Chapter 7

The Human Population

Scientists Disagree on Earth's Carrying Capacity

Figure 7.1
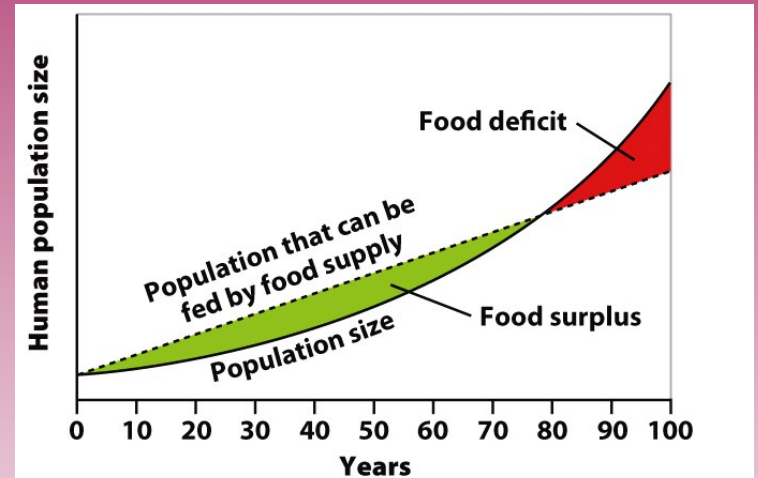*Environmental Science*
© 2012 W. H. Freeman and Company
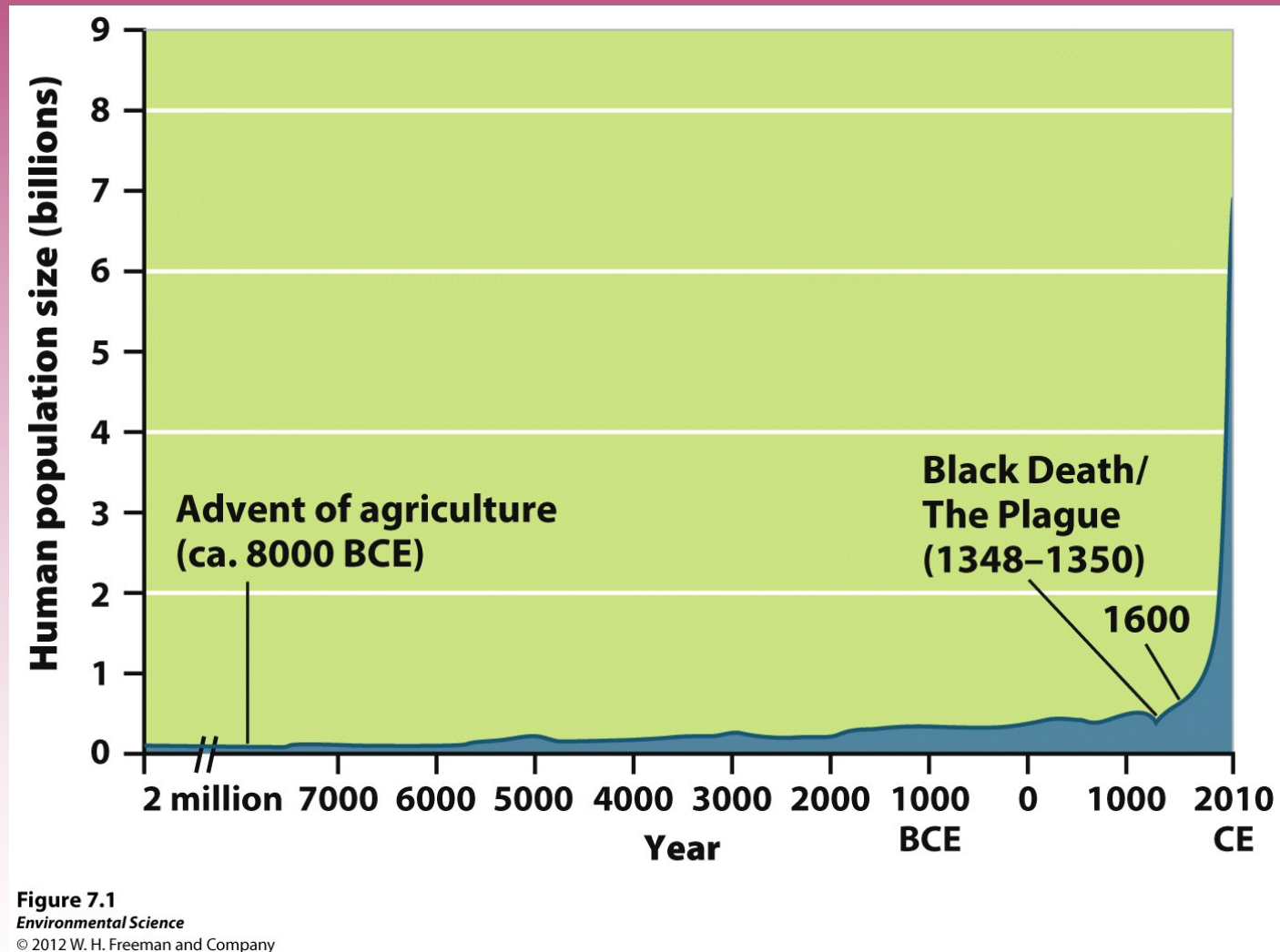
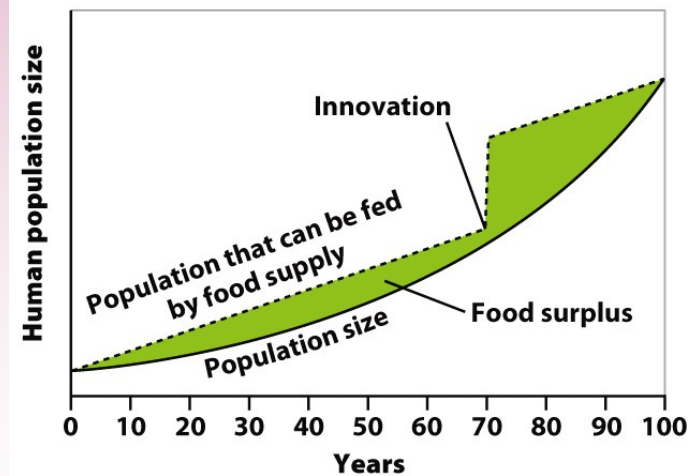Stabilize somewhere between 6.8-10.5 billion by 2100

Scientists Disagree on Earth's Carrying Capacity

- The following graphs show theoretical models of food supply and population size.

- Population exponential, but food production is _____.

What explains the difference?

(a) No significant improvement in agricultural technology

(b) Significant improvement in agricultural technology

Figure 7.2
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Factors that Drive Human Population Growth

- Demography- the study of human populations and population trends.
  - Changes in Population Size
  - Fertility
  - Life Expectancy
  - Age Structure
  - Migration

Changes in Population Size

- **Immigration**- the movement of people into a country

- **Emigration**- the movement of people out of a country.

