MILLER/SPOOLMAN

LIVING IN THE ENVIRONMENT

17TH

Chapter 6

The Human Population and Its Impact

Heatbeat; World Population Clock; Population Growth Rates

- Heartbeat
- World Population Clock
- World Bank Population Growth Rates

Five Most Populous Countries, 2010 and 2050

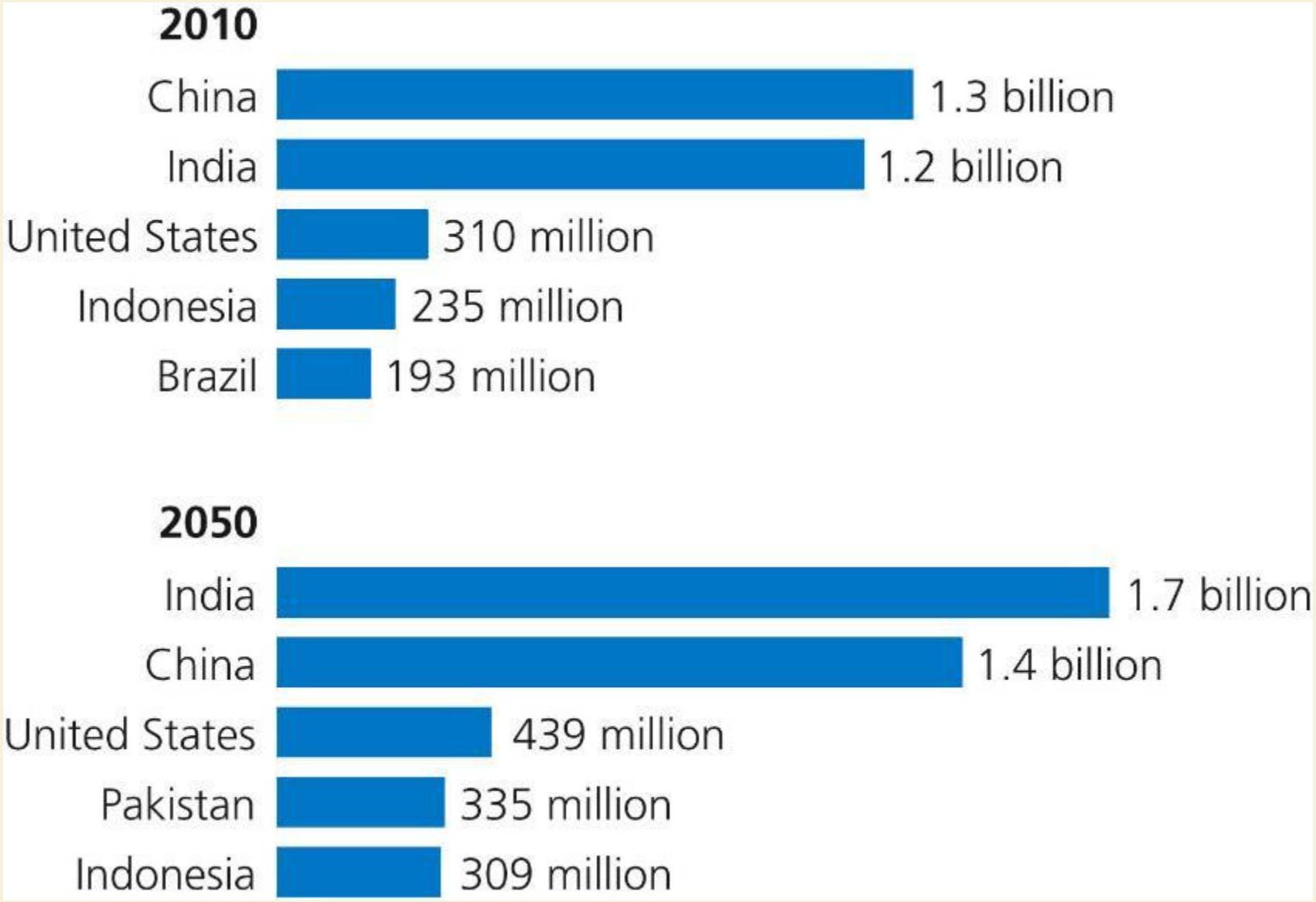
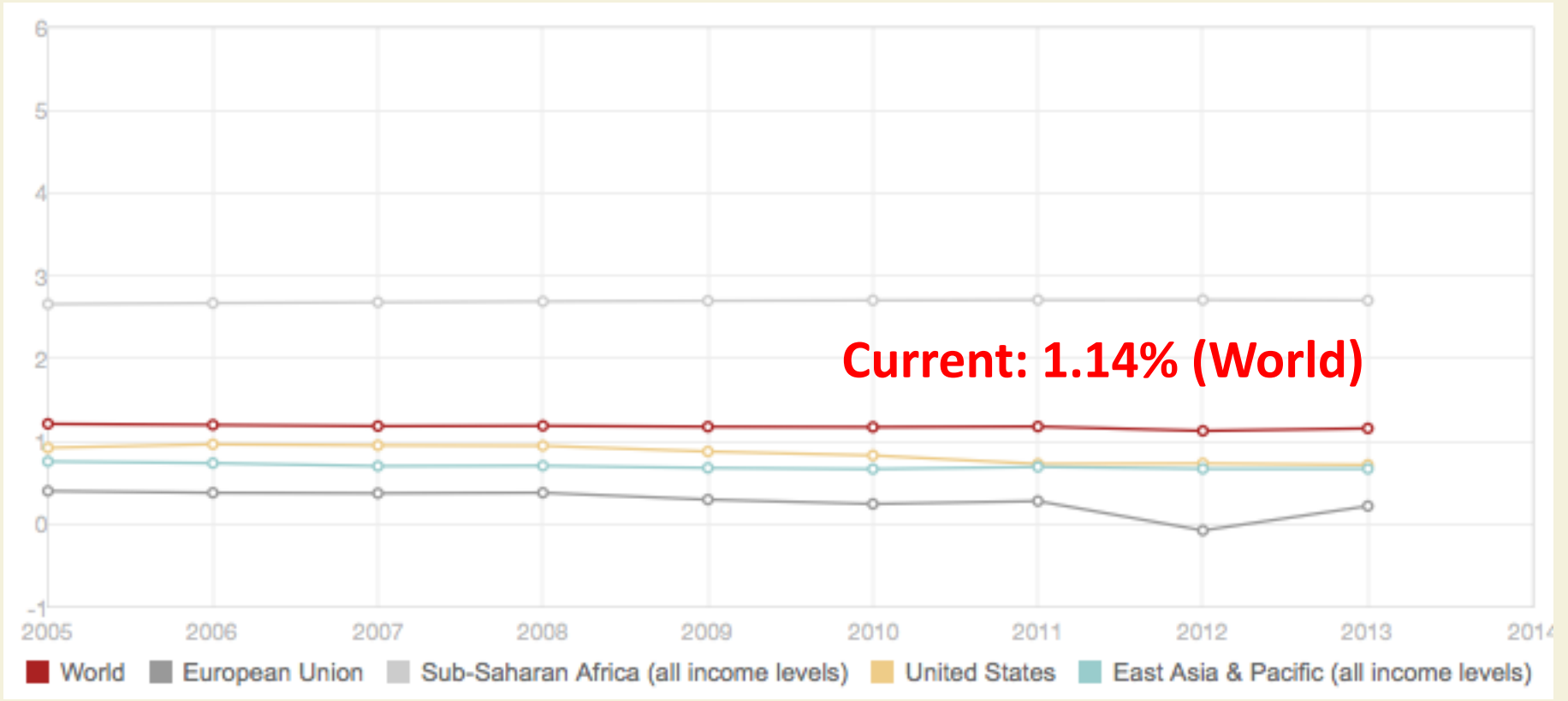


Fig. 6-4, p. 127

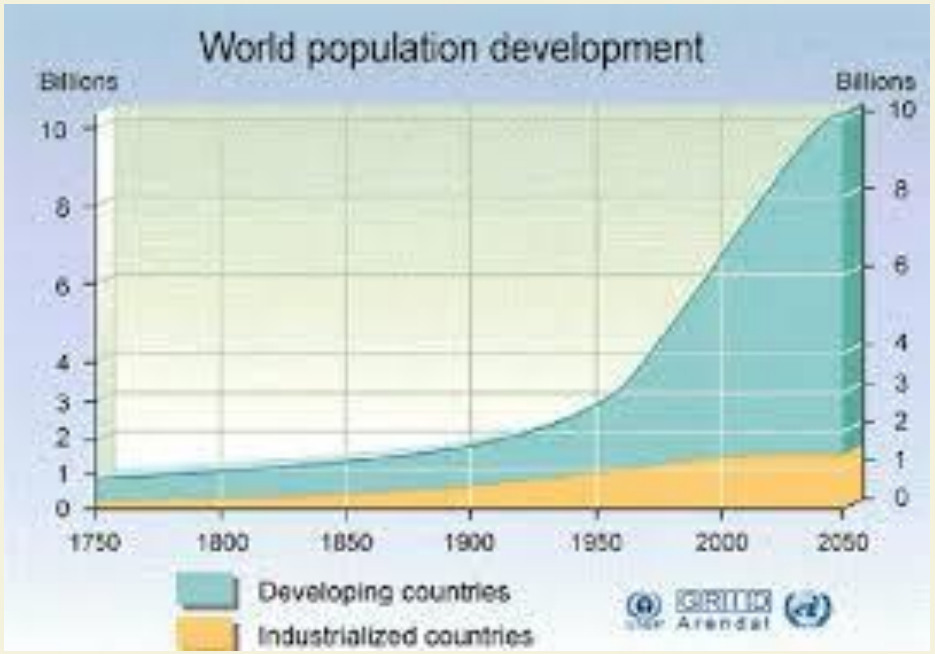
World Bank: Population % Change



Pick Three: U.S. and two others

- Use the Population Clock to find the current population.
- Use World Bank site to find current population growth.
- Using an exponential model, predict the population in each of the three nations in 20 years and 50 years.

Why study human population in Environmental Science?



Remember IPAT?

Population interacts with several other factors to determine a society's environmental impact. One widely-cited formula is the "I = PAT" equation, proposed by Paul R. Ehrlich and John P. Holdren in 1974 (footnote 1).

Environmental Impact = Population x Affluence (or consumption) x Technology

Natural Capital Degradation: Altering Nature to Meet Our Needs

Natural Capital Degradation

Altering Nature to Meet Our Needs

Reducing biodiversity

Increasing use of net primary productivity

Increasing genetic resistance in pest species and disease-causing bacteria

Eliminating many natural predators

Introducing harmful species into natural communities

Using some renewable resources faster than they can be replenished

Disrupting natural chemical cycling and energy flow

Relying mostly on polluting and climate-changing fossil fuels

Fig. 6-B, p. 129

6-1 How Many People Can the Earth Support?

