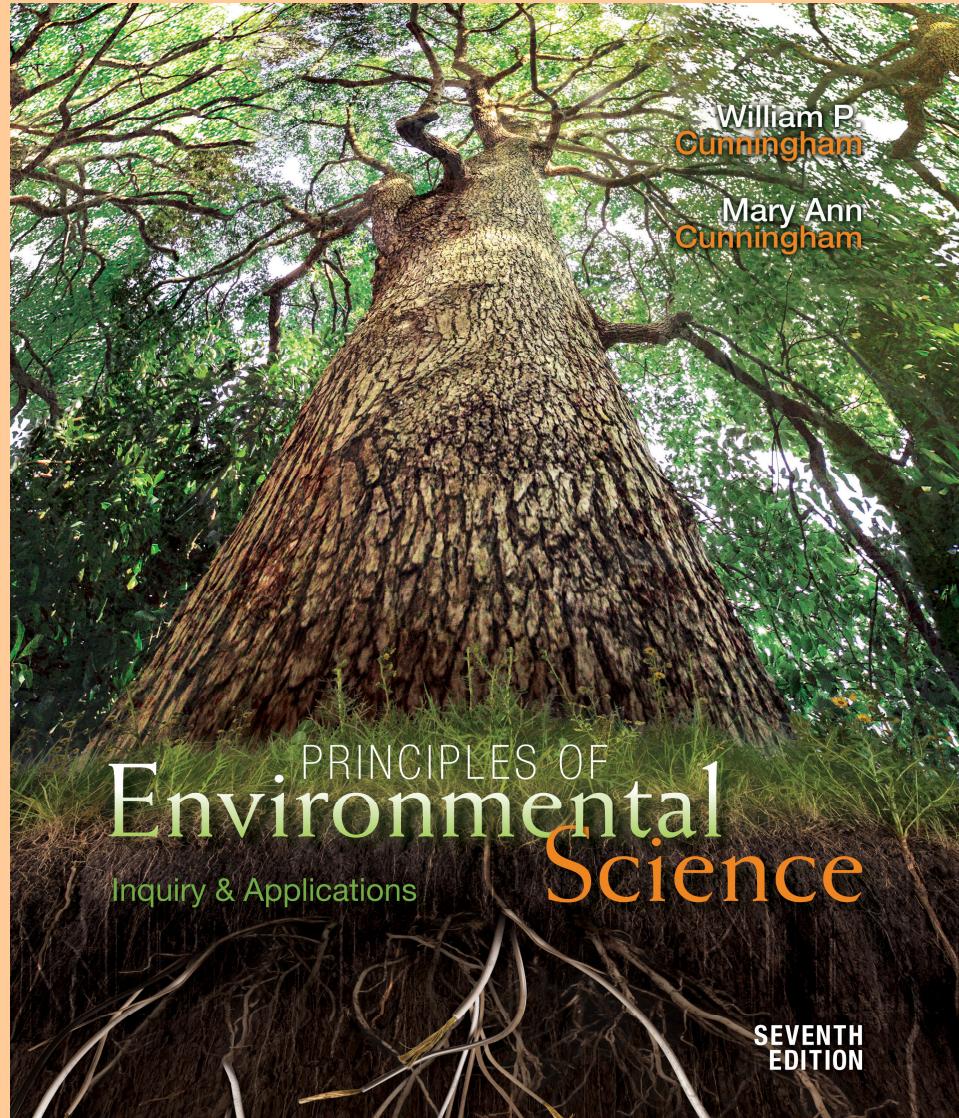




# Chapter 4

## Lecture Outline



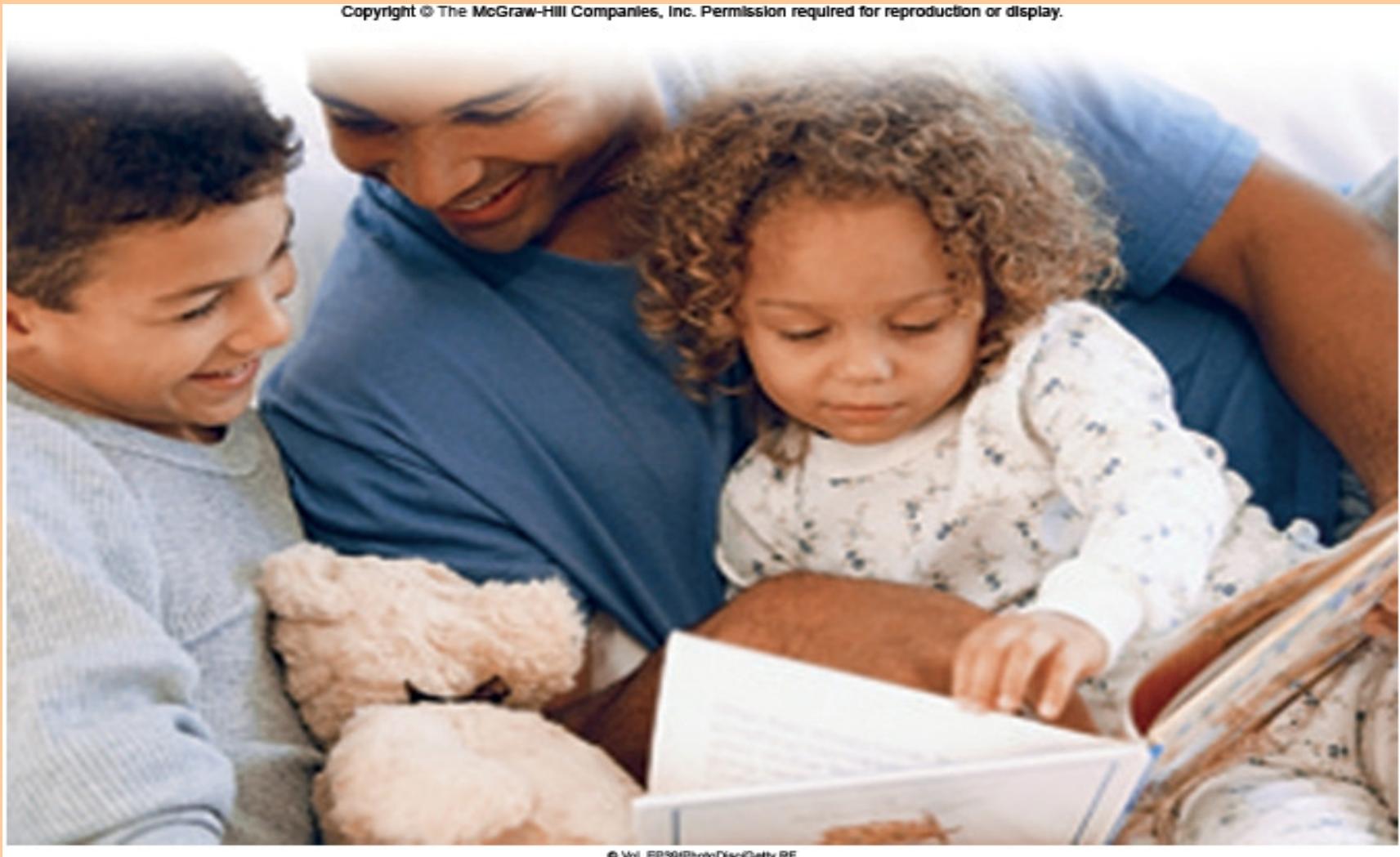
# Learning Outcomes

***After studying this chapter, you should be able to answer the following questions:***

- Why are we concerned about human population growth?
- Will the world's population triple in the twenty-first century as it did in the twentieth?
- What is the relationship between population growth and environmental impact?
- Why did human populations grow so rapidly in the last century?
- How is human population growth changing in different parts of the world?
- How does population growth change as a society develops?
- What factors slow down or speed up human population growth?

# Population Stabilization in Brazil

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© Vol. EP89/PhotoDisc/Getty RF

*For every complex problem there is an answer that is clear, simple, and wrong.*

—H. L. Mencken

## **4.1 Past and Current Population Growth are Very Different**

- Every second, on average, four or five children are born, somewhere on the earth. In that same second, one or two other people die.
- In 2011 the United Nations announced that we had reached 7 billion people, having added the most recent billion in only 12 years. We're now growing at 1.13 percent per year.
- Whether human populations will continue to grow at present rates and what this would imply for environmental quality and human life are among the most central questions in environmental science.

# Human Populations Grew Slowly Until Recently

- For most of our history, humans were not very numerous.
- Populations of early hunting and gathering societies probably numbered only a few million before the invention of agriculture 10,000 years ago.