- **Net migration rate-** the difference between immigration and emigration in a give year per 1,000 people in the country.
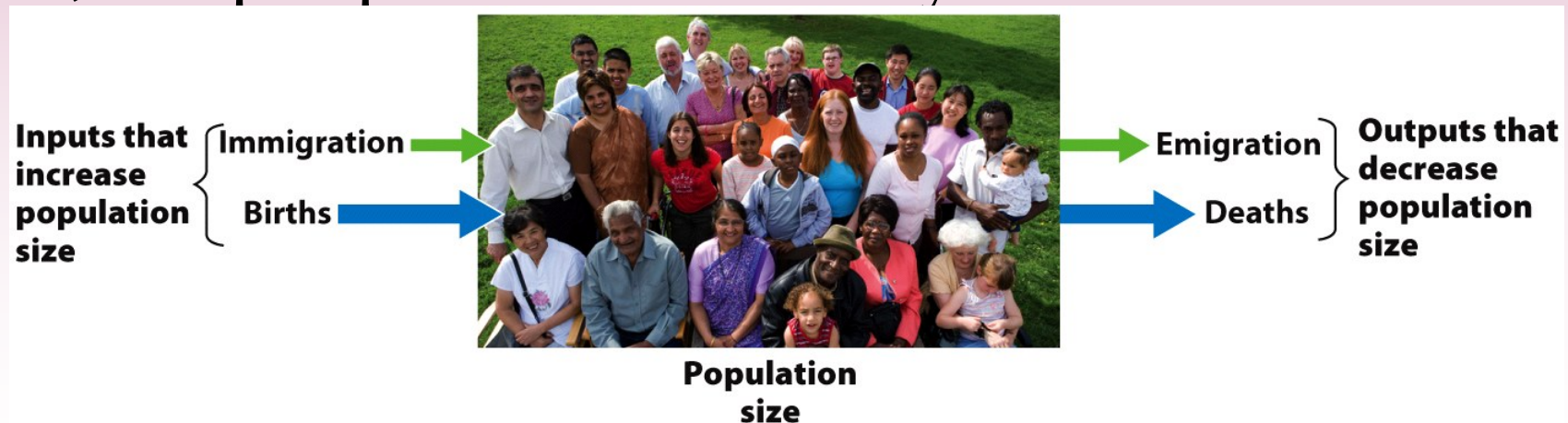

Figure 7.3
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Growth Rate (r%)

- r% = new population/old population x 100

- What happens to the population over time if r is constant and positive?

Changes in Population Size

- Crude birth rate (CBR)= the number of births per 1,000 individuals per year.

- Crude death rate (CDR)= the number of deaths per 1,000 individuals per year.

- Global population growth rate =

    (CBR- CDR)/ 10

- National population growth rate =

    (CBR+ immigration) - (CDR + emigration)/ 10

- Doubling time (in years)= 70/growth rate (%)

Fertility

- Total fertility rate- an estimate of the average number of children that each woman in a population will bear.

- Replacement level fertility- the total fertility rate required to offset the average number of deaths in a population and for the current population size to remain stable.

- Replacement level fertility is 2.1 in developed countries
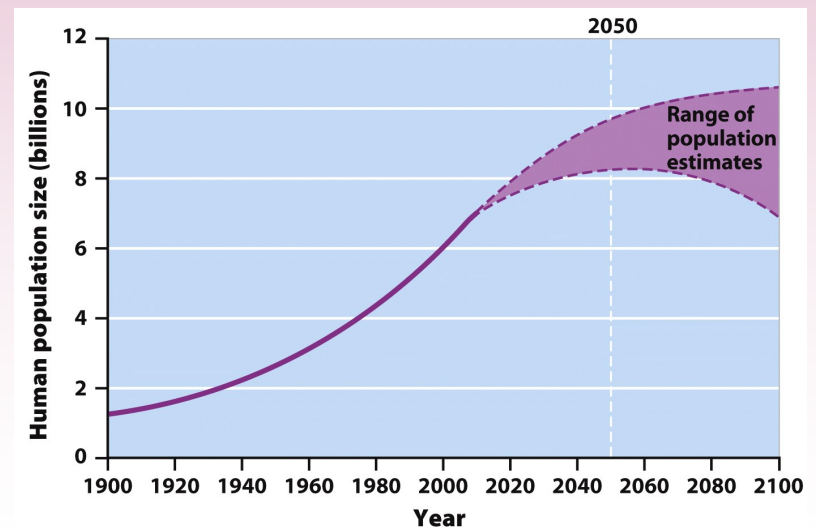
Are the TFRs different for the min and max predictions?

Figure 7.4
Environmental Science
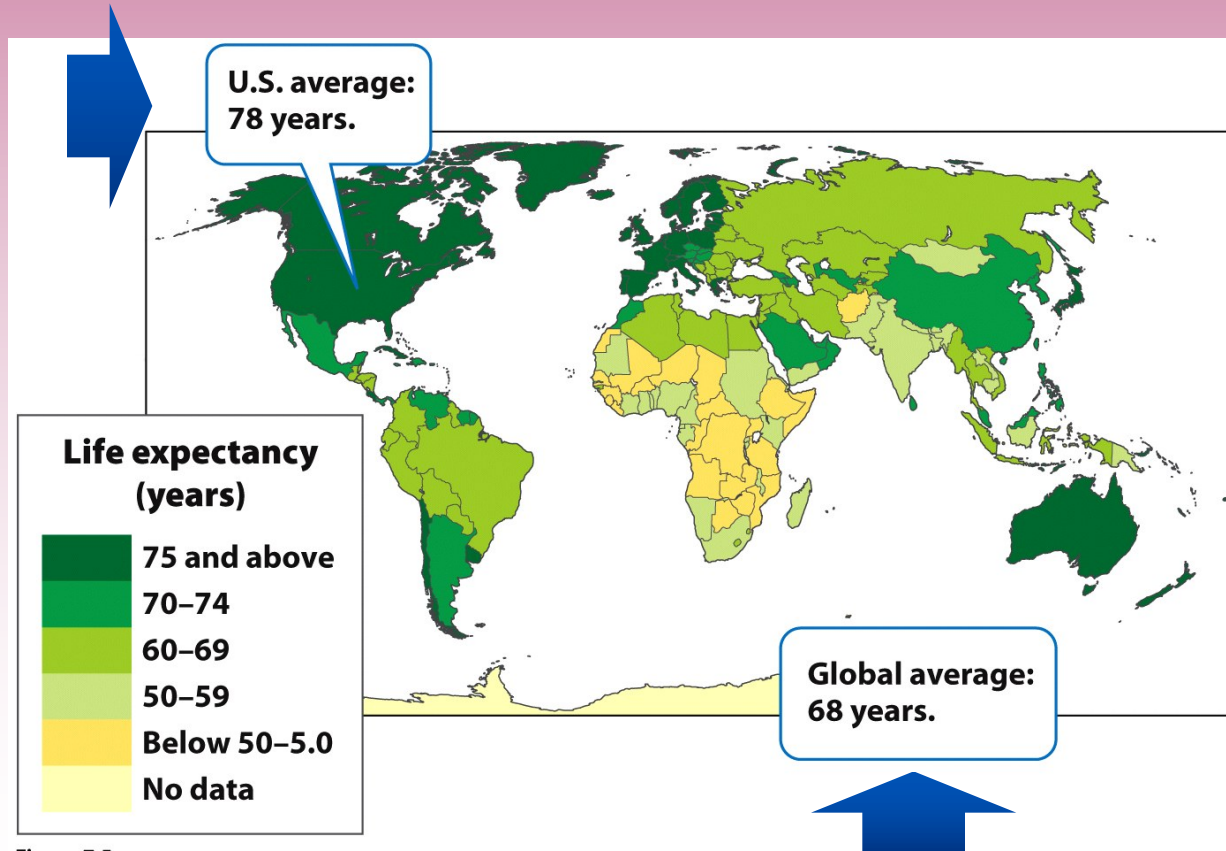© 2012 W. H. Freeman and Company

