

- **Postindustrial** (services > goods):
  - birth rate continues to drop
  - reach zero population growth or negative
Demographic Transition

- **Demographic trap** at stage 2:
  - Growing population outstrips economic growth
  - Overwhelms local life-support systems
  - Shortage of skilled workers, lack of financial capital, debts, reduced economic assistance
Reducing population growth by family planning

- **Family planning**: providing educational and clinical services that help couples to choose how many and when to have children.
  - 10% contraceptive use in 1960
  - 51% in 2006
  - Reduced abortions (legal and illegal)
  - Lowered risk of maternal and fetal death from pregnancy
  - Reduce TFR in developing countries from 6 in 1960 to 3 in 2006 (55% drop)
Reducing population growth by family planning

• Issues still remain:
  > 42% pregnancies in developing nations still unplanned, 26% aborted
  > 201 million couples w/o access to family planning services
  > Could prevent 52 million unwanted pregnancies, 22 million abortions, 1.4 million infant deaths, 142,000 pregnancy related deaths

• Other issues:
  > married couples v. unmarried/teenagers
  > birth control for men?
  > pro-life and pro-choice
  > population control v. individual welfare
Empowering Women: Gender equality

• 3 factors lead women to have fewer and healthier children:
  > Education
  > Employment outside of home
  > Living in societies where rights are not suppressed

Understanding gender equality and women's empowerment

Gender equality implies a society in which women and men enjoy the same opportunities, outcomes, rights and obligations in all spheres of life. Equality between men and women exists when both sexes are able to share equally in the distribution of power and influence; have equal opportunities for financial independence through work or through setting up businesses; enjoy equal access to education and the opportunity to develop personal ambitions. A critical aspect of promoting gender equality is the empowerment of women, with a focus on identifying and redressing power imbalances and giving women more autonomy to manage their own lives. Women's empowerment is vital to sustainable development and the realization of human rights for all.

http://www.unfpa.org/gender/empowerment.htm
Empowering Women: Gender equality

• Why does it make sense to empower women?
  > 50% of world population
  > Women can play a vital role in sustainable development
    – 60-80% of work associated with growing food, gathering fuelwood, and hauling water in rural areas of developing countries
  > Education and well-being well correlated
    – Illiteracy can trap women in poverty
  > Choice for when and how many kids.
  > Culturally sensitive approaches to seek results
UN Conference on Population and Development Goals by 2015:

- Develop and implement national population policies.
- Universal access to *family planning* and reproductive care
- *Reduce poverty*
- Better health care and food
- Education especially for women and adults
- Job opportunities for *women*
- Nutrition programs in school (draws girls + children)
- Increased involvement of men in family planning
- reduce unsustainable patterns of production and consumption

*Possible to reach replacement-level fertility with in 1-2 decade but how?*
Using the handout provided, create a venn diagram that compares and contrasts the case studies on China and India.