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



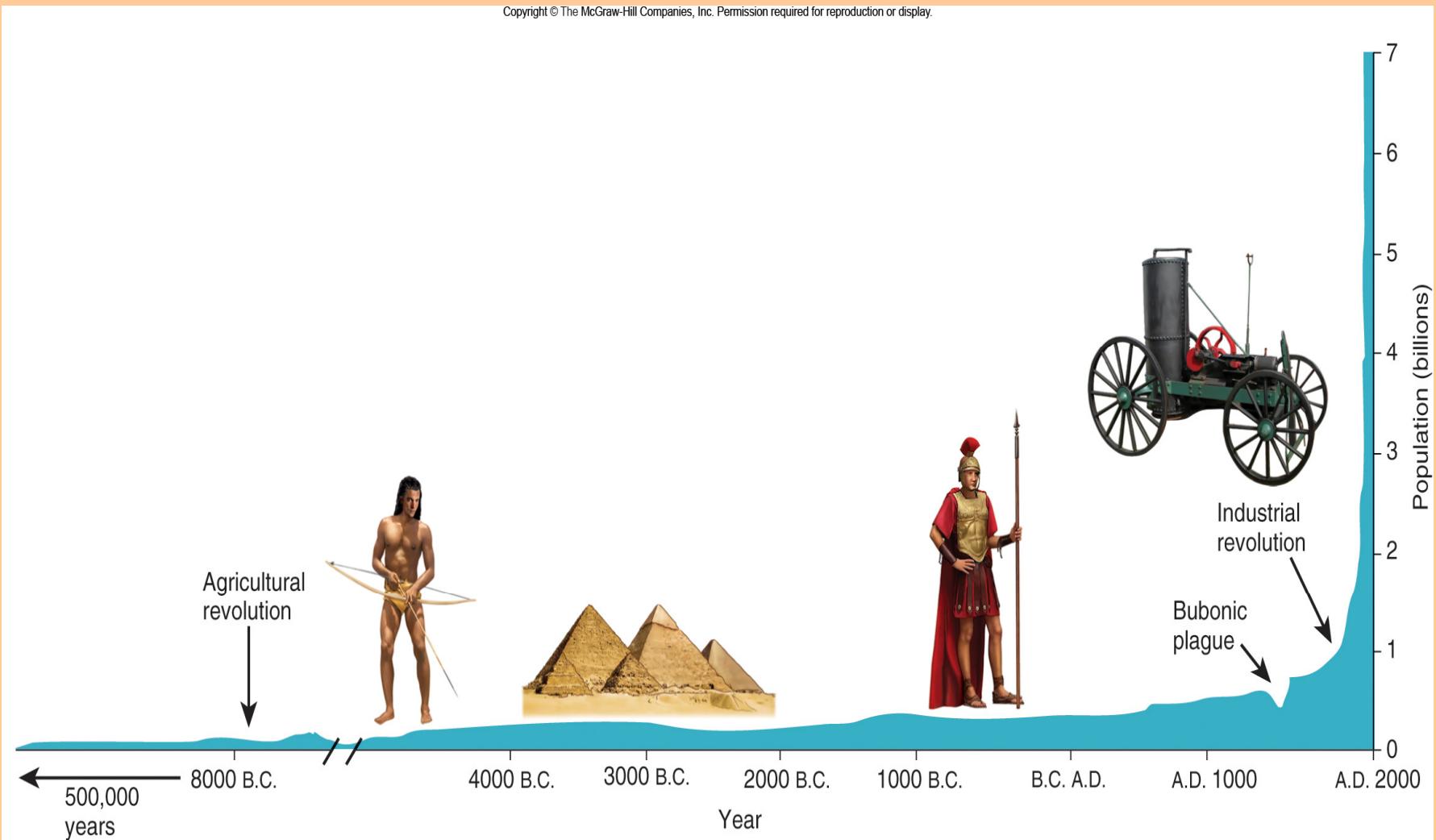
© Apichart Weerawong/AP/Wide World Photos

# Human Population Increases are Relatively Recent

- As you can see in figure 4.3, human populations began to increase rapidly after about A.D. 1600.
- It only took 156 more years to get to 3 billion in 1960.
- It took us about 12 years to add the seventh billion.
- The number of living humans tripled during the twentieth century.
  - Will it do so again in the twenty-first century?
  - Will we reach equilibrium soon enough and at a size that can be sustained over the long term?

# Human Populations Throughout History

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



# Today, Access to Birth Control Affects the Number of Children Families Have

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© Vol. EP39/PhotoDisc/Getty RF

## 4.2 Perspectives on Population Growth

- As with many topics in environmental science, people have widely differing opinions about population and resources.
- Some believe that population growth is the ultimate cause of poverty and environmental degradation.
- Others argue that poverty, environmental degradation, and overpopulation are all merely symptoms of deeper social and political factors.
- The worldview we choose to believe will profoundly affect our approach to population issues.

# Does Environment or Culture Control Human Population Growth?

- Since the time of the Industrial Revolution, individuals have argued about the causes and consequences of population growth.
- In 1798, Thomas Malthus hypothesized that human populations would outstrip their food supply and collapse into starvation, crime, and misery.
- A few decades later, Karl Marx presented an opposing view, that population growth resulted from poverty, resource depletion, pollution, and other social ills.

# Is the World Overcrowded?

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© William P. Cunningham

# What is the Carrying Capacity for Humans?

- Some believe that we are approaching, or may have surpassed, the earth's carrying capacity.
- Joel Cohen, at Rockefeller University reviewed published estimates of the maximum human population size the planet can sustain. The estimates, spanning 300 years of thinking, converged on a median value of 10–12 billion.
- David Pimental from Cornell University states that “By 2100, if current trends continue, 12 billion miserable humans will suffer a difficult life on Earth.”

# Technology Increases Carrying Capacity for Humans

- Optimists argue that Malthus was wrong in his predictions of famine and disaster 200 years ago because he failed to account for scientific and technical progress.
- Since then, progress in agricultural productivity, engineering, information technology, commerce, medicine, and sanitation, have made it possible to support approximately 1,000 times as many people per unit area as was possible 10,000 years ago.
- Will we continue to find technological solutions?

# Calculating the Impact of Human Population

- Our environmental effects aren't just a matter of population size; they also depend on what kinds of resources we use and how we use them.
- This concept is summarized as the  **$I = PAT$  formula**. Our environmental impacts ( $I$ ) are the product of our population size ( $P$ ) times affluence level ( $A$ ) and the technology level ( $T$ ).
- A family living an affluent lifestyle in the U.S. could cause greater environmental damage than a whole village of African hunters and gatherers.

# Ecological Footprints Can Calculate Impact

- Another way to estimate our environmental impacts is to express our consumption choices into the equivalent amount of land required to produce goods and services.
- This gives us a single number, called our **ecological footprint**, which estimates the relative amount of productive land required to support each of us.
- For example, forests and grasslands store carbon, protect watersheds, purify our water, and provide wildlife habitat.

# Population Growth Could Bring Benefits

- More people means larger markets, more workers, and efficiencies of scale in mass production of goods.
- It also means more people to find new resources and better solutions to problems.
- Economist Julian Simon believed that people are the “ultimate resource” and that no evidence shows that pollution, crime, unemployment, crowding, the loss of species, or any other resource limitations will worsen with population growth.

## 4.3 Many Factors Determine Population Growth

- **Demography** encompasses vital statistics about people, such as births, deaths, and where they live, as well as total population size.
- In this section, we will investigate ways to measure and describe human populations and discuss demographic factors that contribute to population growth.

# How Many of Us are There?

- The United Nations estimate of 7 billion people in 2011 is only an estimate. Even in this age of information technology and advanced communication, counting the number of people in the world is an inexact science.
- We really live in two very different demographic worlds. One of these worlds is poor, young, and growing rapidly, while the other is rich, old, and shrinking in population size.

# We Live in a Demographically Divided World

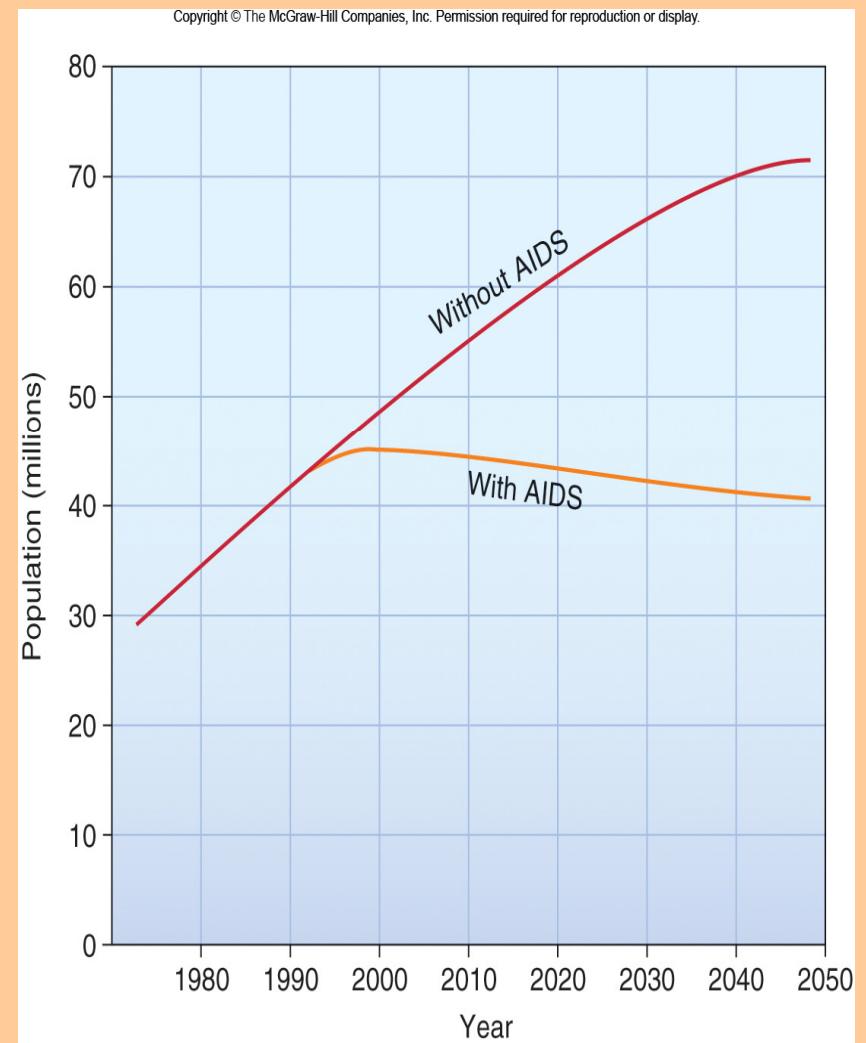
Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© Frans Lemmens/Getty

# AIDS Affects Population Growth Rates

- In Zimbabwe, Botswana, Zambia, and Namibia, up to 39% of the adult population have AIDS or are HIV positive.
- Without AIDS, the average life expectancy would have been nearly 70 years. Now, with AIDS, life expectancy has dropped to only 31.6 years.