Fertility

- Developed countries- countries with relatively high levels of industrialization and income. (TFR ~ 2.1)

- Developing countries- countries with relatively low levels of industrialization and income of less that $3 per person per day. (TFR>2.1)

What happens if TFR <2.1?

Life Expectancy

- Life expectancy- the average number of years that an infant born in a particular year in a particular country can be expected to live, given the current average life span and death rate of that country.

U.S. average: 78 years.

Life expectancy (years)
- 75 and above
- 70–74
- 60–69
- 50–59
- Below 50–5.0
- No data

Global average: 68 years.

Figure 7.5
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Subsaharan?

What would increase life expectancy?

Life Expectancy

- Infant mortality rate- the number of deaths of children under 1 year of age per 1,000 live births.

- Child mortality rate- the number of deaths of children under age 5 per 1,000 live births.
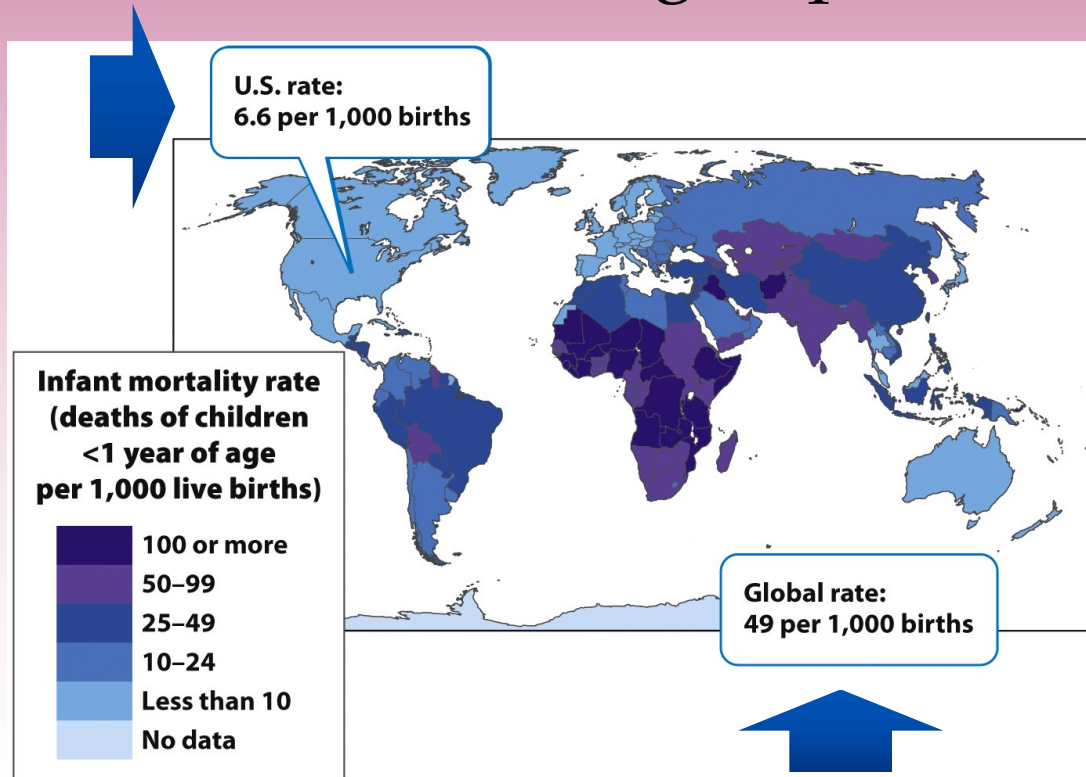
U.S. rate:
6.6 per 1,000 births

Infant mortality rate (deaths of children <1 year of age per 1,000 live births)

- 100 or more
- 50–99
- 25–49
- 10–24
- Less than 10
- No data

Global rate:
49 per 1,000 births

Figure 7.6
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What accounts for low infant mortality?

- Disease (HIV)
- Many old people = high CDR

Age Structure

- Age structure diagrams (population pyramids)-visual representations of age structure within a country for males and females.

