ENVE203
Environmental Engineering Ecology
(Dec 10, 2012)

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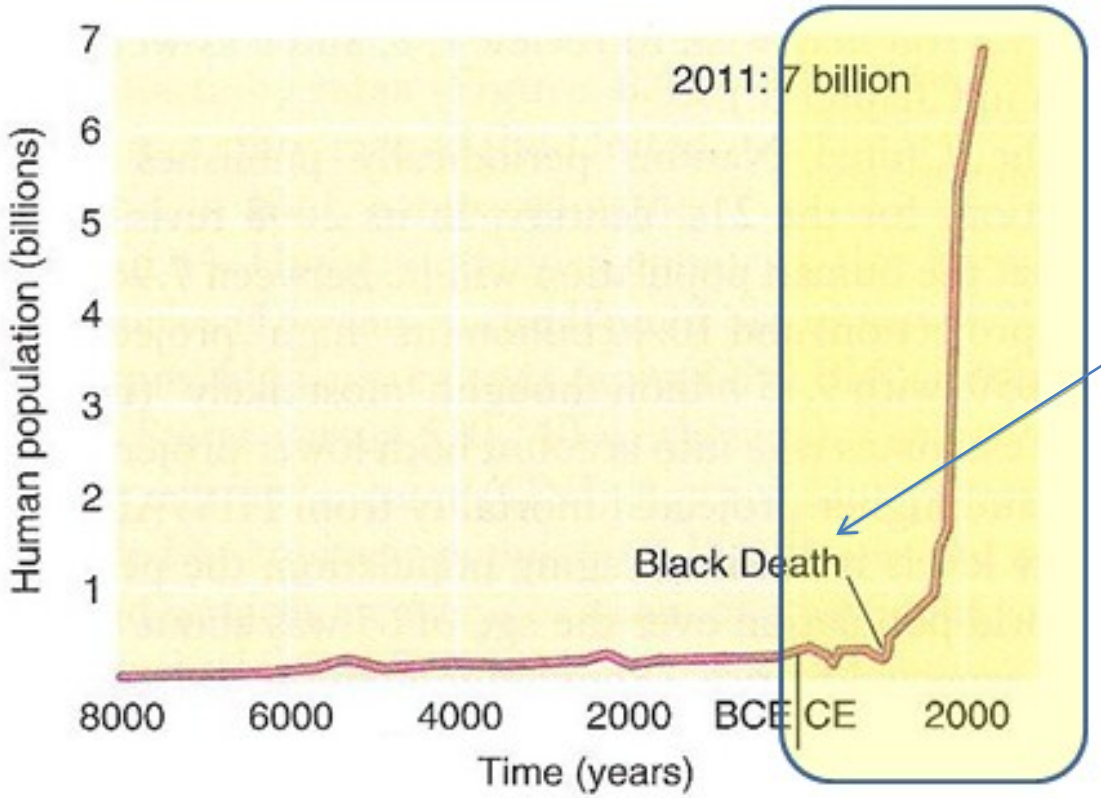
'The Human Population'