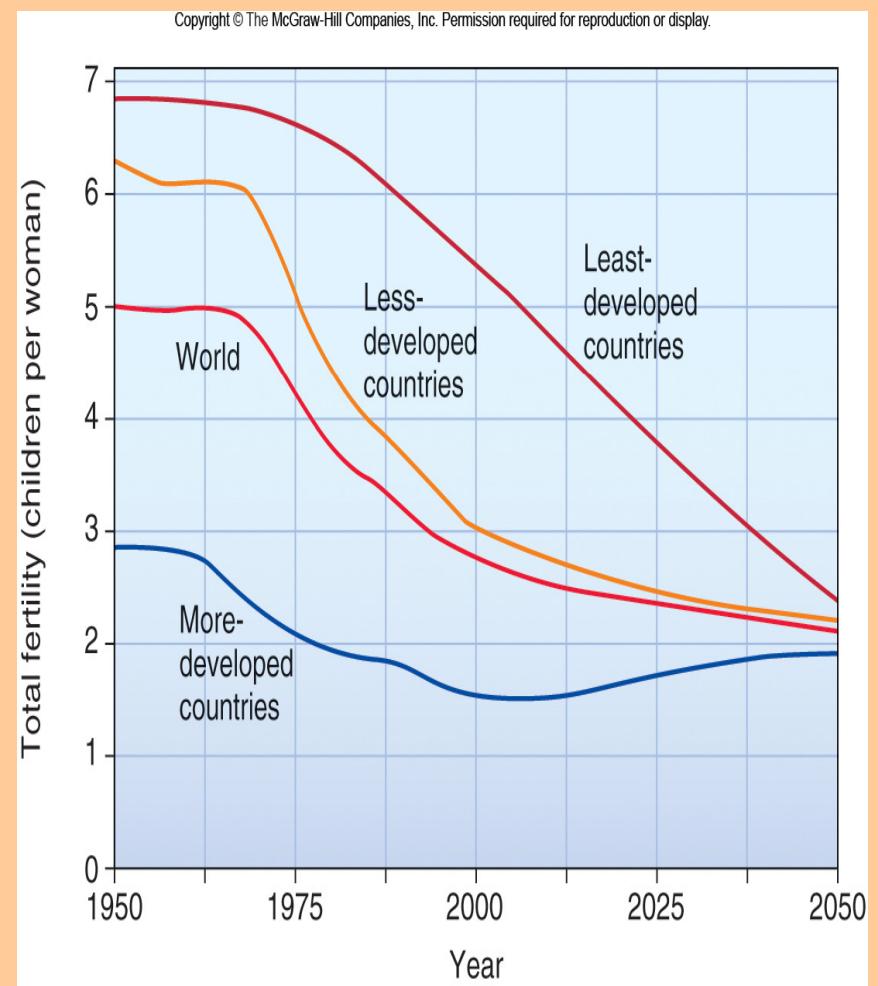


# **Factors Affecting Population Growth**

- Fertility varies among cultures and at different times.
- Mortality offsets births.
- Life expectancy is rising worldwide.
- Living longer has profound social implications.

# Fertility Varies Among Cultures and at Different Times

- The **total fertility rate** is the number of children born to an average woman in a population during her entire reproductive life.
- This rate varies according to many factors.



# World Fertility Rates are Declining

- **Zero population growth (ZPG)** occurs when births plus immigration in a population just equal deaths plus emigration.
- It takes several generations of replacement-level fertility to reach ZPG.
- Fertility rates have declined dramatically in most regions of the world over the past 50 years.
- While the world as a whole still has an average fertility rate of 2.6, growth rates are now lower than at any time since World War II.

# Life Expectancy is Rising Worldwide

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

**TABLE 4.2 | The World's Largest Countries**

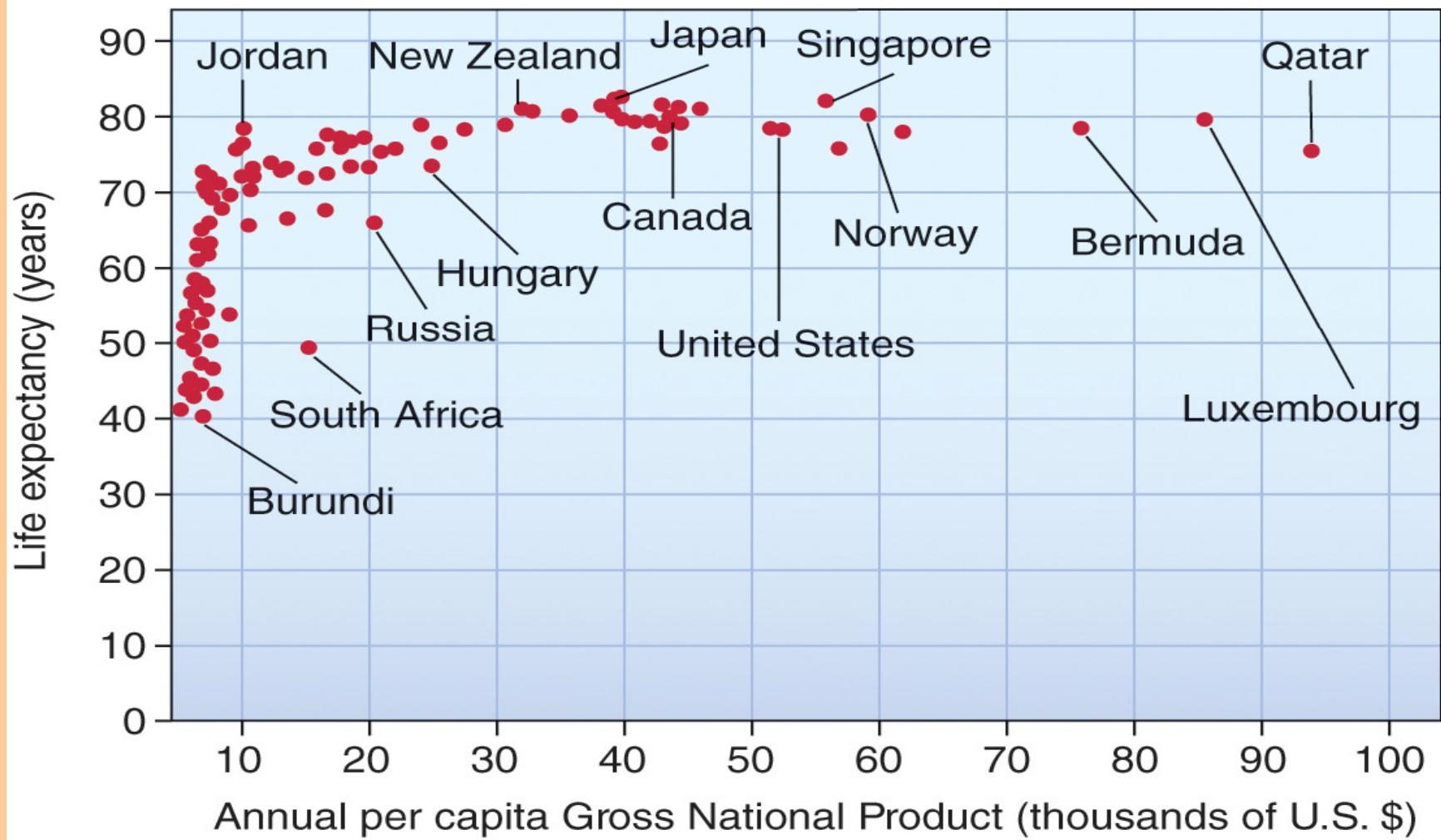
2010		2050	
COUNTRY	POPULATION (MILLIONS)	COUNTRY	POPULATION (MILLIONS)
China	1,339	India	1,628
India	1,204	China	1,437
United States	313	United States	420
Indonesia	240	Nigeria	299
Brazil	203	Pakistan	295
Pakistan	178	Indonesia	285
Bangladesh	159	Bangladesh	231
Nigeria	155	Brazil	220
Russia	142	Dem. Rep. of Congo	183

SOURCE: Data from the U.S. Census Bureau, 2012.