- As shown in figure 7.8

Figure 7.8
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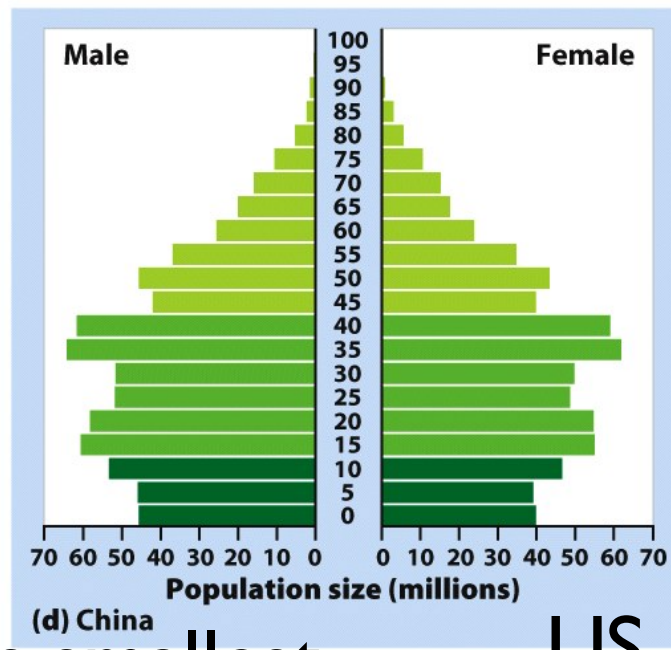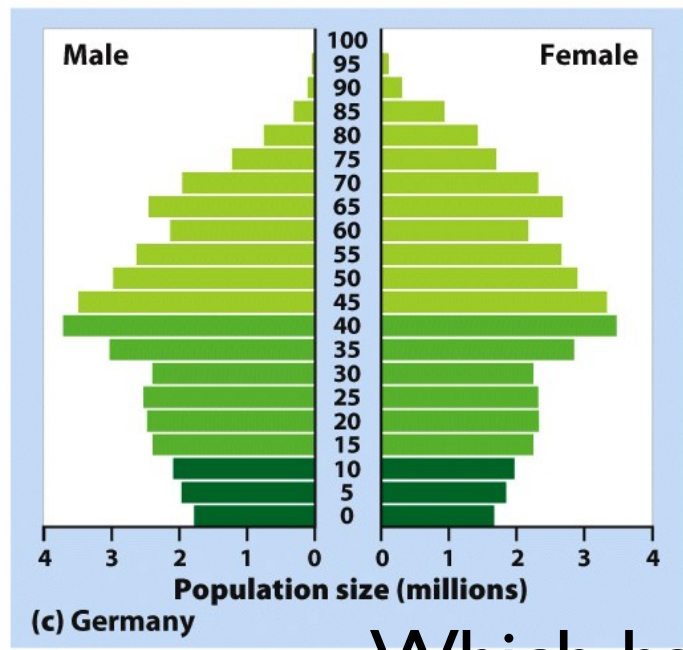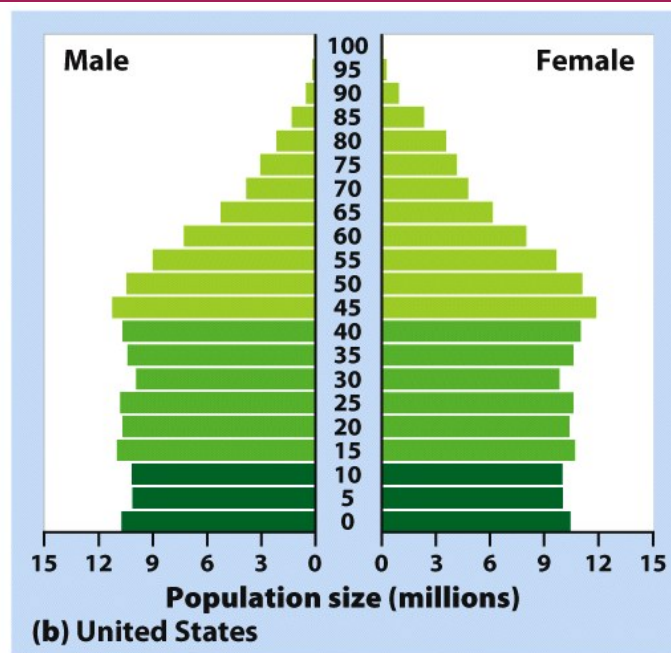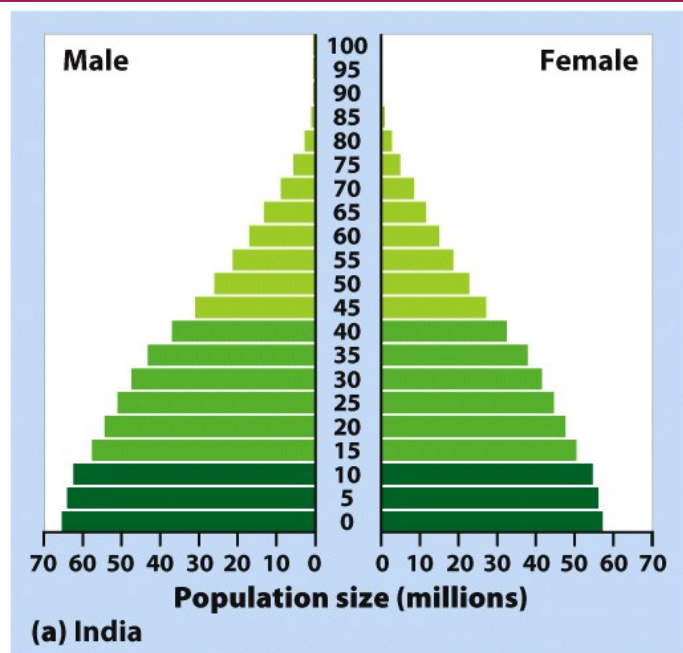
Matching:
a) Stable
b) Declining
c) Growing

a) Italy
b) Canada
c) China
d) Venezuela

Which has smallest population?

US – how many females under 15?

The Demographic Transition

- The theory of the demographic transition is the theory that as a country moves from a subsistence economy to industrialization and increased affluence, it undergoes a predictable shift in population growth.
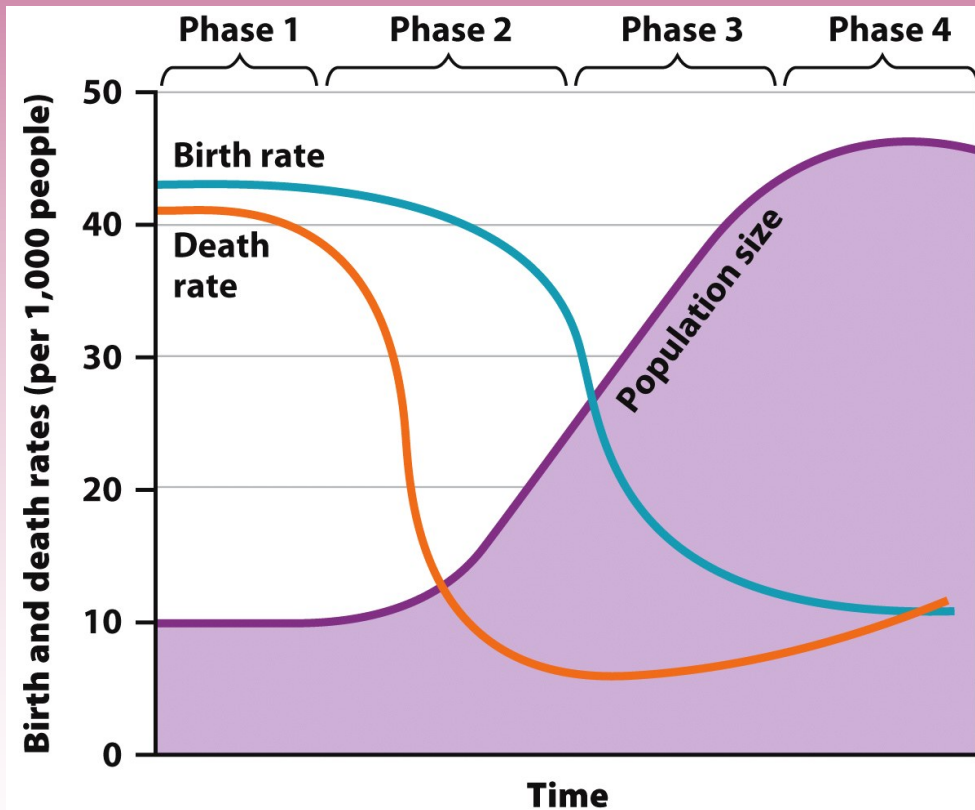

Figure 7.9
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Which pyramid fits?
Inverted pyramid
House
Pyramid

Industrialization
Subsistence/Preindustrial
Affluence & high econ dev
Economy & Educ improve

The Stages of the Demographic Transition

- Phase 1: Slow population growth because there are high birth rates and high death rates which offset each other.