- ***Concept 6-1*** *We do not know how long we can continue increasing the earth's carrying capacity for humans without seriously degrading the life-support system that keeps us and many other species alive.*

Core Case Study: Slowing Population Growth in China: A Success Story

- 1.3 billion people
- Promotes one-child families
  - Contraception, abortion, sterilization
- Fast-growing economy
- Serious resource and environmental problems

Human Population Growth

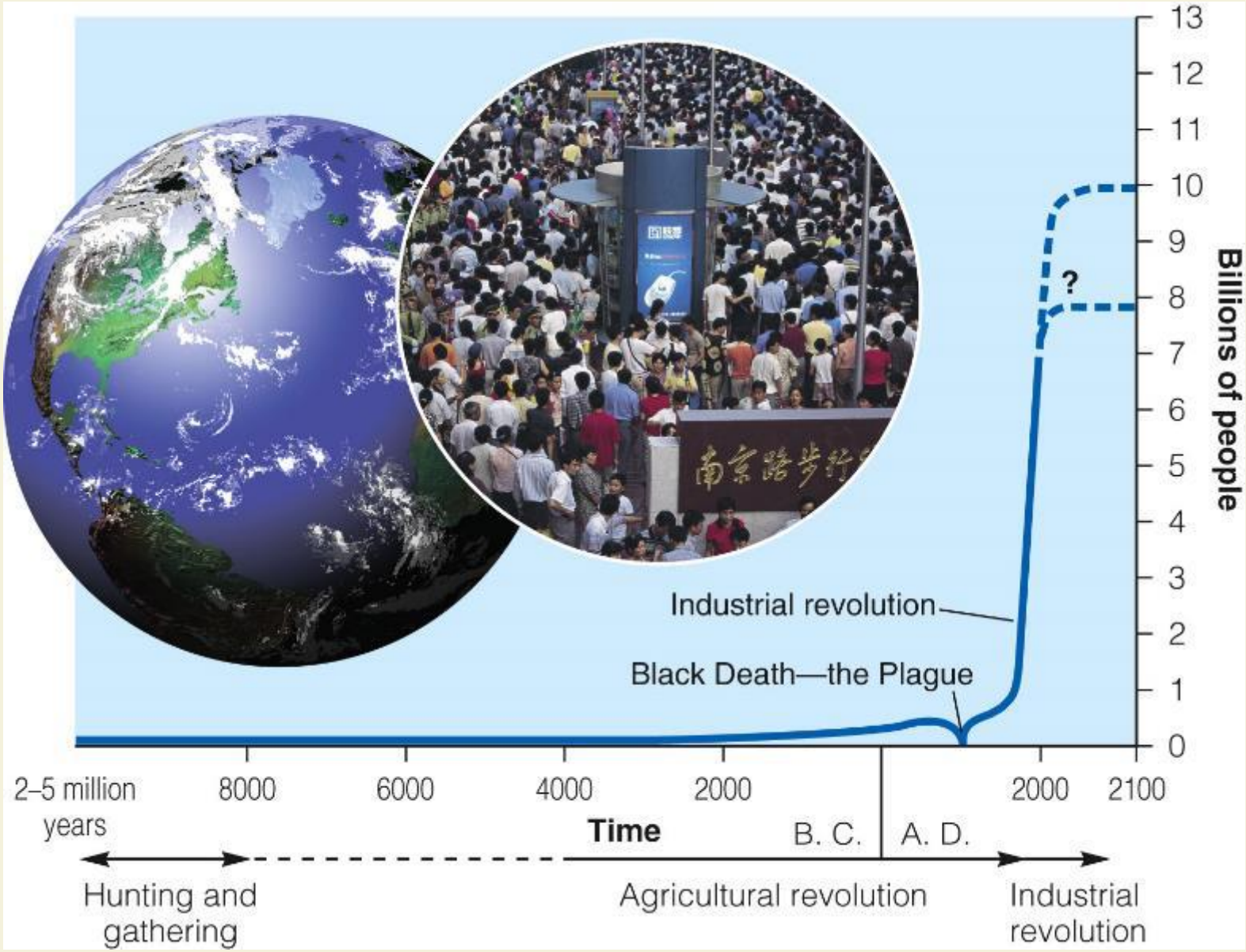


Fig. 1-18, p. 21

Population Time Line: 10,000 BC - 2042

Year	Event	Human population (approximate)
50,000 BC	Hunter-gatherer societies	1.2 million
10,000 BC	End of last Ice Age	4 million
8,000 BC	Agricultural Revolution	5 million
500 BC		100 million
1,000 AD		250 million
1347–1351	Black Death (Plague); 75 million people die	
1500		450 million
1750	Industrial Revolution begins in Europe	791 million
1800	Industrial Revolution begins in the United States	
1804		1 billion
1845–1849	Irish potato famine: 1 million people die	
1927		2 billion
1943	Penicillin used against infection helps decrease death rates	
1957	Great famine in China; 20 million die	
1961		3 billion
1974		4 billion
1984		5 billion
1987		6 billion
2011	Projected human population:	7 billion
2024	Projected human population:	8 billion
2042	Projected human population:	9 billion

Figure 3, Supplement 9

Question: Population increase in the world's population from 1900-2000 was due to what, in large part?

- 1900: 1.65 billion
- 2000: 6 billion

- Answer: Sharp decline in death rates.

- Due to what?

Human Population Growth Continues but It Is Unevenly Distributed (1)

- Reasons for human population increase
  - Movement into new habitats and climate zones
  - Early and modern agriculture methods
  - Control of infectious diseases through
    - Sanitation systems
    - Antibiotics
    - Vaccines
    - Health care

- Most population growth over last 100 years due to drop in death rates

Human Population Growth Continues but It Is Unevenly Distributed (2)

- Population growth in developing countries is increasing 9 times faster than developed countries

- 2050
  - 95% of growth in developing countries
  - 7.8-10.8 billion people

- Should the optimum sustainable population be based on **cultural carrying capacity?**