- **Life span** is the oldest age to which a species is known to survive.
- **Life expectancy** is the average age that a newborn infant can expect to attain in any given society.

# Life Expectancy is Related to Income

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

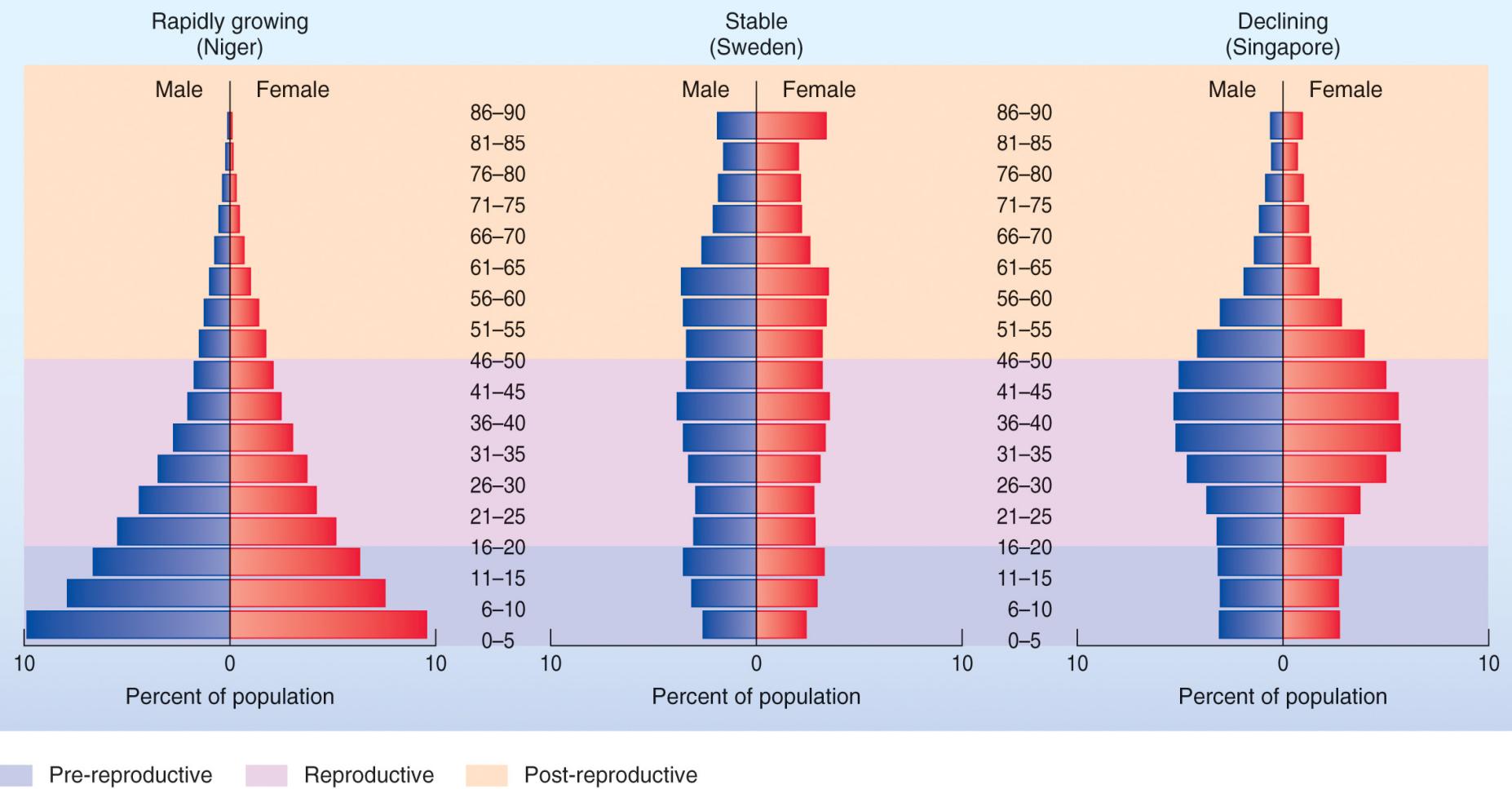


# Living Longer has Profound Social Implications

- **Age class histograms** can show differences between different ages of people in a population and illustrate the social implications of population growth.
- These histograms can be used to determine the **dependency ratio**, the number of nonworking compared with working individuals in a population.
- In Niger, for example, each working person supports a high number of children. In the United States, by contrast, a declining working population is now supporting an ever larger number of retired persons.

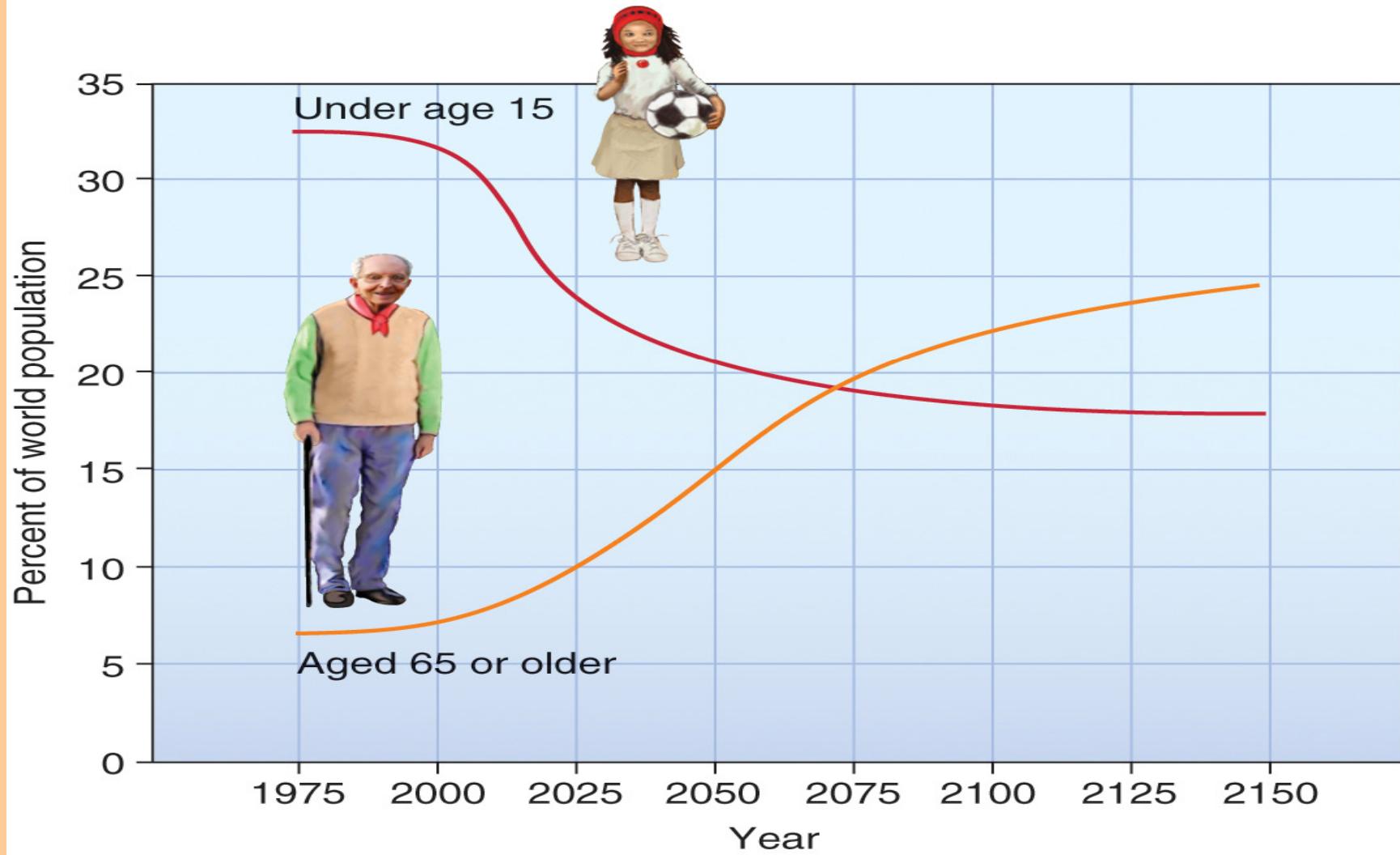
# Age Class Histograms

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



# Projection of Shifting Dependency Ratios

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



## 4.4 Fertility is Influenced by Culture

- A number of social and economic pressures affect decisions about family size which, in turn, affects the population at large. In this section we will examine both positive and negative pressures on reproduction.

# People Want Children for Many Reasons

- Factors that increase people's desire to have babies are called **pronatalist pressures**.
- Children may be the only source of support for elderly parents in countries without a social security system.
- Often children are valuable to the family not only for future income, but even more as a source of current income and help with household chores.
- Society also has a need to replace members who die or become incapacitated.