- Phase 2: Rapid population growth because birth rates remain high but death rates decline due to better sanitation, clean drinking water, increased access to food and goods, and access to health care.

- Phase 3: Stable population growth as the economy and educational system improves and people have fewer children.

- Phase 4: Declining population growth because the relatively high level of affluence and economic develop encourage women to delay having children.

Family Planning

- Family planning- the regulation of the number or spacing of offspring through the use of birth control.
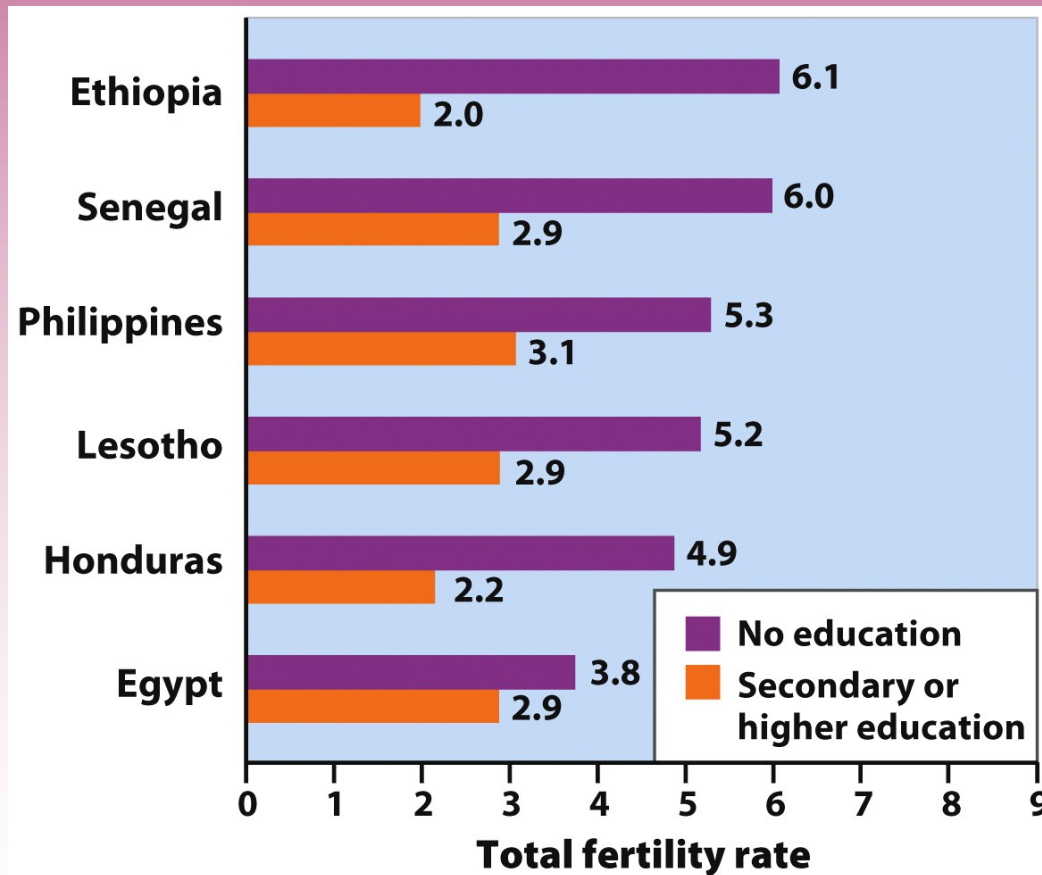
What is a really good way to slow population growth?