Annual Growth Rate of World Population, 1950-2010

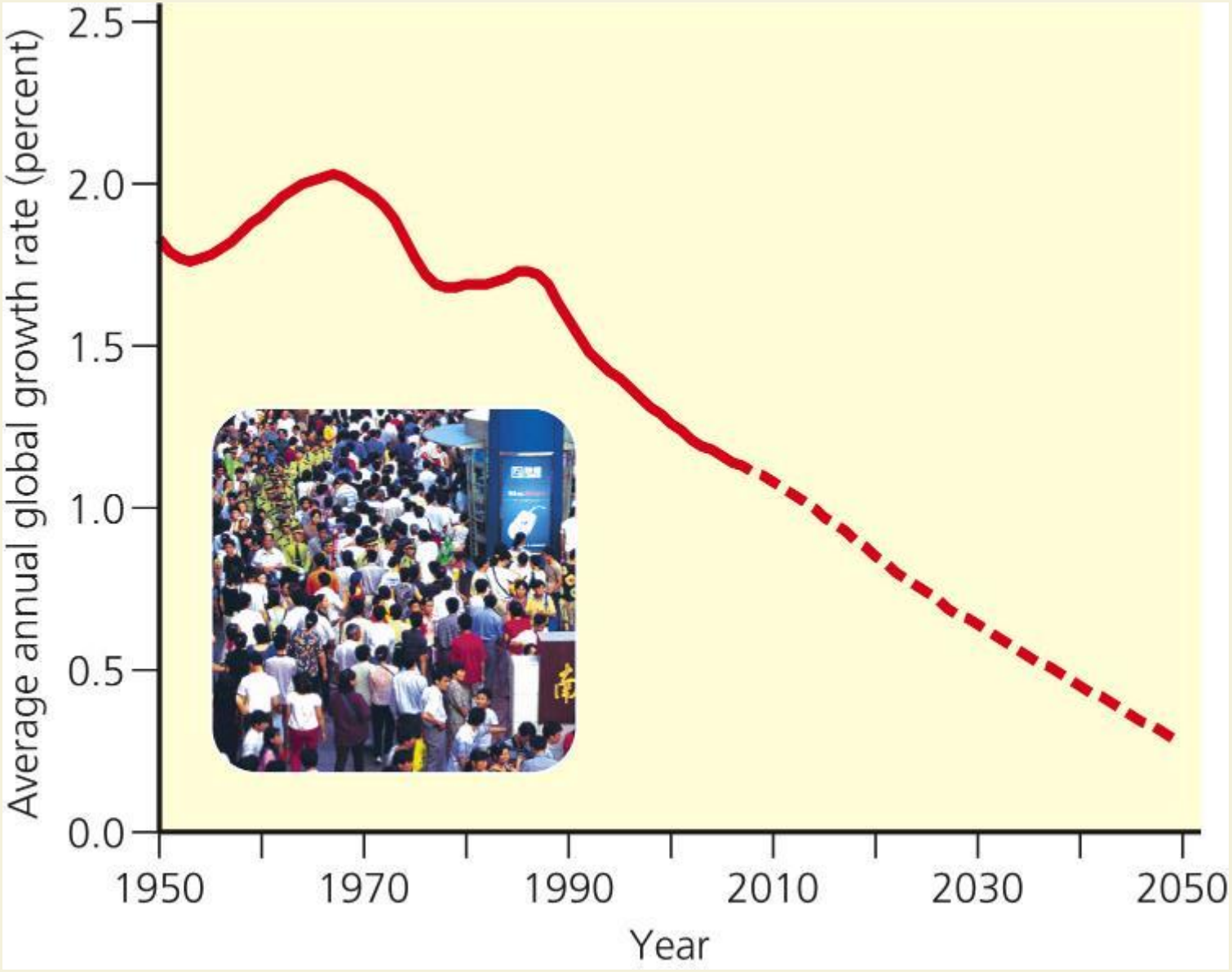


Fig. 6-2, p. 127

Where Population Growth Occurred, 1950-2010

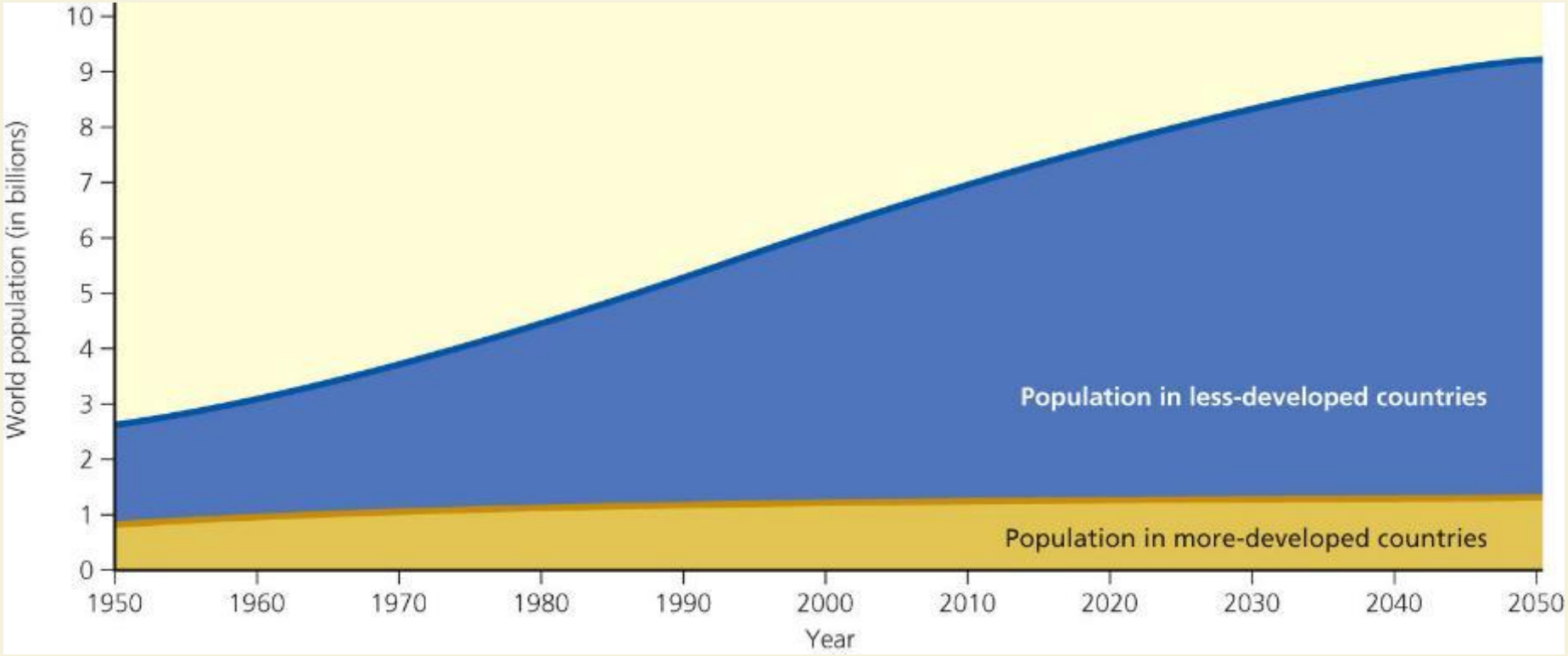


Fig. 6-3, p. 127

Science Focus: How Long Can The Human Population Keep Growing?

- Thomas Malthus and population growth: 1798
- Overpopulation and overconsumption
- Will technology increase human carrying capacity?
- Can the human population grow indefinitely?

6-2 What Factors Influence the Size of the Human Population?

- ***Concept 6-2A*** *Population size increases because of births and immigration, and decreases through deaths and emigration.*

- ***Concept 6-2B*** *The average number of children born to women in a population (total fertility rate) is the key factor that determines population size.*

The Human Population Can Grow, Decline, or Remain Fairly Stable

- Population change
  - Births: fertility
  - Deaths: mortality
  - Migration

- **Population change** =
  (births + immigration) – (deaths + emigration)

- **Crude birth rate**: # live births/1000/year

- **Crude death rate**: # deaths/1000/year

Women Having Fewer Babies but Not Few Enough to Stabilize the World's Population

- Fertility rate
  - Number of children born to a woman during her lifetime
- **Replacement-level fertility rate**
  - Average number of children a couple must have to replace themselves
  - 2.1 in developed countries
  - Up to 2.5 in developing countries
- **Total fertility rate (TFR)**
  - Average number of children born to women in a population