# In Low-tech Agricultural Areas Children are Additional Laborers

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© William P. Cunningham

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



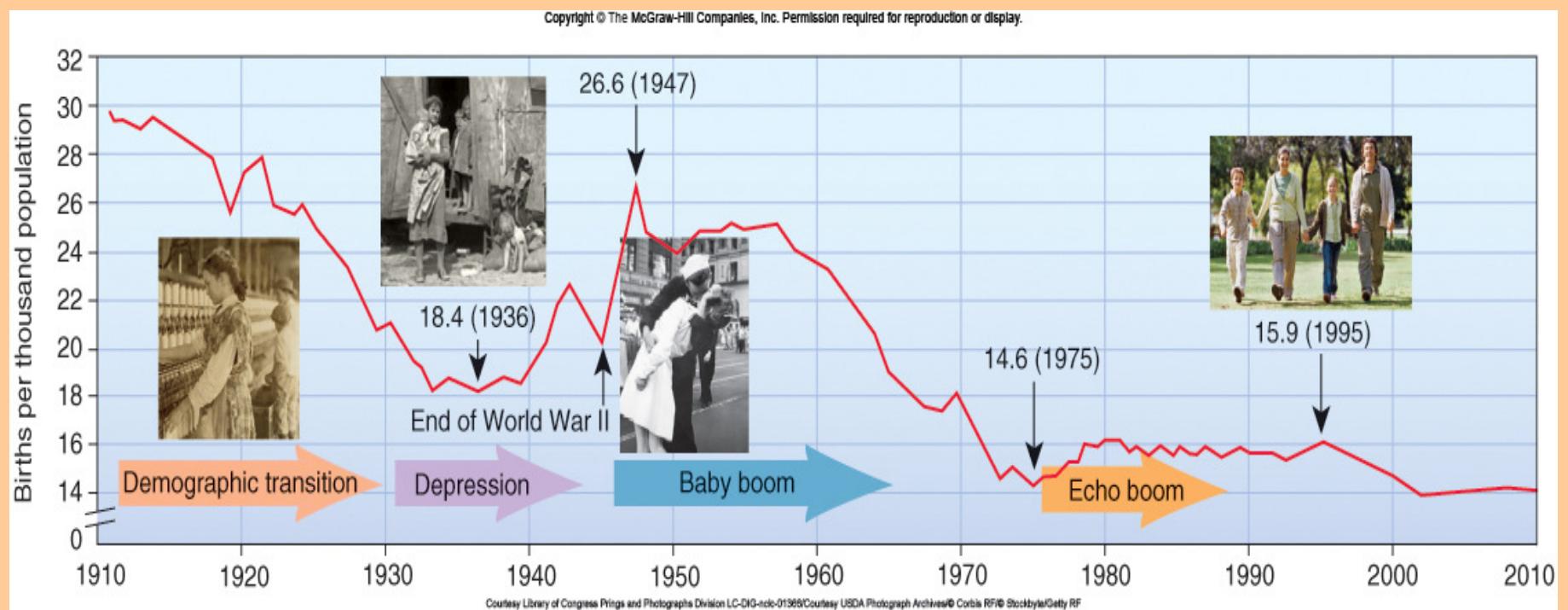
© Vol. 17/PhotoDisc/Getty RF

# **Education and Income Affect the Desire for Children**

- Highly developed countries
  - Higher education and personal freedom affect women to not have children.
  - The desire to spend time and money on other priorities limits the number of children.
- Developing countries
  - Feeding and clothing is minimally expensive, adding one more child is negligible compared to the costs in developed countries.

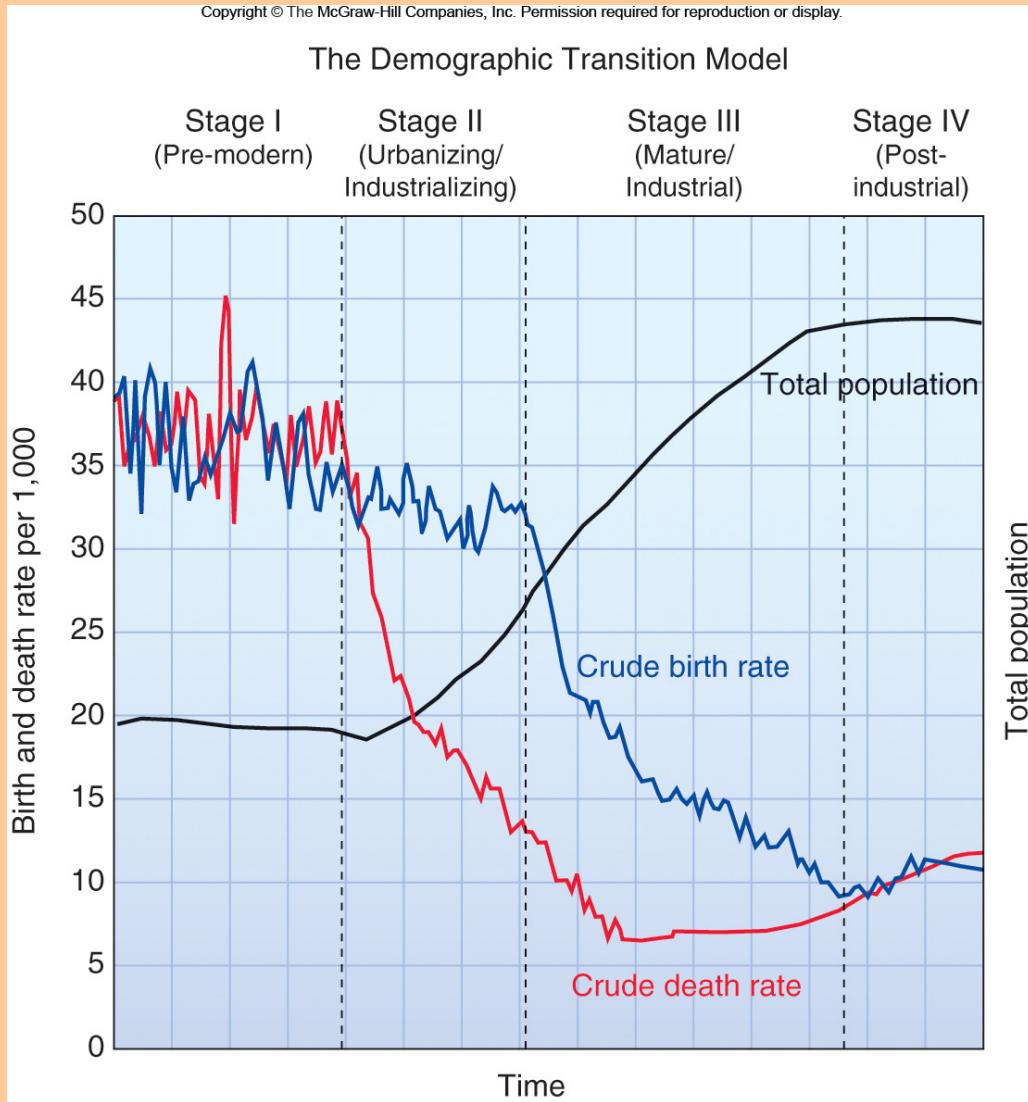
## 4.5 A Demographic Transition Can Lead to Stable Population Size

**Demographic transition** is a typical pattern of falling death rates and birth rates due to improved living conditions that usually accompanies economic development.