Figure 7.12
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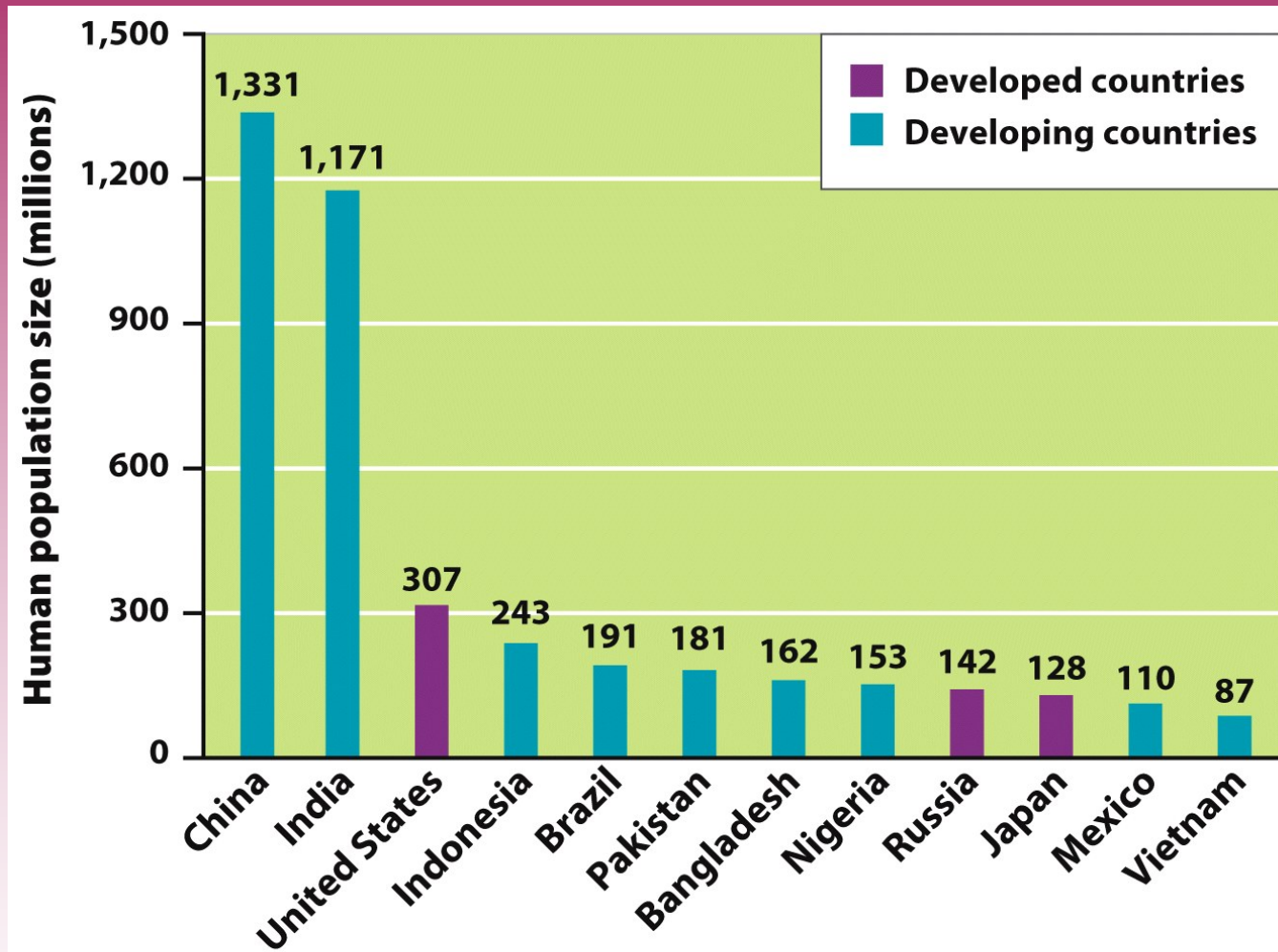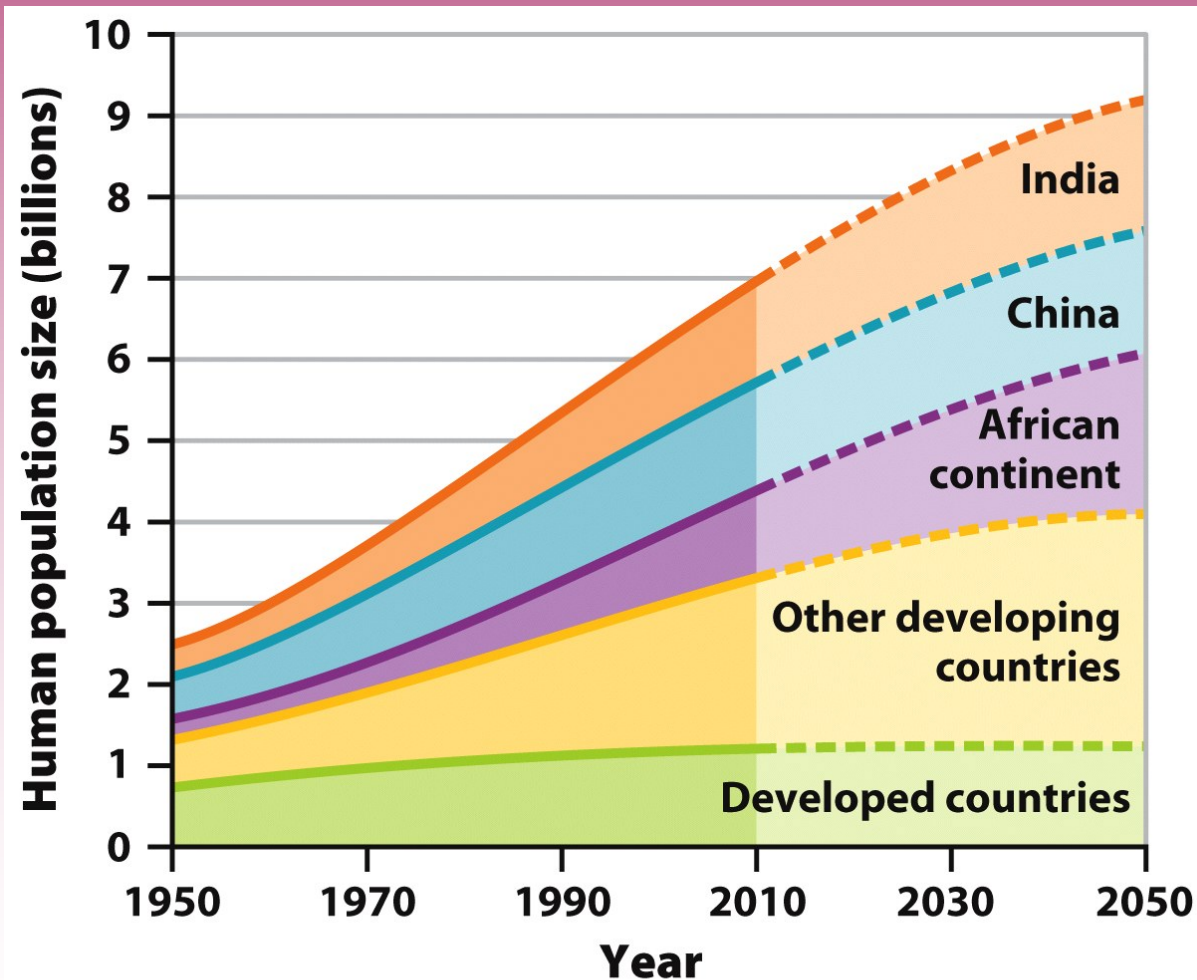# The 12 Most Populous Countries in the World

Figure 7.13
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The relationship between economic development and population growth rate for developing nations.

Figure 7.14
Environmental Science
© 2012 W. H. Freeman and Company

What is the total population in the year 2050?

How would you find %change from 2010 to 2050?

Ecological Footprints

- **Affluence** - having a lot of wealth such as money, goods, or property.

Figure 7.15
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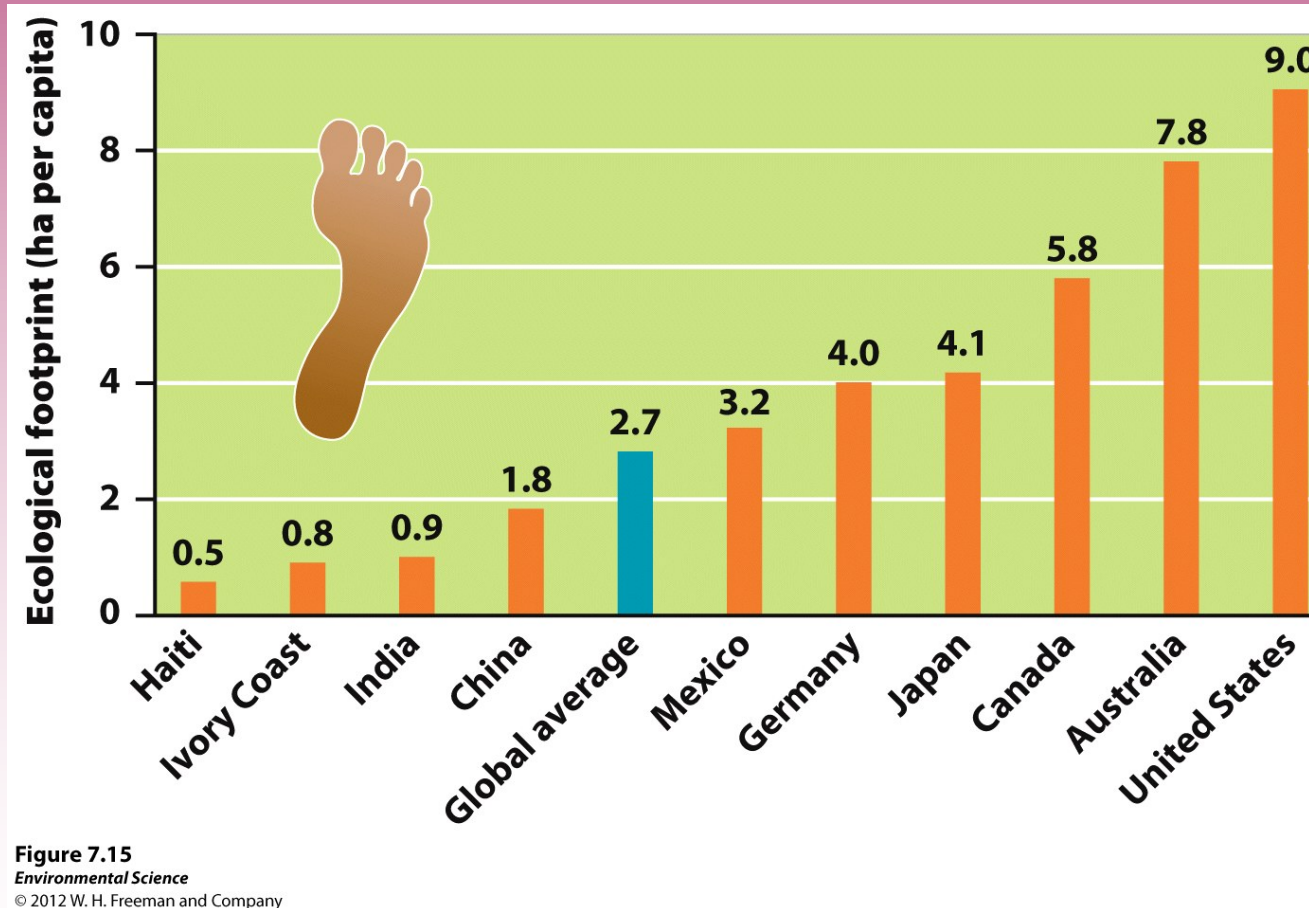
More than 50% of US's footprint is from making our STUFF