Demography

Science of human population structure & growth

Application of population statistics: Demographics

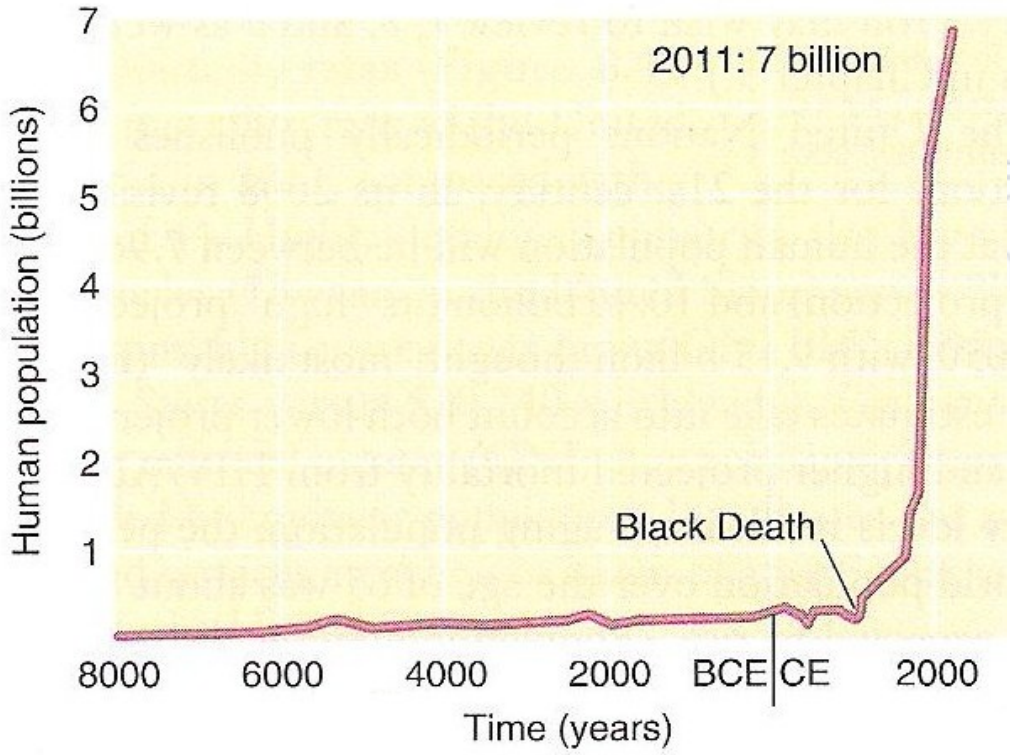


Devastating disease in the 14th century

During the last 1000 years, the human population has been increasing exponentially

Demography

Population experts predict that the population will level out during the 21st century, possibly forming the S curve observed in other species



Current and Future Population Numbers

World population: 7 billion in 2011

increased by about 95 million from 2010 to 2011

Increase due to an increase in the birth rate? (*b*)

The world birth rate has declined during the past 200 years

Increase in population was due to a dramatic decrease in the death rate (*d*)

Current and Future Population Numbers

decrease in the death rate (*d*)

- Greater food production
- Better medical care
- Improvements in water quality
- Improvements in sanitation practices

Growth rate will continue to decrease slowly until zero population growth is attained

→ when birth rate equals death rate

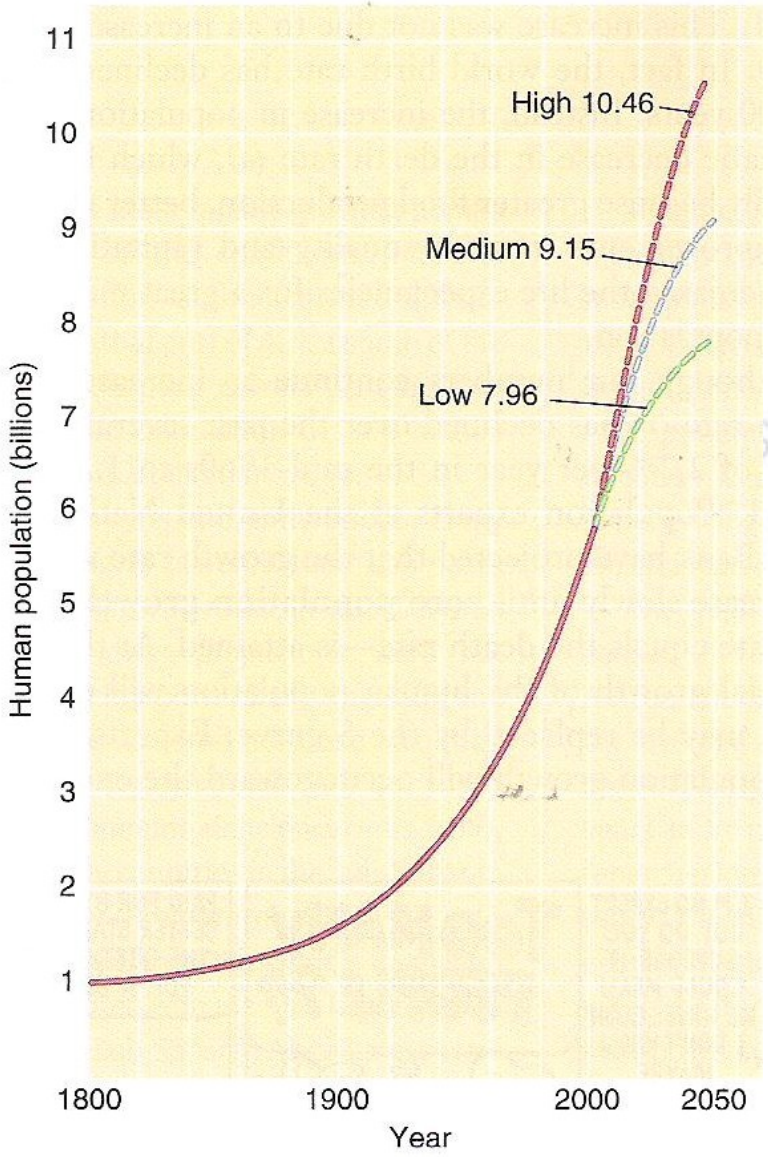
Current and Future Population Numbers

Exponential growth of the human population will end, and the J curve may be replaced by the S curve