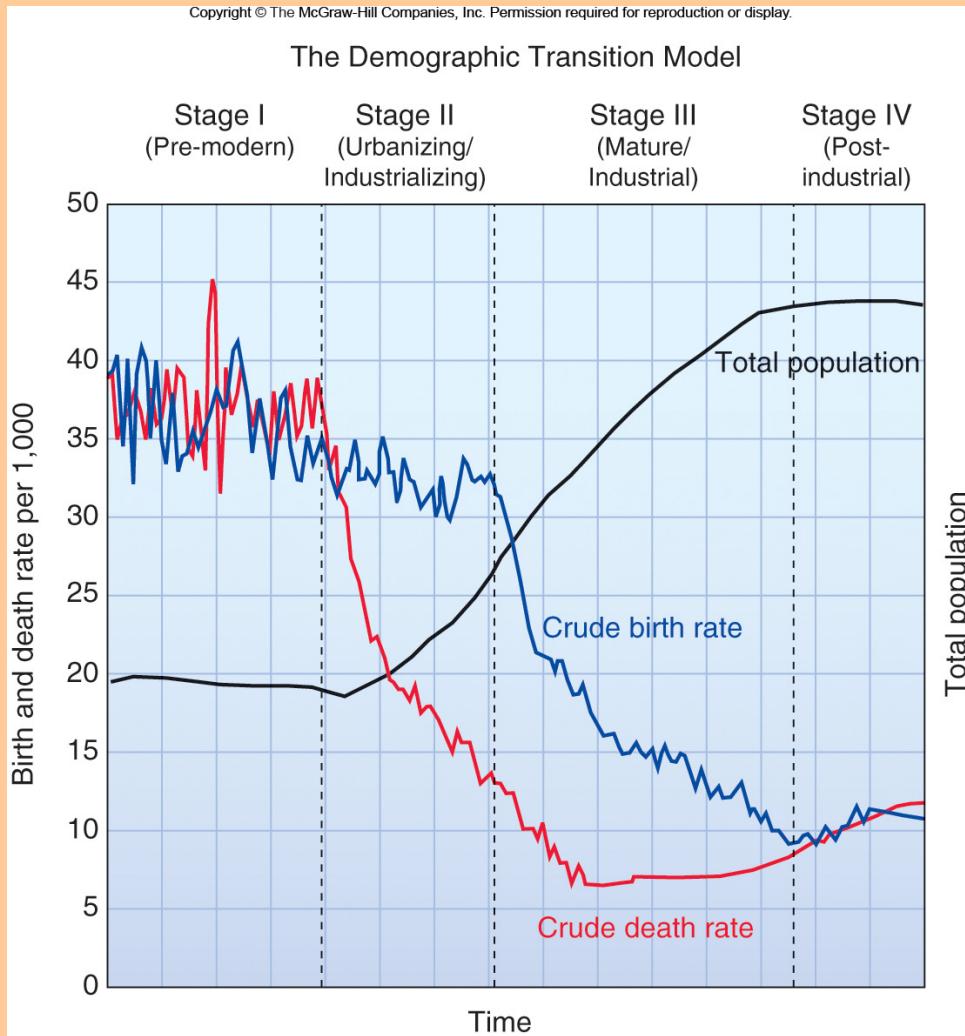


# Stage I

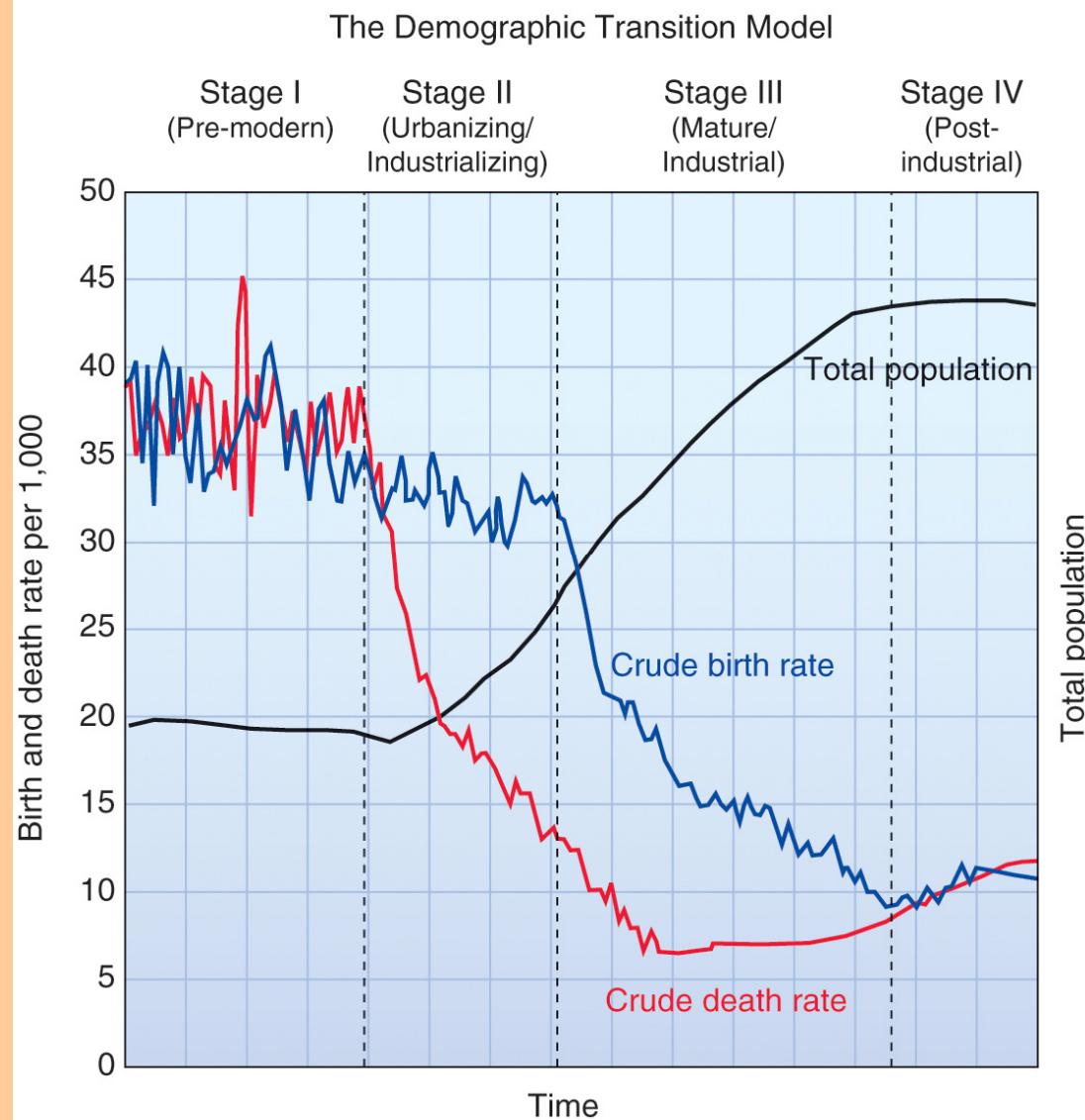
- Economic and social conditions change mortality and births.
  - Stage I represents the conditions in a premodern society.



# Stage II



- Economic development in Stage II brings better jobs, medical care, sanitation, and a generally improved standard of living, and death rates often fall very rapidly.

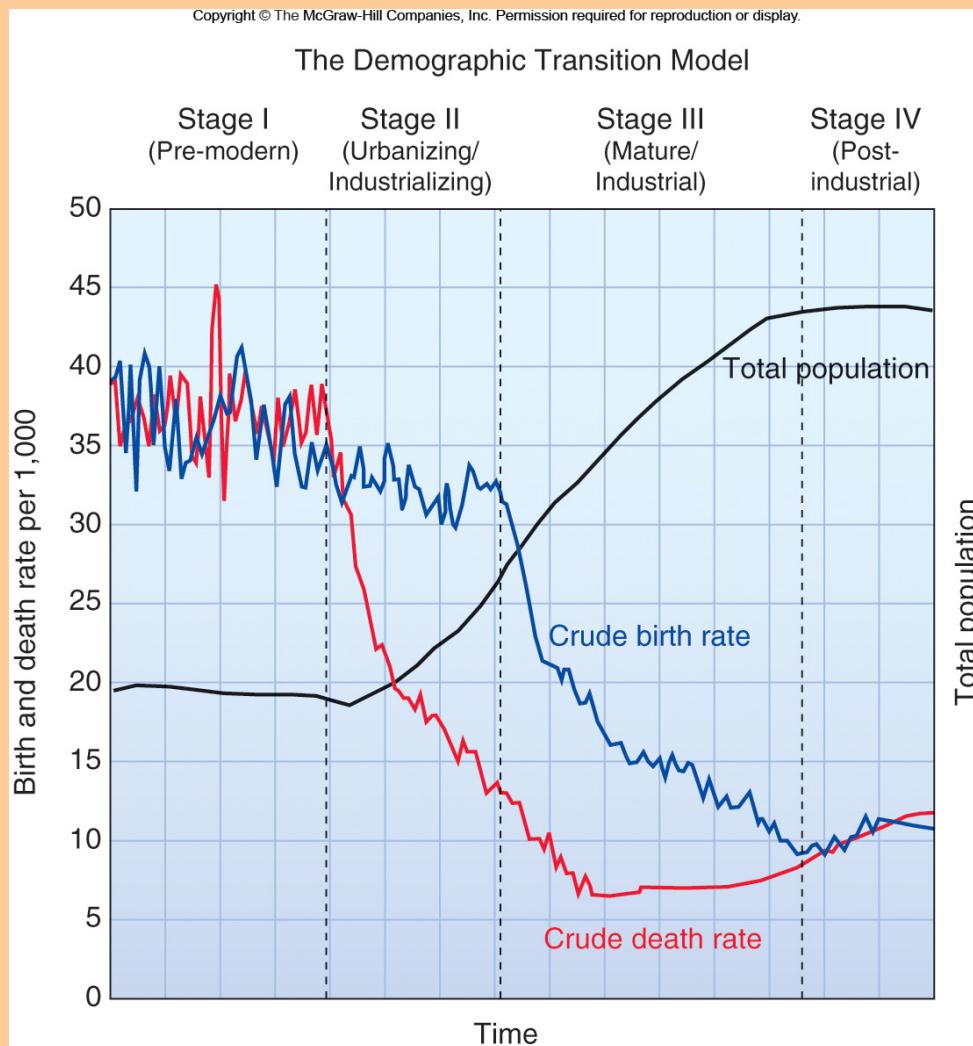


## Stage III

- Note that populations grow rapidly during Stage III when death rates have already fallen but birth rates remain high.

# Stage IV

- Stage IV represents conditions in developed countries, where the transition is complete and both birth rates and death rates are low, often a third or less than those in the predevelopment era.