The IPAT Equation

- To estimate the impact of human lifestyles on Earth we can use the IPAT equation:

- **I**mpact= **P**opulation X **A**ffluence X **T**echnology

Figure 7.16a
Environmental Science
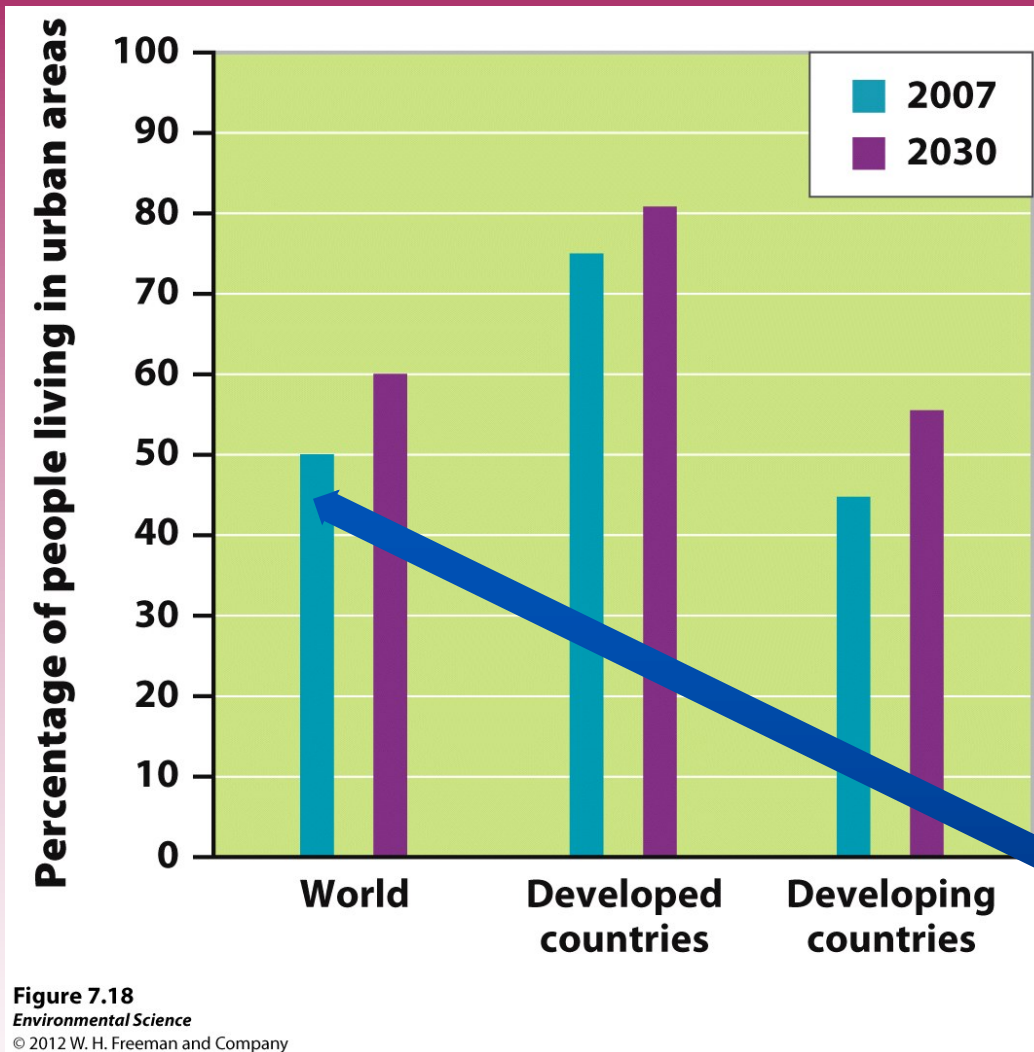© 2012 W. H. Freeman and Company

Figure 7.16b
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Figure 7.18
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What are some pros and cons for the environment of living in urban areas?

Urban populations – 50% of world
Use 75% of resources

TABLE 7.1 The 20 largest urban areas in the world

Rank	City, country	Population (millions)
1	Tokyo, Japan	35.7
2	New York–Newark, United States	19.0
3	Mexico City, Mexico	19.0
4	Mumbai, India	19.0
5	São Paulo, Brazil	18.9
6	Delhi, India	16.0
7	Shanghai, China	15.0
8	Kolkata, India	14.8
9	Dacca, Bangladesh	13.5
10	Buenos Aires, Argentina	12.8
11	Los Angeles–Long Beach–Santa Ana, United States	12.5
12	Karachi, Pakistan	12.1
13	Cairo, Egypt	11.9
14	Rio de Janeiro, Brazil	11.8
15	Osaka–Kobe, Japan	11.3
16	Beijing, China	11.1
17	Manila, Philippines	11.1
18	Moscow, Russia	10.4
19	Istanbul, Turkey	10.0
20	Paris, France	9.90

Source: United Nations Population Division.
Note: Data are from 2007 and contain the areas defined by the United Nations as "urban agglomerations."

Table 7.1
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The Impact of Affluence

- Gross domestic product (GDP)- the value of all products and services produced in a year in that country.

- GDP is made up of consumer spending, investments, government spending, and exports minus imports.

- A countries GDP often correlates with its pollution levels.