Total fertility rate, 1955-2010

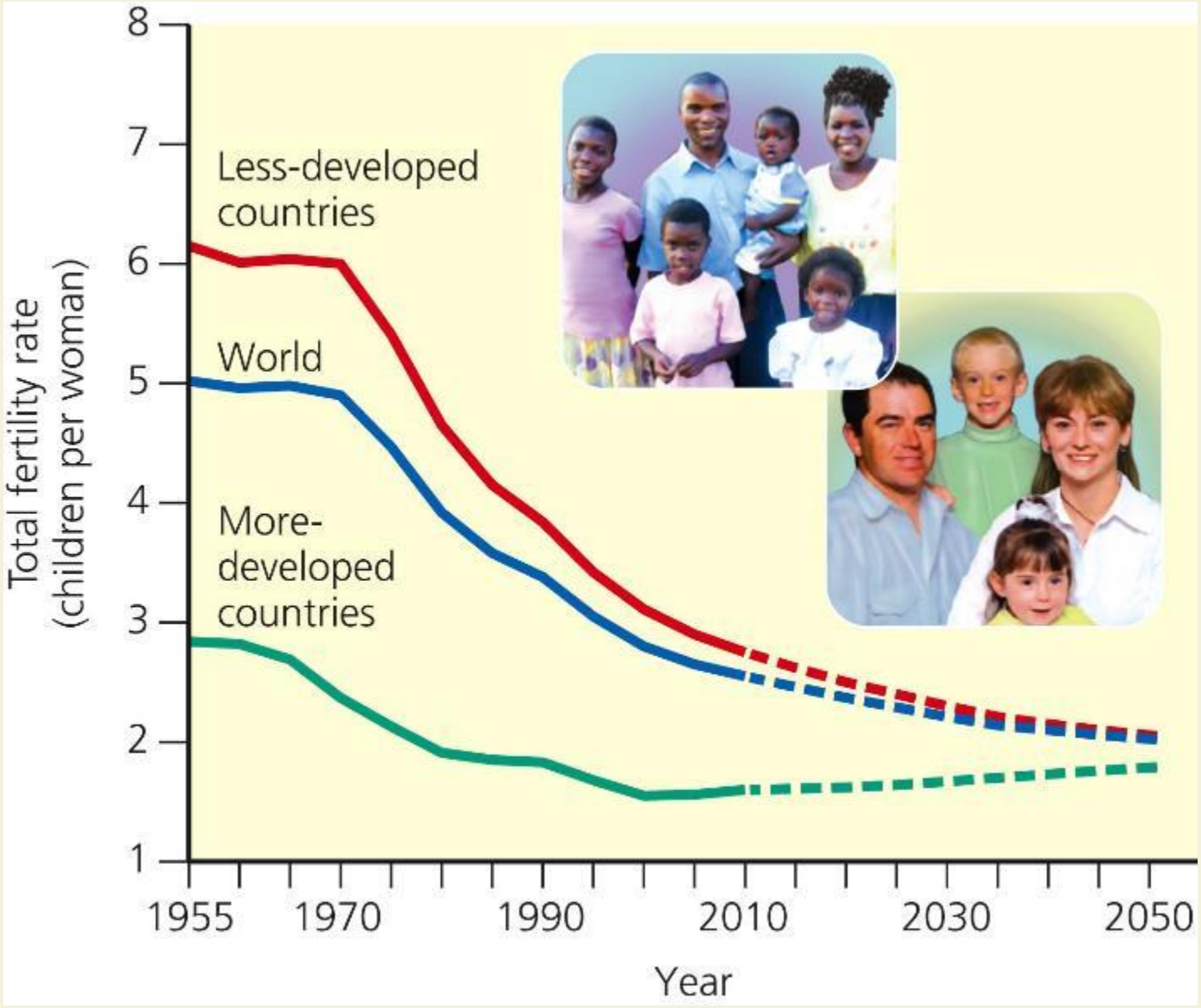


Fig. 6-5, p. 130

2010 Rate of Population Increase

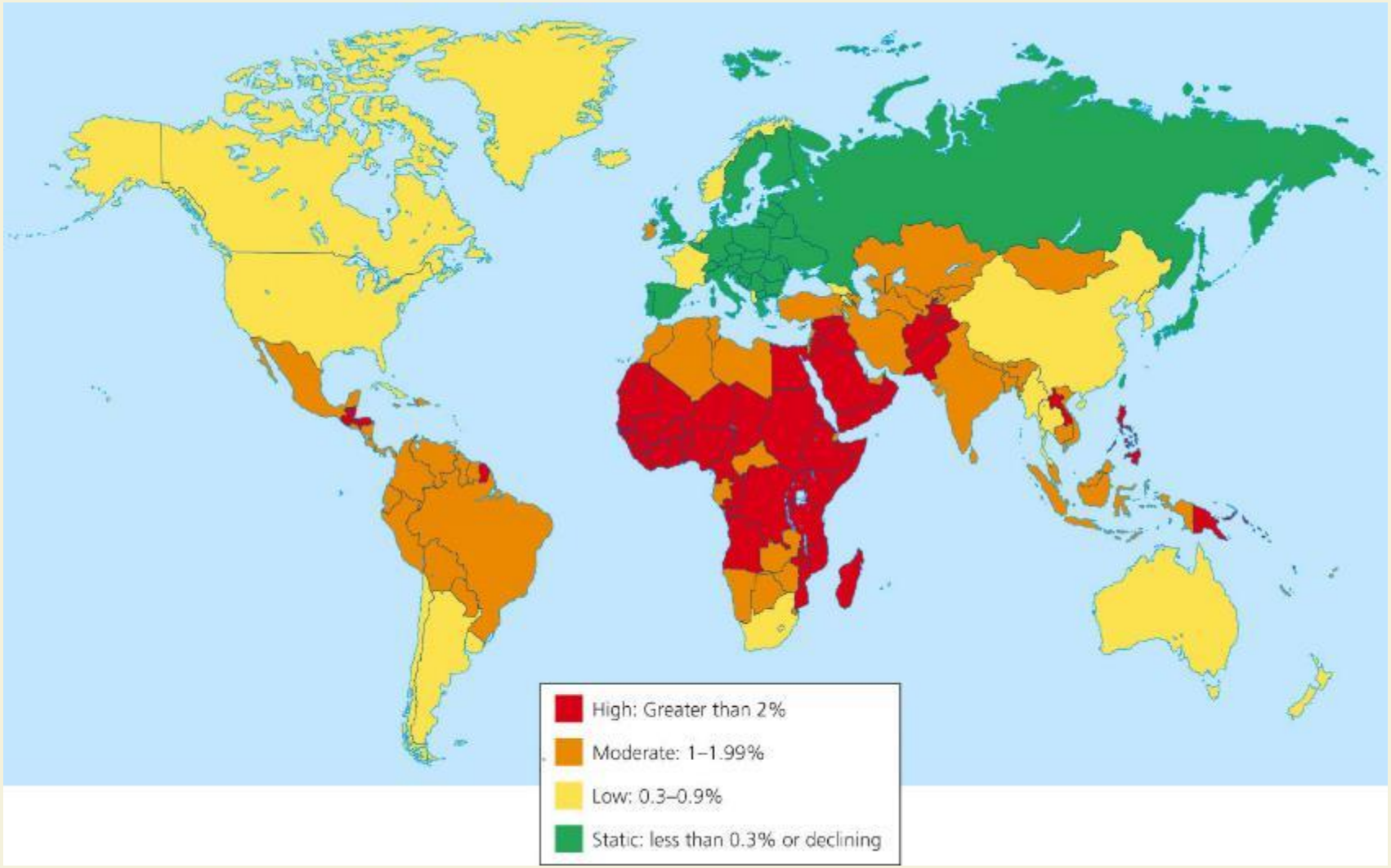


Figure 11, Supplement 8

Total Fertility Rate

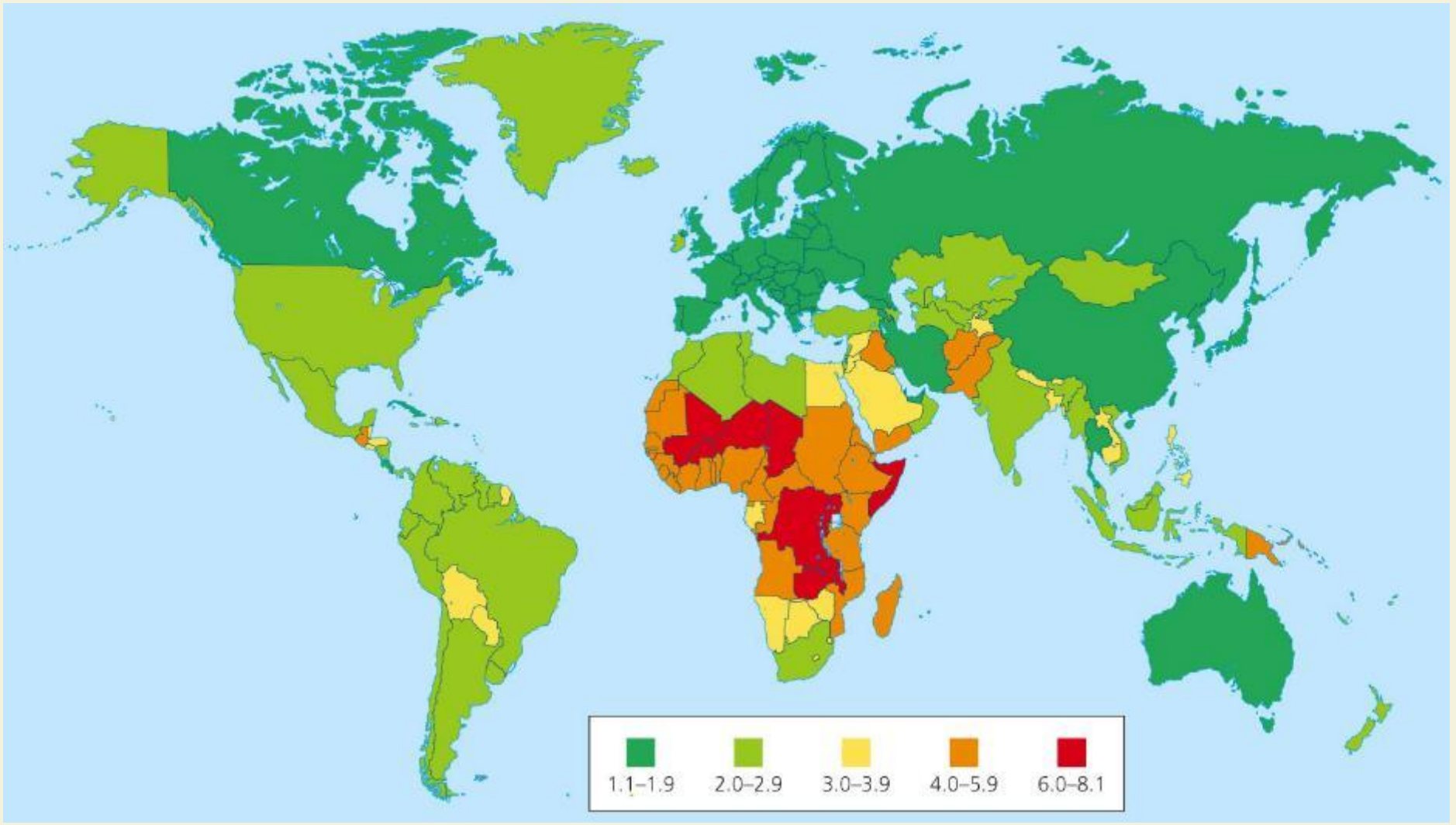


Figure 12, Supplement 8

Why much higher total fertility rates in developing countries?

- Children needed for labor force
  - Hauling water
  - Collecting firewood
- No pensions
  - More children to support parents in old age
- Rural
- Lack of educational and employment opportunities for women
- Customs and religious beliefs
- Lack of reliable birth control methods/contraceptives

Case Study: The U.S. Population Is Growing Rapidly

- Population still growing and not leveling off
  - 76 million in 1900
  - 310 million in 2010
- Drop in TFR in U.S.
  - Rate of population growth has slowed
- Changes in lifestyle in the U.S. during the 20th century

U.S. TFRs and birth rates 1917-2010

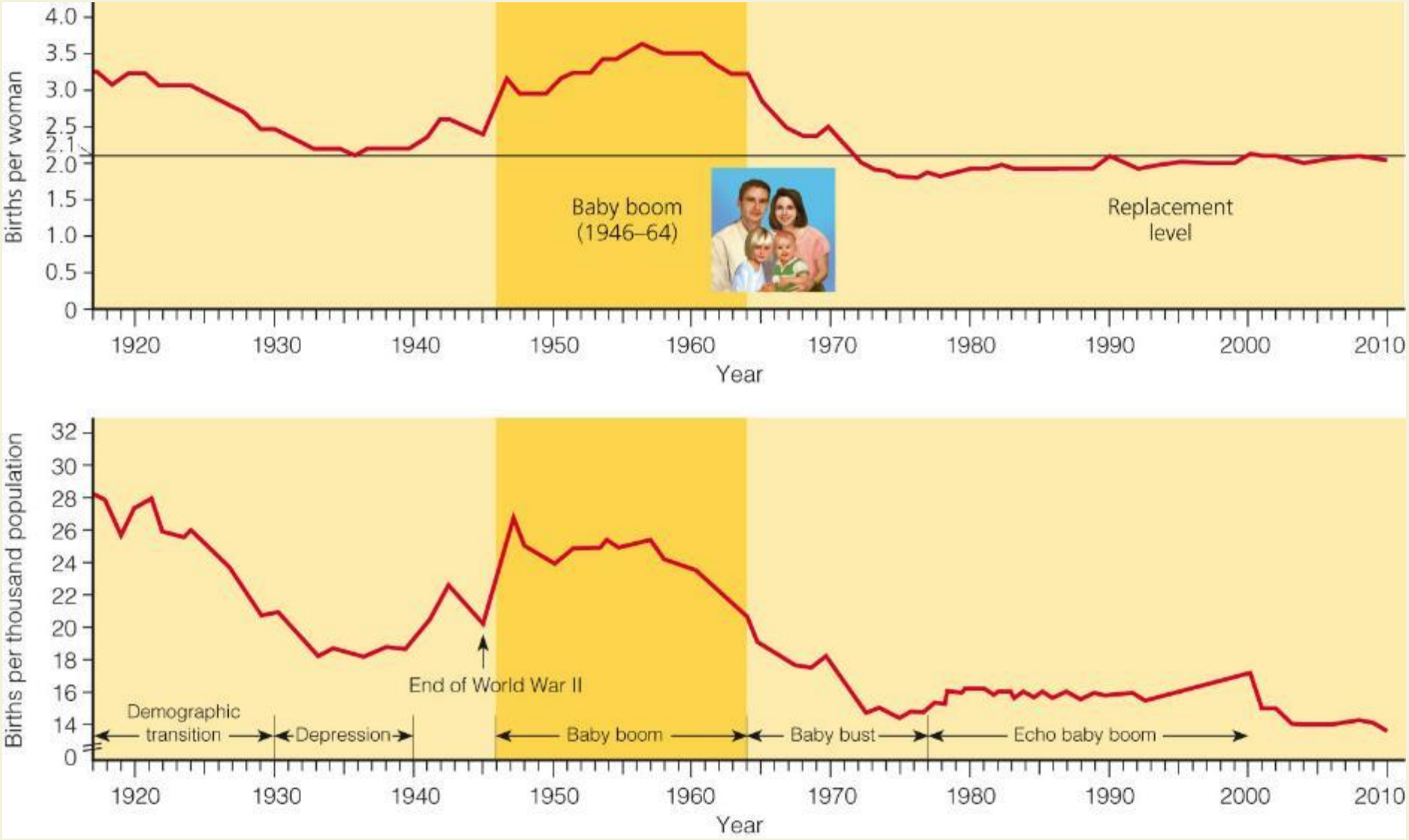


Fig. 6-6, p. 131

20th Century Lifestyle Changes in the U.S.

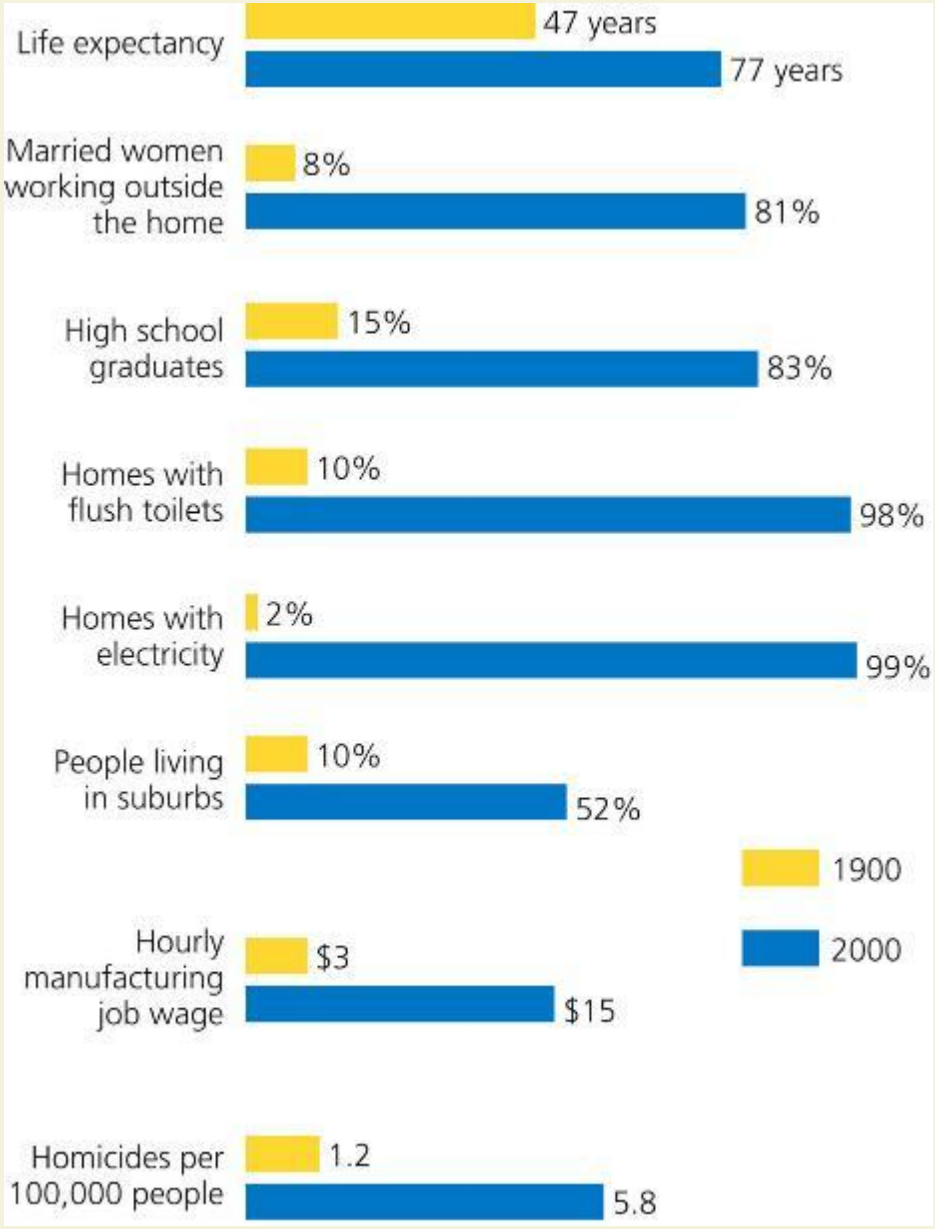


Fig. 6-7, p. 132

Review Question #7: Several Factors Affect Birth Rates and Fertility Rates (1)