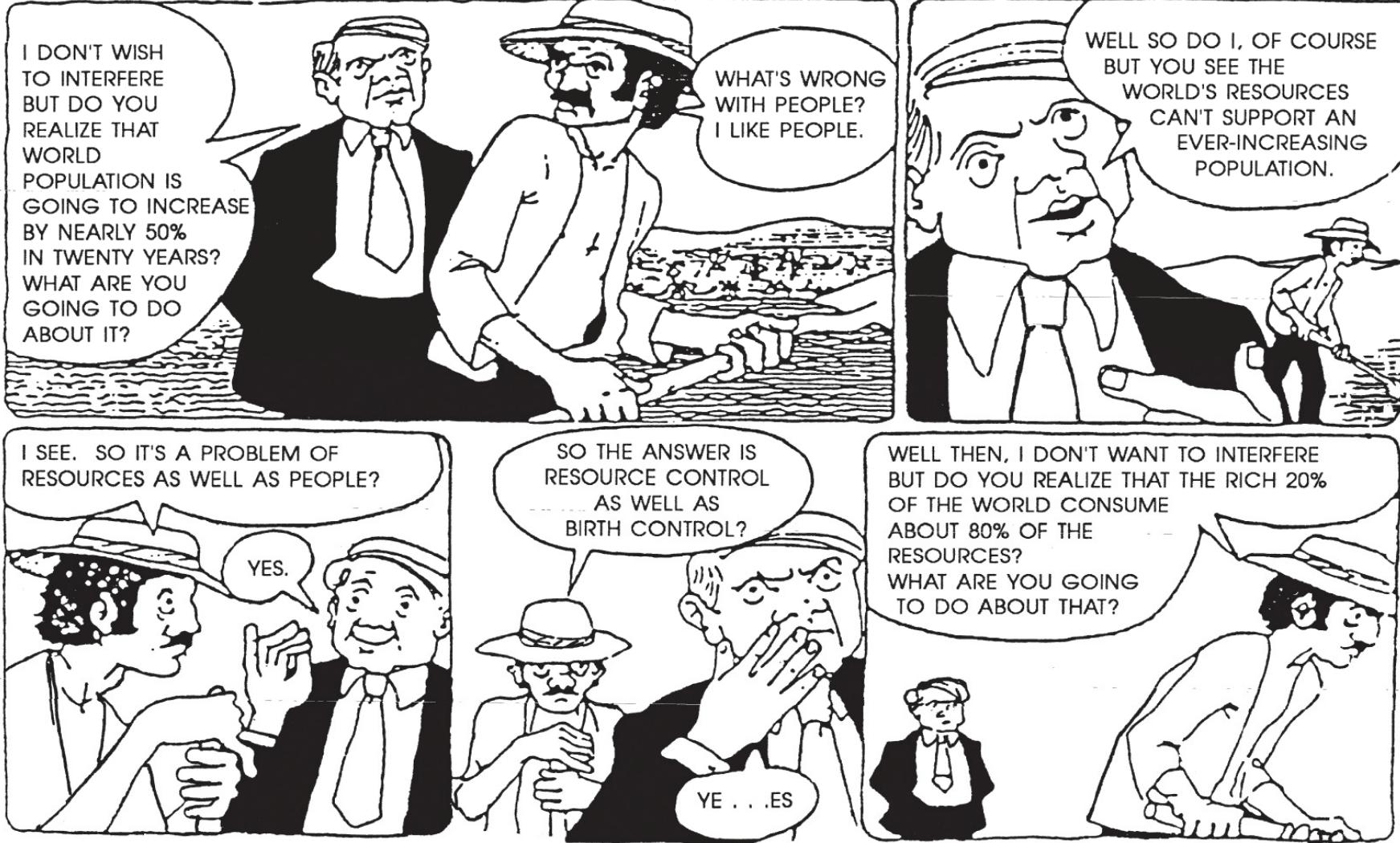
# **Many Countries are in a Demographic Transition**

- Some demographers claim that a demographic transition already is in progress in most developing nations.
- They believe that a lag between falling death and birth rates may hide this for a time but that the world population should stabilize sometime in this century.
- Some countries have had remarkable success in population control. In Thailand, China, and Colombia, for instance, total fertility dropped by more than half in 20 years. Morocco, Jamaica, Peru, and Mexico all have seen fertility rates fall by 30 to 40 percent.

# Two Ways to Complete the Demographic Transition

- The Indian states of Kerala and Andra Pradesh exemplify two very different approaches to regulating population growth.
- In Kerala, providing a fair share of social benefits to everyone is seen as the key to family planning.
- The leaders of Andra Pradesh, on the other hand, have adopted a strategy of aggressively emphasizing birth control, rather than promoting social justice.
- Both states have slowed population growth significantly.

# WHAT'S YOUR PROBLEM?

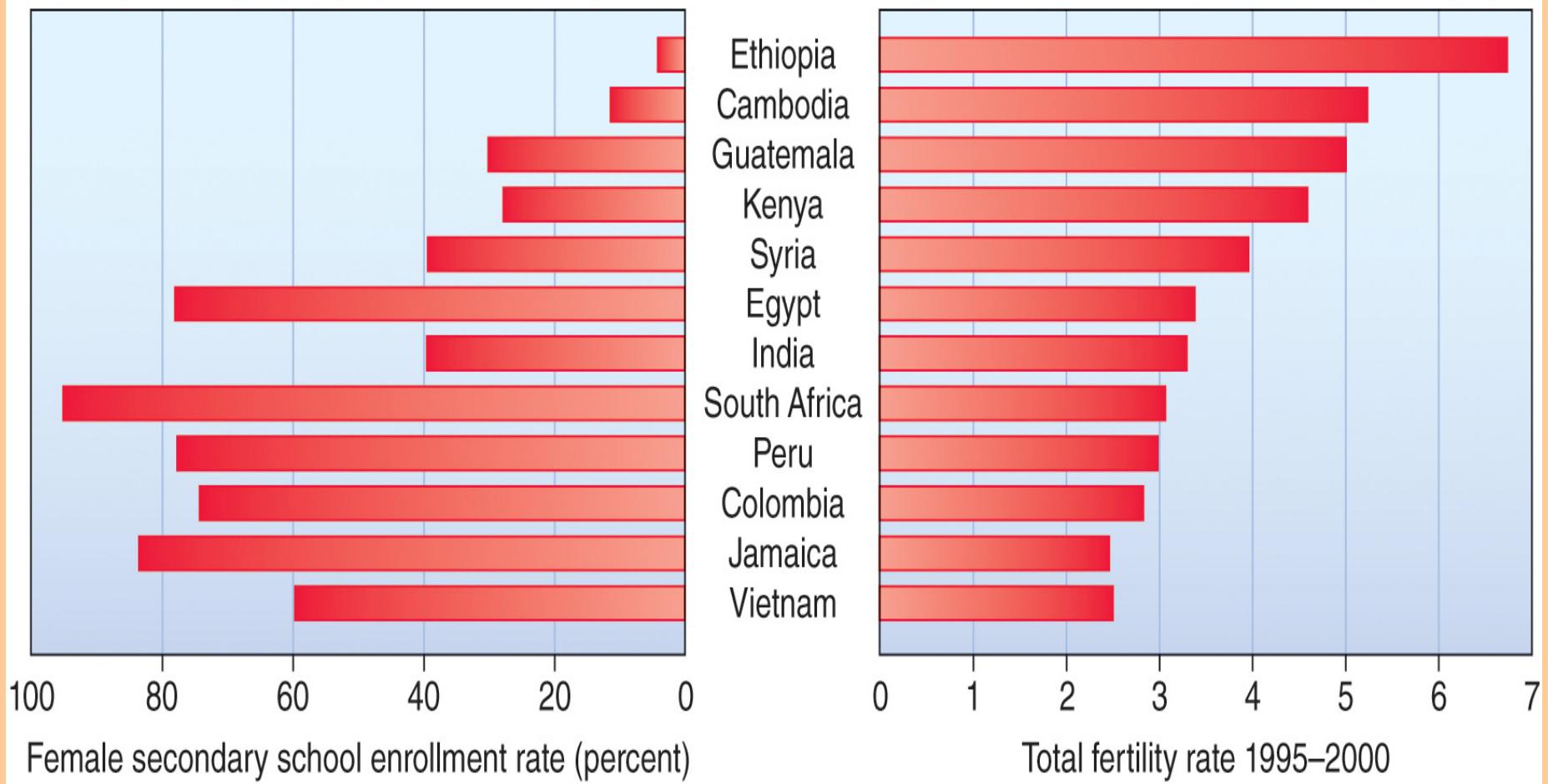


# Improving Women's Lives Helps Reduce Birth Rates

- A broad consensus reached by the 180 participating countries at the 1994 International Conference on Population and Development agreed that the following are necessary to help slow population growth:
  - responsible economic development
  - education and increased women's rights
  - high-quality health care (including family planning services)

# Total Fertility Declines as Women's Education Increases

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



## 4.6 Family Planning Gives Us Choices

- **Family planning** allows couples to determine the number and spacing of their children.
- **Birth control** usually means any method used to reduce births including celibacy, delayed marriage, contraception, and methods that prevent embryo implantation and other methods like induced abortions.

# **Humans Have Always Regulated Their Fertility**

- The high human birth rate of the last two centuries is not the norm, compared to previous millennia of human existence.
- Evidence suggests that people in every culture and every historic period used a variety of techniques to control population size.
- These have included taboos against intercourse while breast-feeding, celibacy, folk medicines, abortion, and infanticide.