Urban area Shantytowns
A billion may live with out potable water, adequate housing, sanitation, health care, jobs…

Figure 7.19
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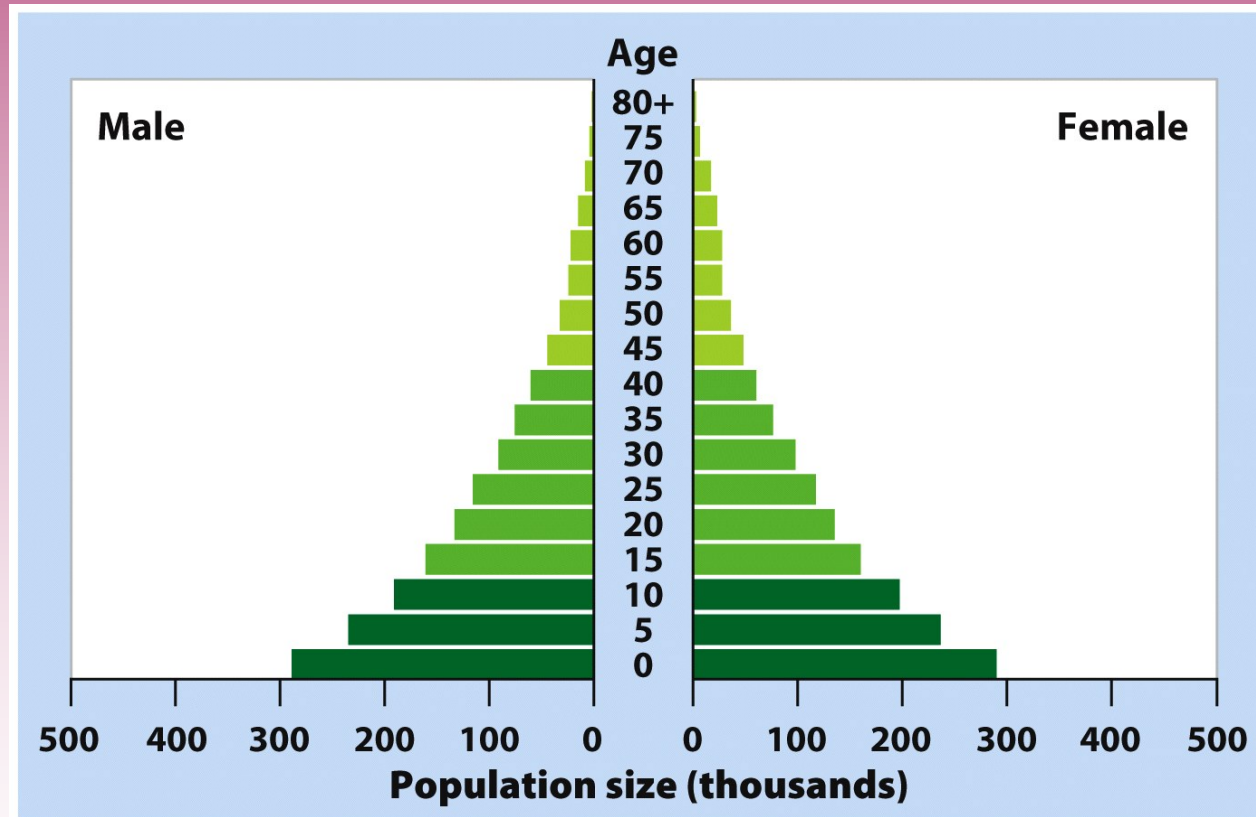# Gender Equity and Population Control in Kerala State (India)…
A Success Story

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India

Bay of
Bengal

Arabian
Sea

Kerala

Indian Ocean

Unnumbered 7 p197b
Environmental Science
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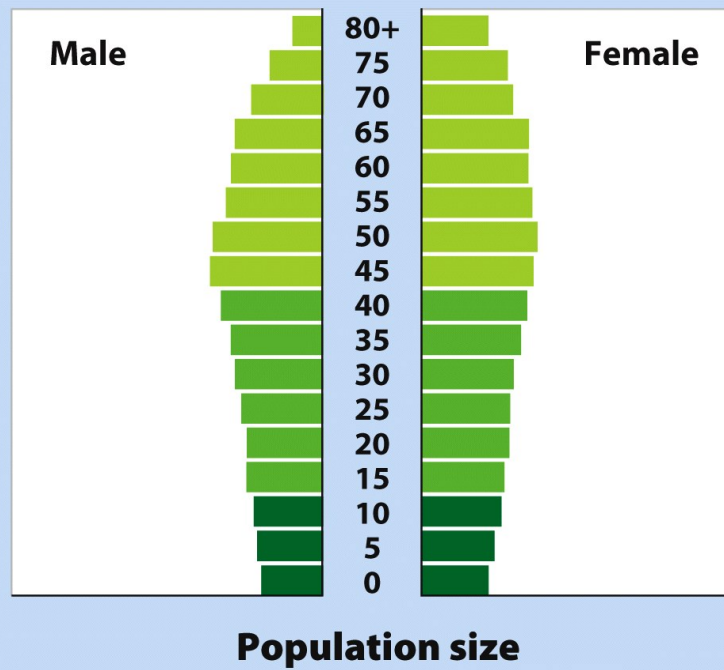# What can you tell about this country based on its Population Pyramid?

Multiple Choice 7.5
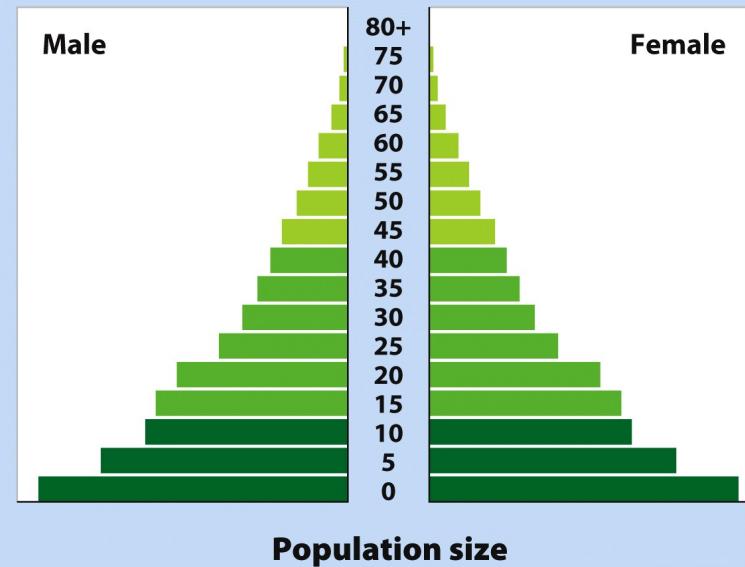*Environmental Science*
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Compare A to B

Country A

Male | Female

80+
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

Population size

Free-Response 7.2a
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Country B

Male | Female

80+
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

Population size

Free-Response 7.2b
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