- Children as part of the labor force
- Cost of raising and educating children
- Availability of private and public pension
- Urbanization
- Educational and employment opportunities for women

Review Question #7: Several Factors Affect Birth Rates and Fertility Rates (2)

- Average age of a woman at birth of first child
- Availability of legal abortions
- Availability of reliable birth control methods
- Religious beliefs, traditions, and cultural norms

Girl Carrying Well Water in India

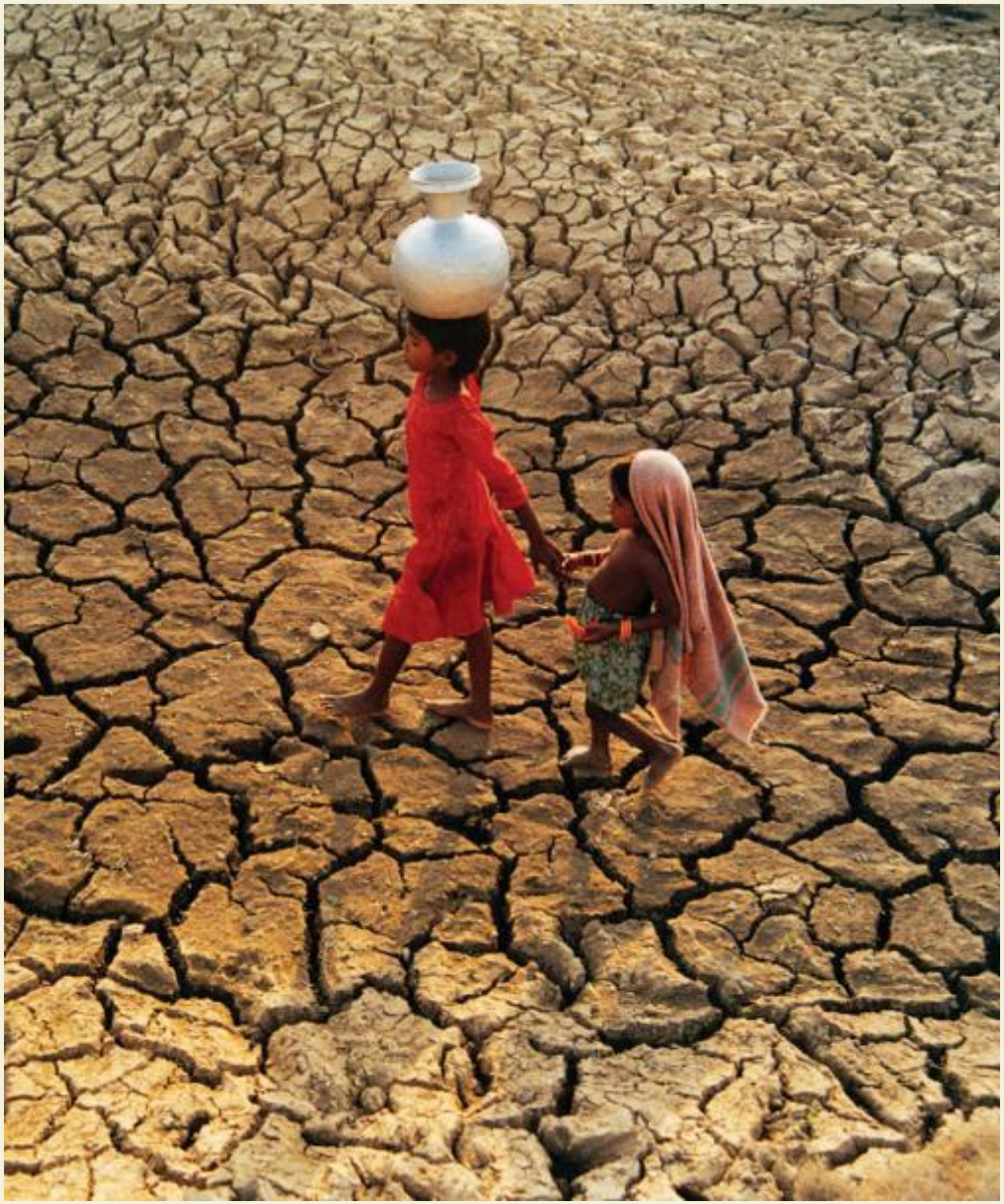


Fig. 6-8, p. 132

Child Laborers in India

Fig. 6-9, p. 133

Several Factors Affect Death Rates (1)

- **Life expectancy**
- **Infant mortality rate**
  - Number of live births that die in first year
- Why are people living longer?
  - Increased food supply and distribution
  - Better nutrition
  - Medical advances
  - Improved sanitation

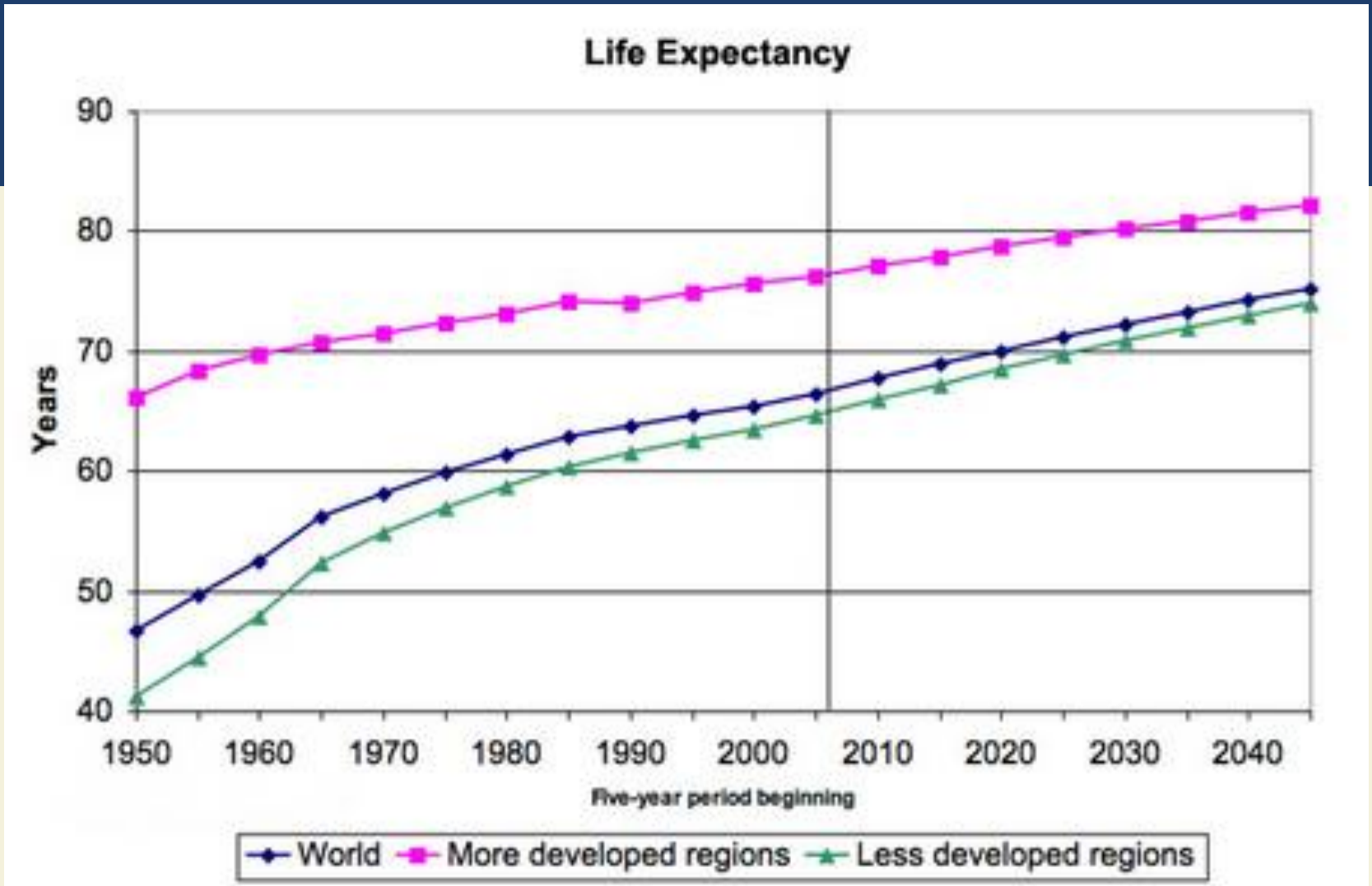


Figure 6. Life expectancy

Several Factors Affect Death Rates (2)

- U.S. is 54th in world for infant mortality rate

- U.S. infant mortality rate high due to
  - Inadequate health care for poor women during pregnancy and their infants
  - Drug addiction among pregnant women
  - High birth rate among teenagers