# Today There are Many Options

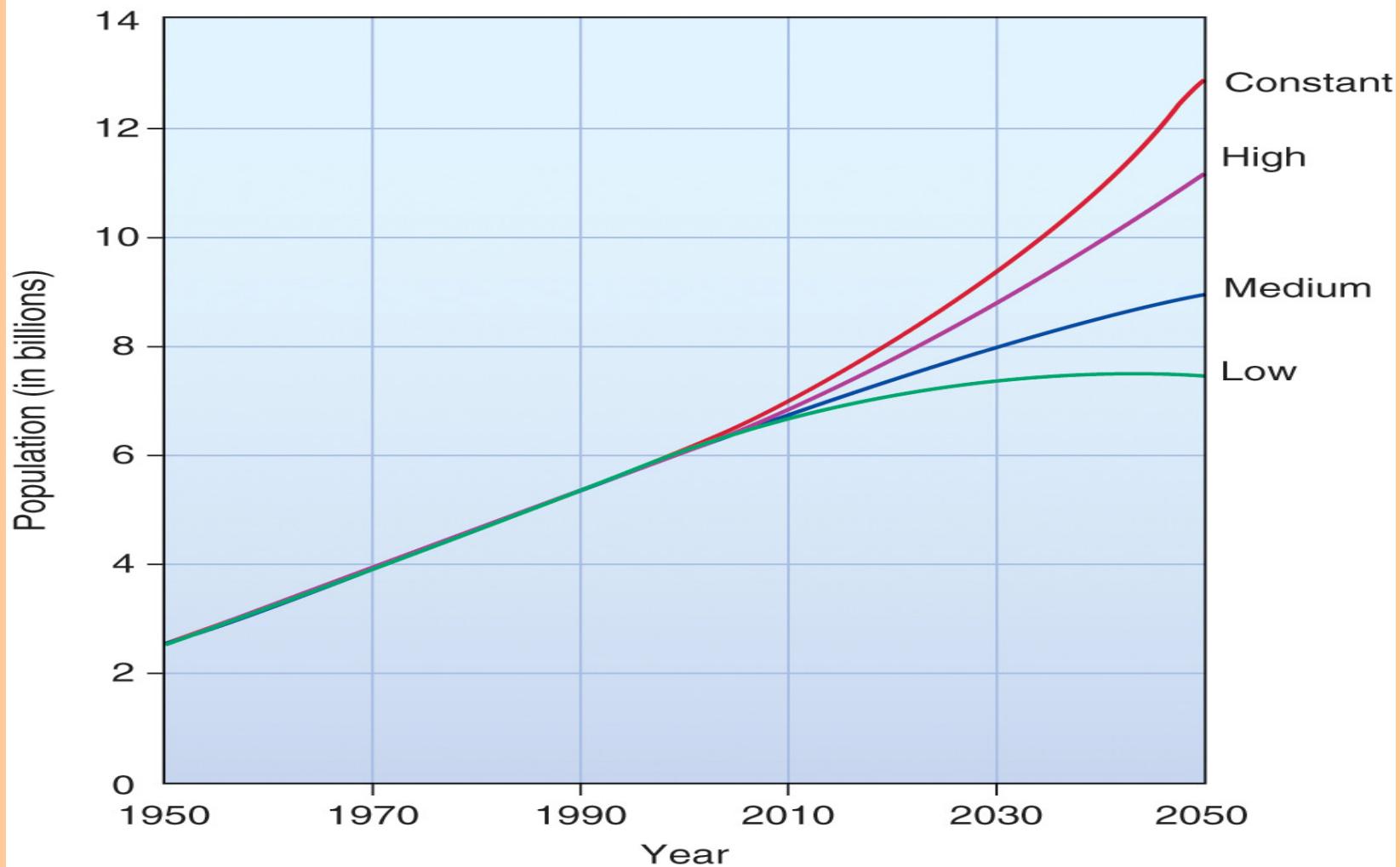
- More than 100 new contraceptive methods are now being studied, and some appear to have great promise to have great promise.
- Recently the U.S. Food and Drug Administration approved five new birth control products. Four of these use various methods to administer female hormones that prevent pregnancy.
- Other methods, such as vaccines for women or injections for men, are years away from use.

## 4.7 What Kind of Future are We Creating Now?

- Most demographers believe that world population will stabilize sometime during this century.
- When we reach that equilibrium, the total number of humans is likely to be somewhere around 8 to 10 billion.
- The United Nations Population Division projects four possible population scenarios.

# World Population Projections

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



# **Successful Family Planning Programs Often Require Significant Societal Changes**

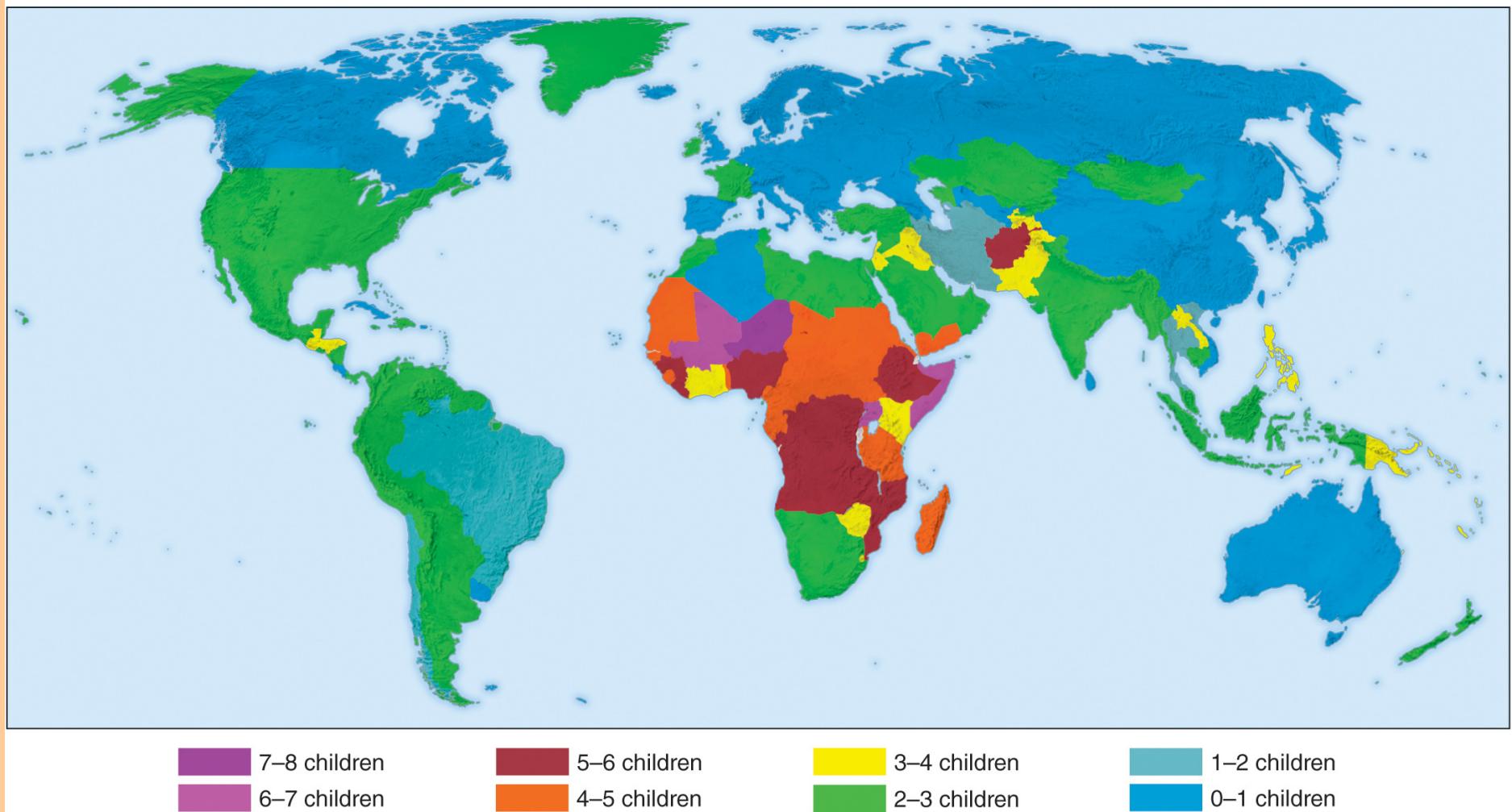
- Among the most important of these are:
  - Improved social, educational, and economic status for women.
  - Improved status for children.
  - Acceptance of calculated choice as a valid element in life in general and in fertility in particular.
  - Social security and political stability that give people the means and the confidence to plan for the future.
  - The knowledge, availability, and use of effective and acceptable means of birth control.

# Brazil Gives Us Hope For the Future

- Already, nearly half the world population lives in countries where the total fertility rate is at or close to the replacement rate.
- The example of Brazil gives us hope that with rising standards of living, population growth will spontaneously slow without harsh government intervention.

# Fertility Rates by Country

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



# Conclusion

- A few decades ago, we were warned that a human population explosion was about to engulf the world.
- However, birth rates have fallen, however, almost everywhere, and most demographers now believe that we will reach an equilibrium around 9 billion people in about 2050.
- How, or if, we should carry out family planning and utilize birth control remains controversial.
- How many humans our planet can support on a long-term basis also remains a vital question.