Experts projection: zero population growth will occur toward the end of the 21st century

Current and Future Population Numbers

Population projections to 2050



- Lower projected fertility levels
- Higher projected mortality from HIV/AIDS

aging population

In 2011 percentage of the world population over the age of 65 → 8 %
Expected to rise

Current and Future Population Numbers

The main unknown factor in any population growth scenario
→ Earth's carrying capacity

Carrying Capacity:
The maximum number of individuals of a population that a particular environment can support for an indefinite period, assuming no changes in the environment

Most published estimates of how many people Earth can support

4 billion – 16 billion

Current and Future Population Numbers

Earth's carrying capacity

most published estimates of how many people Earth can support

4 billion – 16 billion

Estimates vary widely depending on what assumptions are made about

- Standard of living
- Resource production & consumption
- Technological innovations
- Waste generation

Human Migration

Many reasons for the increase in international migration

- Search of jobs or an improved standard of living
  (the most important reason)
- Escape of war or persecution for their race, religion, nationality, or political opinions
- Join other family members who have already migrated

Demographics of Countries

World population figures illustrate overall trends,
do not describe other important aspects,
e.g. population differences from country to country

Country	2011 Population (in millions)	Population Density (per square kilometer)
China	1346	141
India	1241	378
United States	312	32
Indonesia	238	125
Brazil	197	23
Pakistan	177	222
Nigeria	162	176
Bangladesh	151	1046
Russia	143	8
Japan	128	339

Source: Population Reference Bureau.

The World's 10 Most Populous Countries

Demographics of Countries

Highly Developed Countries

United States, Canada, France, Germany, Sweden, Australia, and Japan

- Low rates of population growth
- Lowest birth rates (e.g. Germany has birth rate just below that needed to sustain its population)
- Low infant mortality rates (Year 2011: 6.1 in the United States, 44 world average)
- Highly industrialized relative to the rest of the world
- Have longer life expectancies (78 years in the United States versus 70 years worldwide)
- High average per capita GNI PPPs ($45,640 in the United States versus $10,240 worldwide)

Demographics of Countries

GNI PPP: Gross National Income in Purchasing Power Parity divided by midyear population

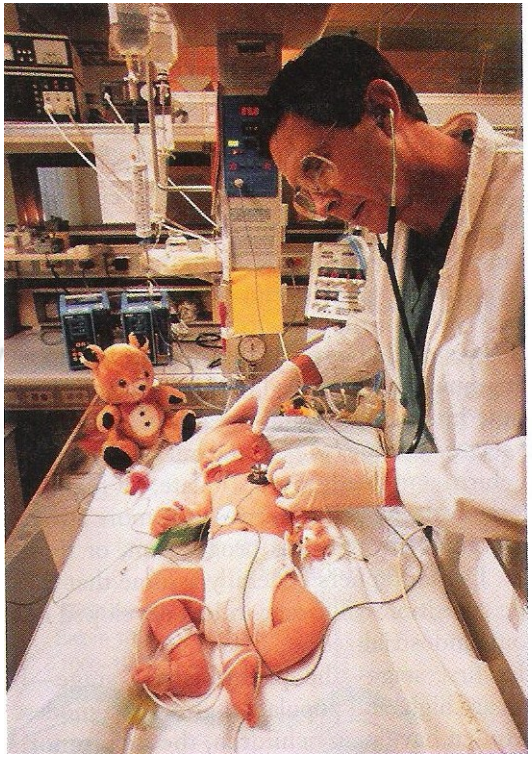
It indicates the amount of goods & services an average citizen of a particular country could buy in the United States

	Developed	*Developing*	
	(Highly Developed) United Sates	*(Moderately Developed) Venezuela*	*(Less Developed) Ethiopia*
Fertility rate	2.0	2.5	5.3
Projected population change, 2011–2050*	1.4	1.4	2,0
Infant mortality rate	6.1 per 1000	15.8 per1000	77 per 1000
Life expectancy at birth	78 years	74 years	56 years
Per capita GNI PPP (2009; U.S. $)**	$45,640	$12,220	$930
Women using modern contraception	73%	62%	14%

*Includes fertility, mortality, and migration estimates, 2050 population is presented as a multiple of the 2011 population.
**GNI PPP = gross national income in purchasing power parity.
Source: Population Reference Bureau.