Infant Mortality Rates, 1950-2010

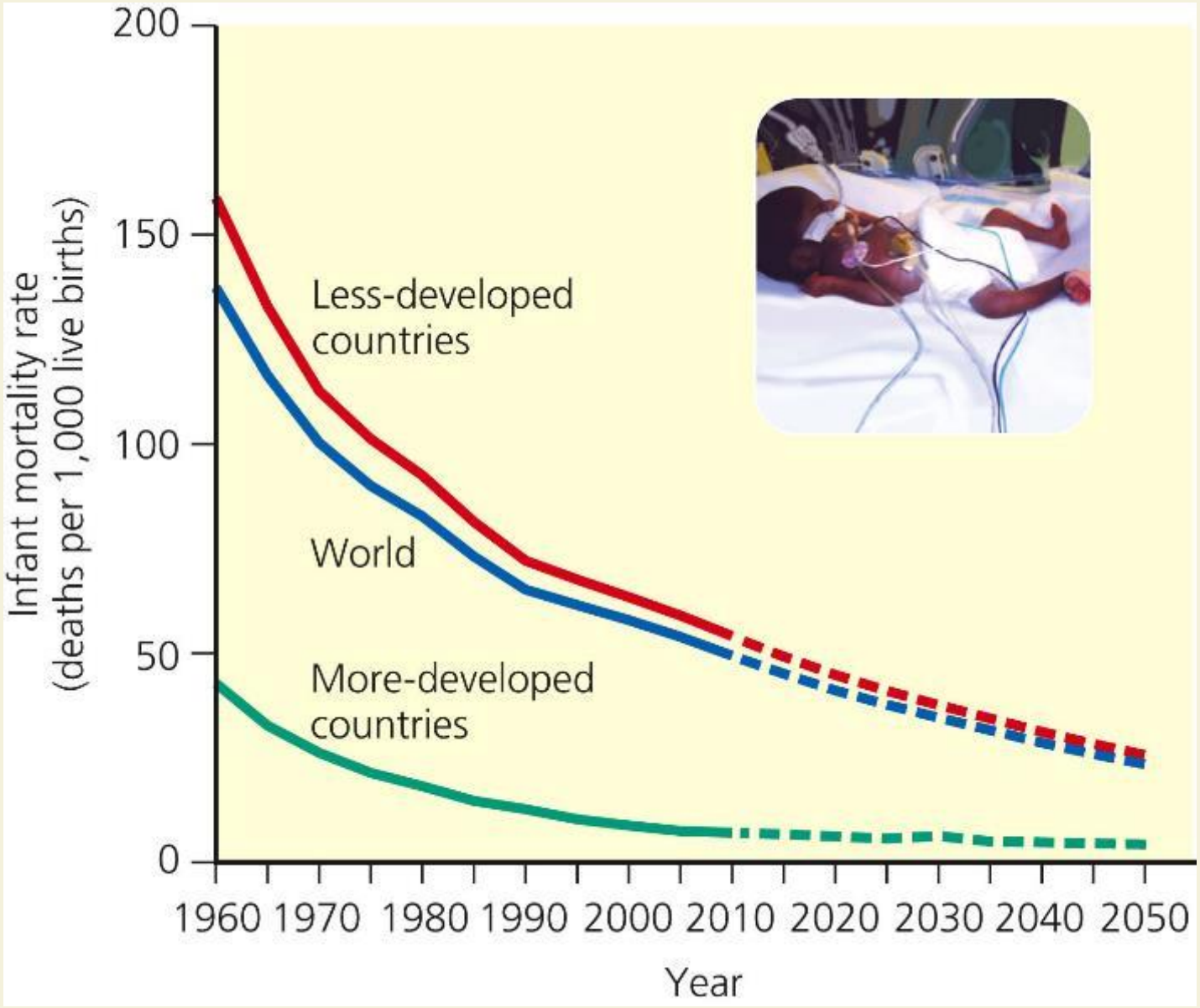


Fig. 6-10, p. 134

Infant Mortality Rates in 2010

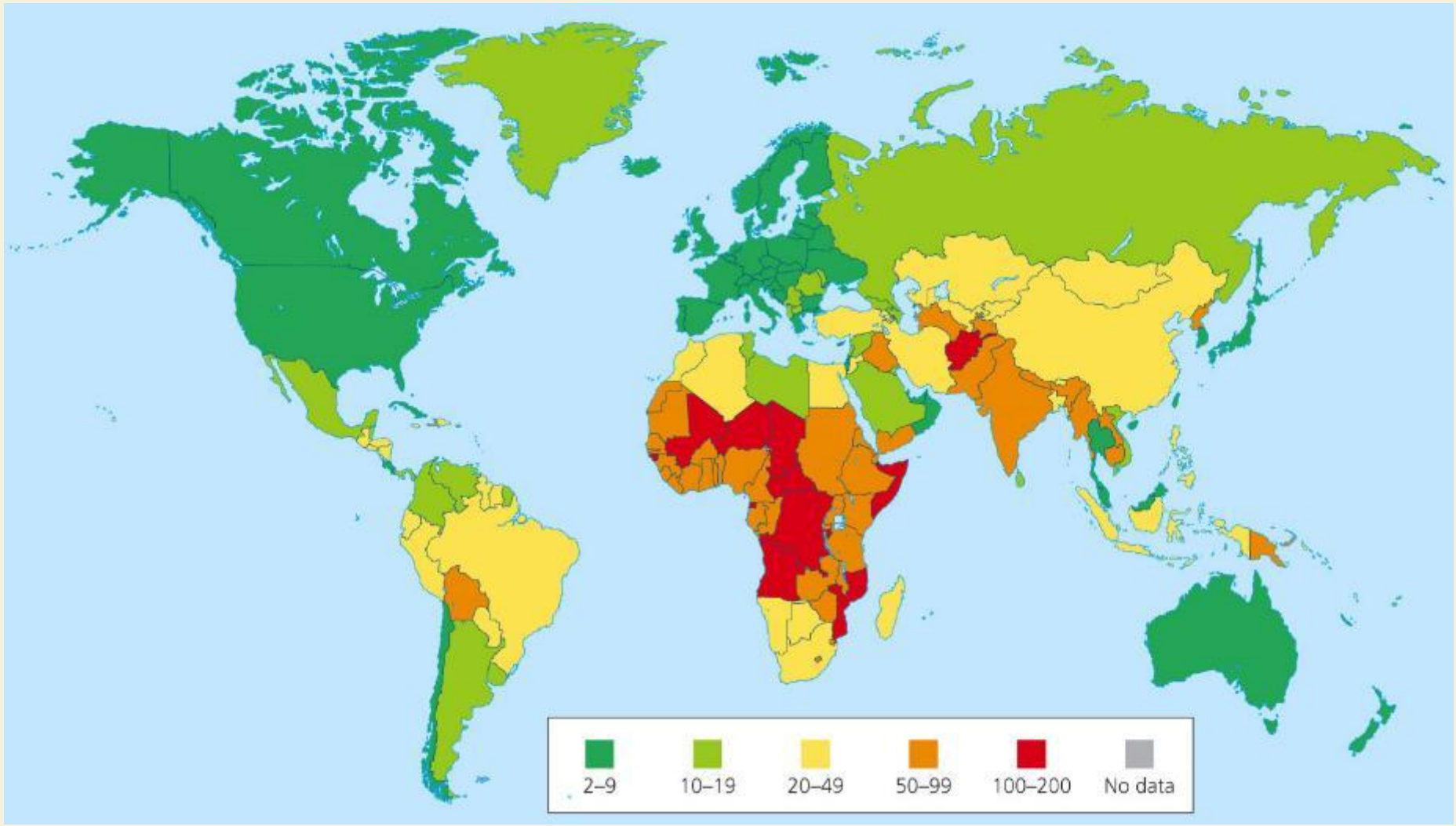


Figure 13, Supplement 8

Hans Rosling

- dont-panic-the-facts-about-population

6-3 How Does a Population's Age Structure Affect Its Growth or Decline?

- ***Concept 6-3*** *The numbers of males and females in young, middle, and older age groups determine how fast a population grows or declines.*

A Population's Age Structure Helps Us Make Projections

- **Age structure** categories
  - Prereproductive ages (0-14)
  - Reproductive ages (15-44)
  - Postreproductive ages (45 and older)

- Seniors are the fastest-growing age group

Generalized Population Age-Structure Diagrams

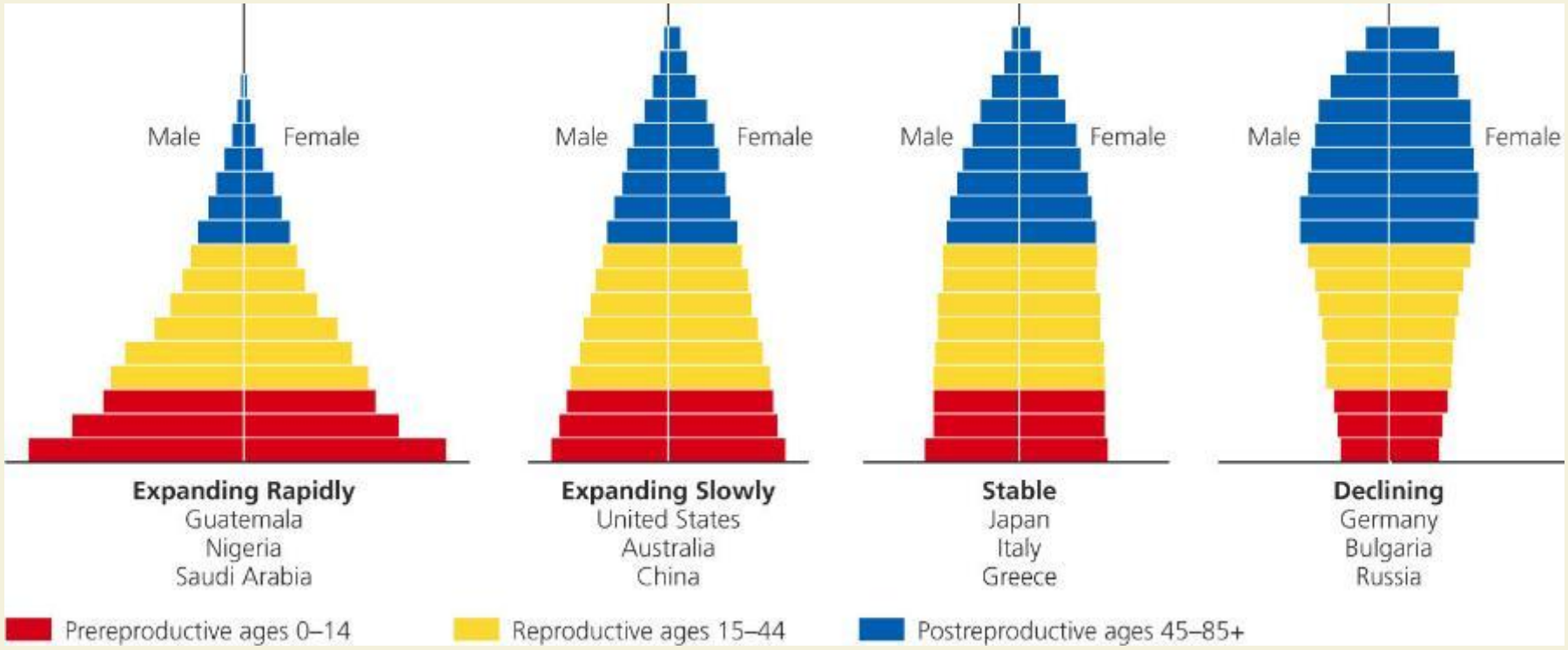


Fig. 6-12, p. 136

Population Structure by Age and Sex in Developing and Developed Countries

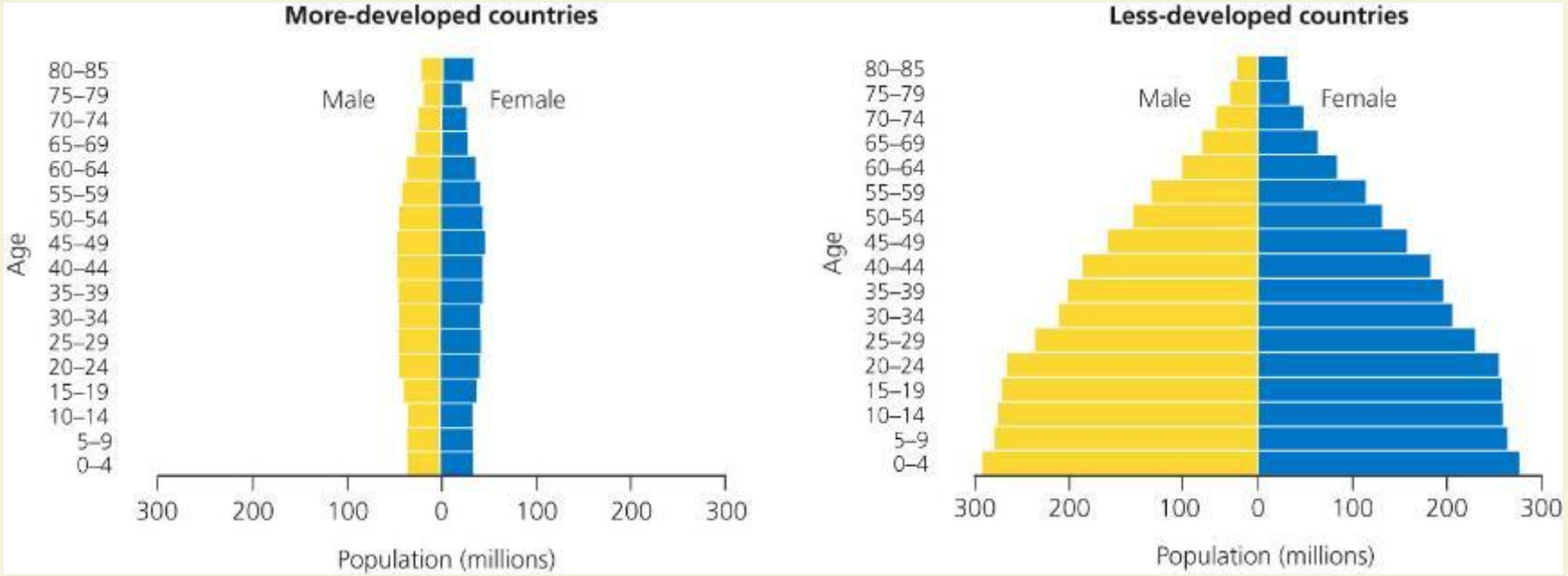


Fig. 6-13, p. 136

Demographic Momentum

- A country with a large % of its people younger than age 15 (wide base in the age-structure diagram) will experience **rapid** population growth unless death rates rise sharply.
  - Because of this *demographic momentum*, the number of births will rise for several decades even if women have an average of only one or two children, due to the large number of girls entering their prime reproductive years.

Case Study: The American Baby Boom

- 79 million people, 36% of adults
- Affect politics and economics
- Now becoming senior citizens
  - Graying of America

Tracking the Baby-Boom Generation in the United States

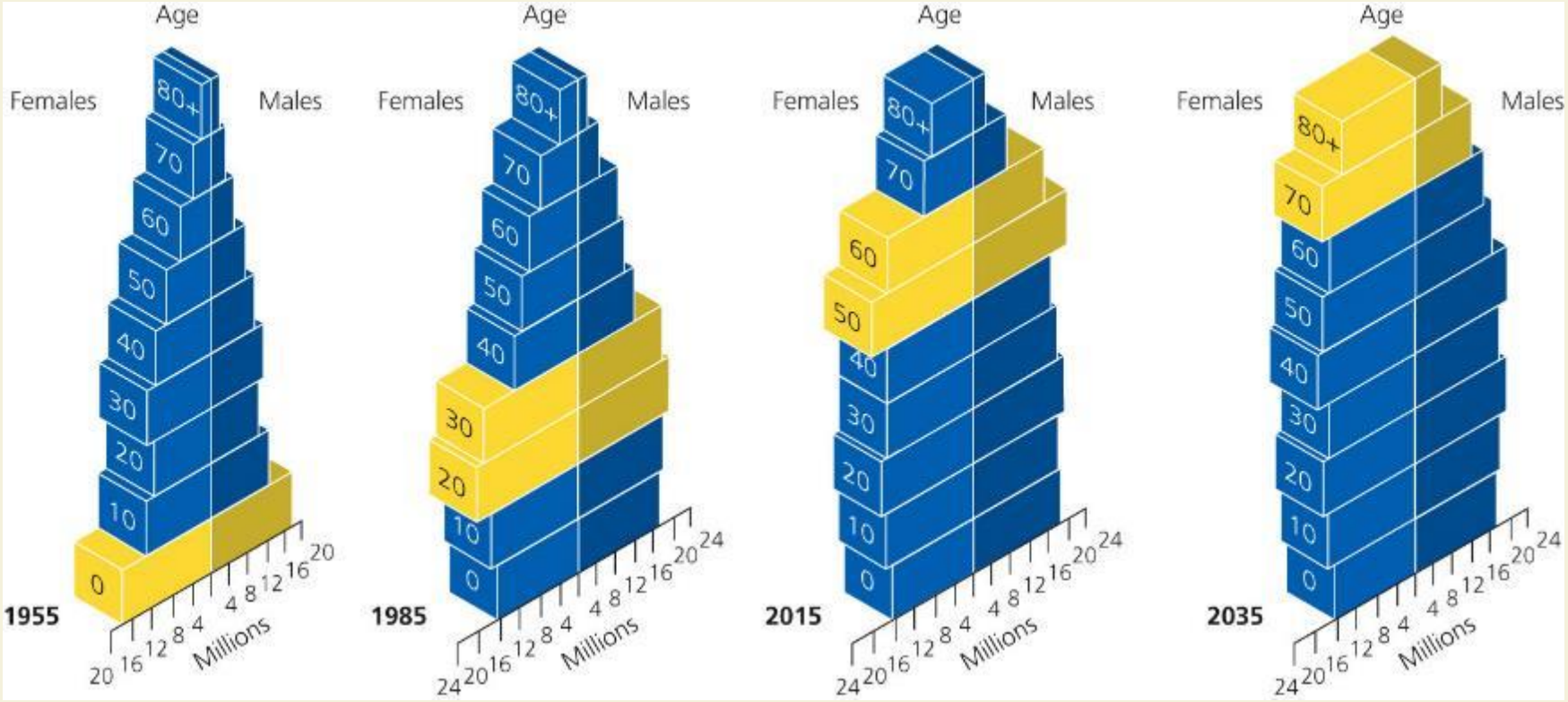


Fig. 6-14, p. 137

Populations Made Up of Mostly Older People Can Decline Rapidly

- Slow decline
  - Manageable

- Rapid decline
  - Severe economic problems
    - How pay for services for elderly
    - Proportionally fewer young people working
    - Labor shortages
  - Severe social problems

Some Problems with Rapid Population Decline

Some Problems with Rapid Population Decline

Can threaten economic growth

Labor shortages

Less government revenues with fewer workers

Less entrepreneurship and new business formation

Less likelihood for new technology development

Increasing public deficits to fund higher pension and health-care costs

Pensions may be cut and retirement age increased

Fig. 6-15, p. 138

Populations Can Decline from a Rising Death Rate: The AIDS Tragedy

- 27 million killed: 1981-2009
- Many young adults die: loss of most productive workers
- Sharp drop in life expectancy
- International community
  - Reduce the spread of HIV through education and health care
  - Financial assistance and volunteers

Botswana Age Structure, With and Without AIDS

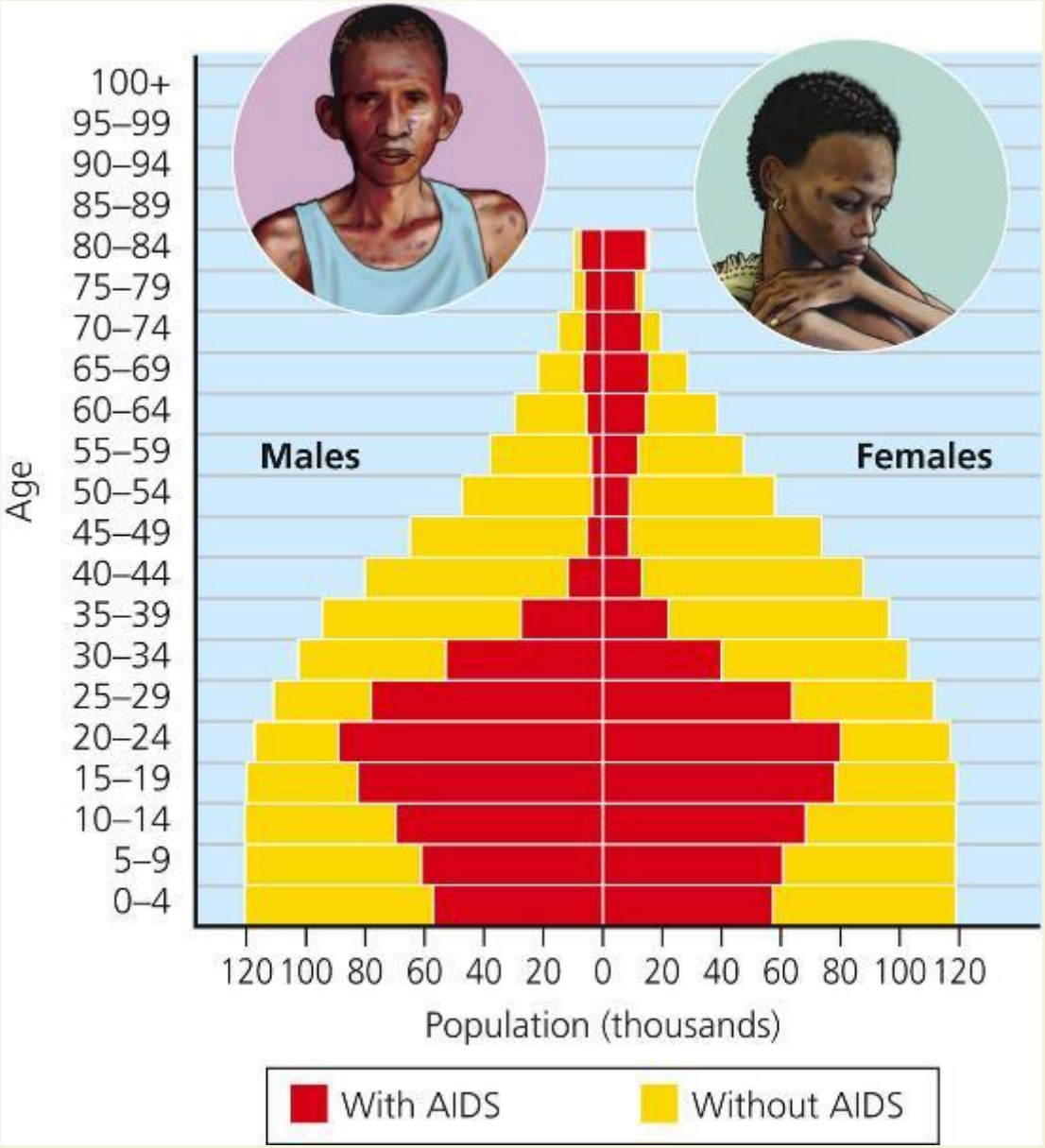


Fig. 6-16, p. 139

6-4 How Can We Slow Human Population Growth?

- ***Concept 6-4*** *We can slow human population growth by reducing poverty, elevating the status of women, and encouraging family planning.*

As Countries Develop, Their Populations Tend to Grow More Slowly

- **Demographic transition**
  - First death rates decline
  - Then birth rates decline

- Four stages
  1. Preindustrial
  2. Transitional
  3. Industrial
  4. Postindustrial

Four Stages of the Demographic Transition

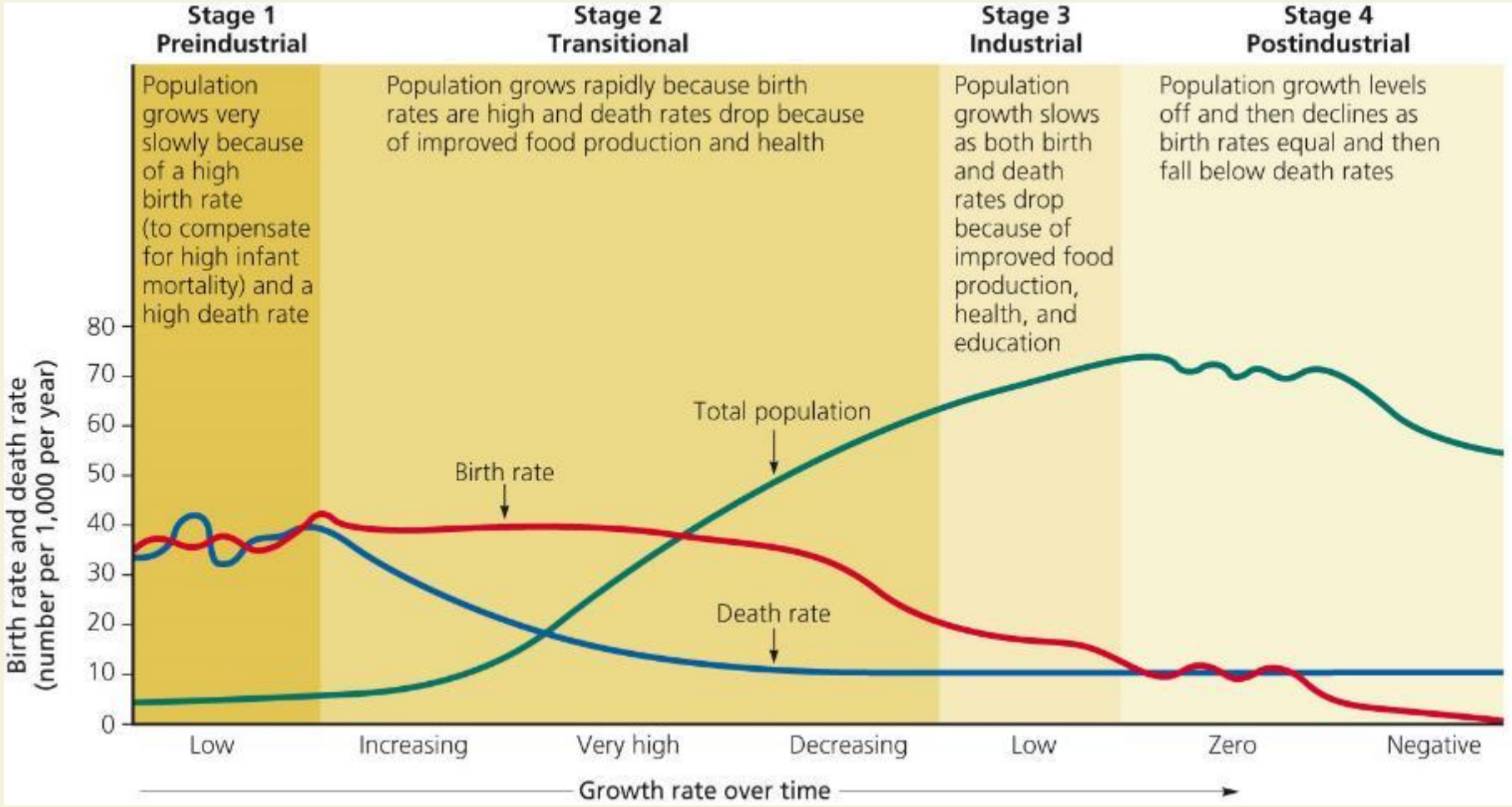


Fig. 6-17, p. 140

TFR in Bangladesh and U.S., 1800-2010

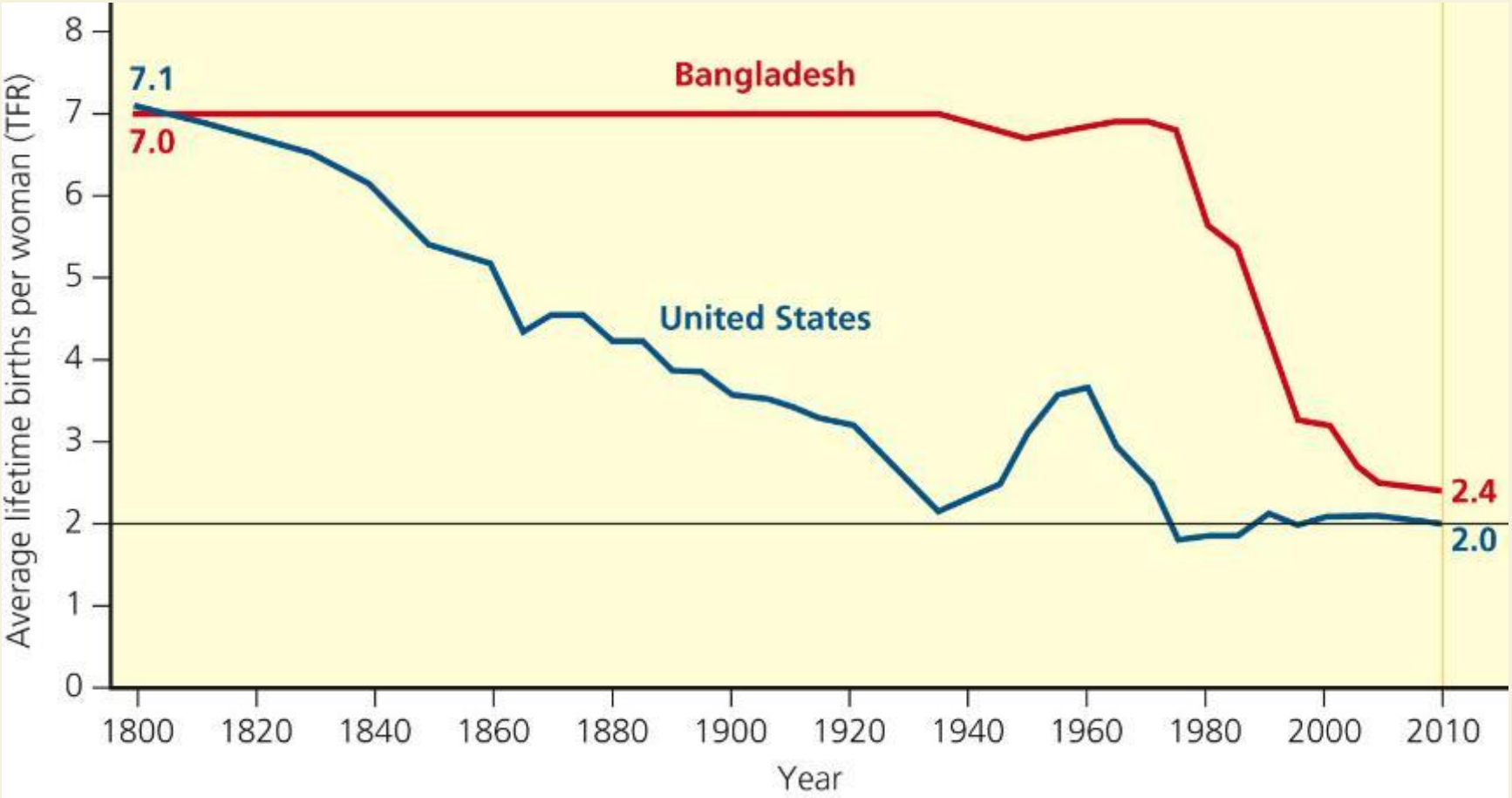


Fig. 6-18, p. 140

Slum in India

Fig. 6-19, p. 141

How do we slow world population growth?

- Reduce poverty
  - Economic development
  - Universal primary education
- Elevate status of women
  - Education
  - Job opportunities
  - Ability to control own fertility
- Family planning and reproductive health care

Empowering Women Can Slow Population Growth

- Factors that decrease total fertility rates:
  - Education
  - Paying jobs
  - Ability to control fertility

- Women
  - Do most of the domestic work and child care
  - Provide unpaid health care
  - 2/3 of all work for 10% of world's income
  - Discriminated against legally and culturally

Burkina Faso Women Hauling Fuelwood

Fig. 6-20, p. 141

Promote Family Planning

- Family planning in less-developed countries
  - Responsible for a 55% drop in TFRs
  - Financial benefits: money spent on family planning saves far more in health, education costs

- Two problems
  1. 42% pregnancies unplanned, 26% end with abortion
  2. Many couples do not have access to family planning

Case Study: Slowing Population Growth in India

- 1.2 billion people, most populous country in 2015
- Problems
  - Poverty
  - Malnutrition
  - Environmental degradation

- Bias toward having male children
- Poor couples want many children
- Only 48% of couples use family planning

Three Big Ideas

1. The human population is increasing rapidly and may soon bump up against environmental limits.

2. Even if population growth were not a serious problem, the increasing use of resources per person is expanding the overall human ecological footprint and putting a strain on the earth's resources.

Three Big Ideas

3. We can slow population growth by reducing poverty through economic development, elevating the status of women, and encouraging family planning.