Demographics of Countries

Infant mortality rate: The number of infant deaths (under age 1) per 1000 live births



Demographics of Countries

Developing countries

Moderately Developed Countries

Less Developed Countries

Demographics of Countries

Moderately Developed Countries

Mexico, Turkey, Thailand, most South American nations

- Birth rates & infant mortality rates are higher than those in HDCs, but they are declining
- Medium level of industrialization
- Average per capita GNI PPPs are lower than those of HDCs

Demographics of Countries

Less Developed Countries

Bangladesh, Niger, Ethiopia, Cambodia

- Highest birth rates
- Highest infant mortality rates
- Shortest life expectancies
- Lowest per capita GNI PPPs in the world

Demographics of Countries

Replacement-level fertility
Number of children a couple must produce to 'replace' themselves

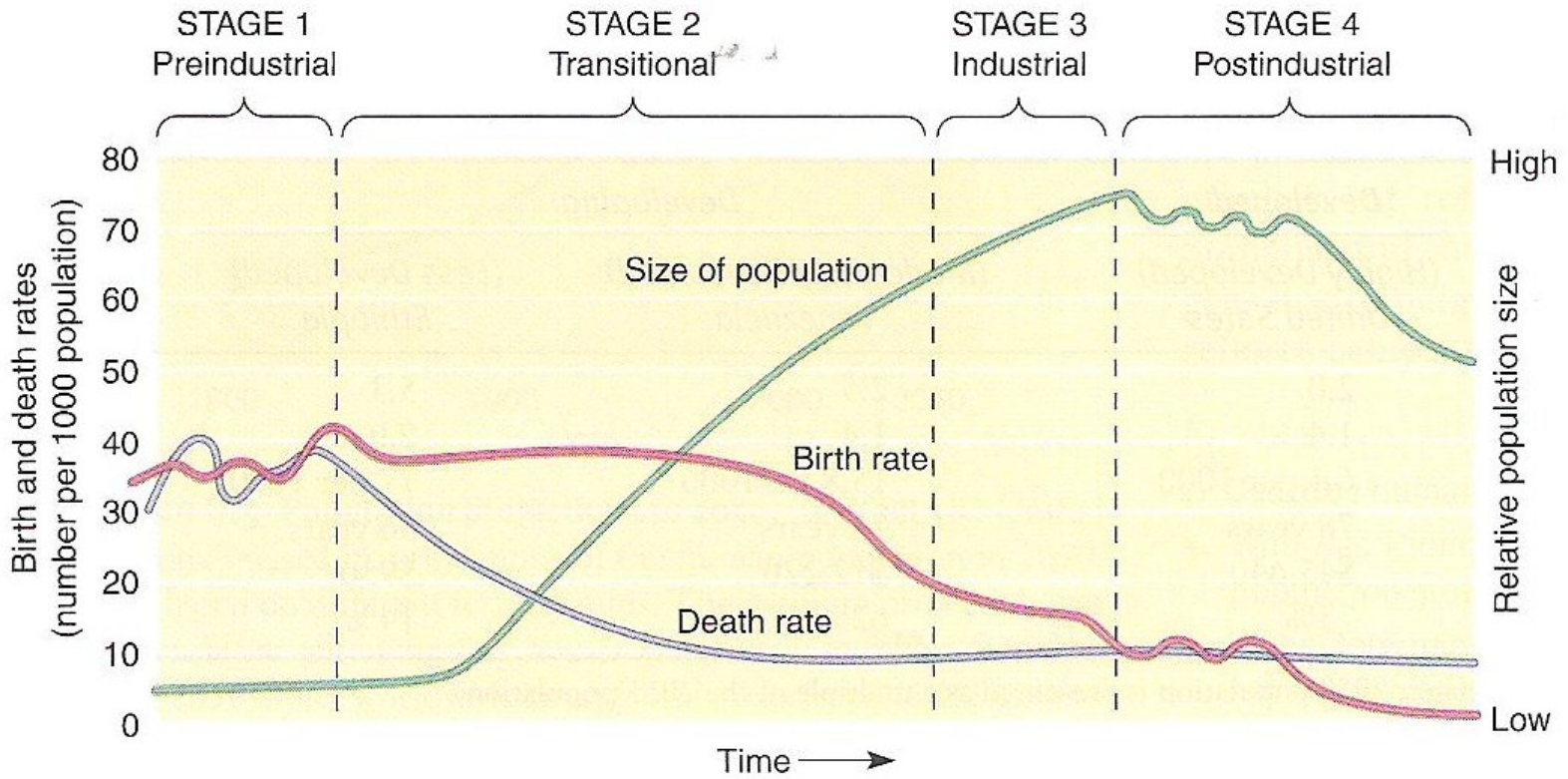
Usually given as 2.1 children → > 2.0 because some infants and children die before they reach the productive age

Worldwide, the totat fertility rate (TFR) is currently 2.5 → above the replacement level

Demographic Stages

4 demographic stages through which a population progresses as its society becomes industrialized

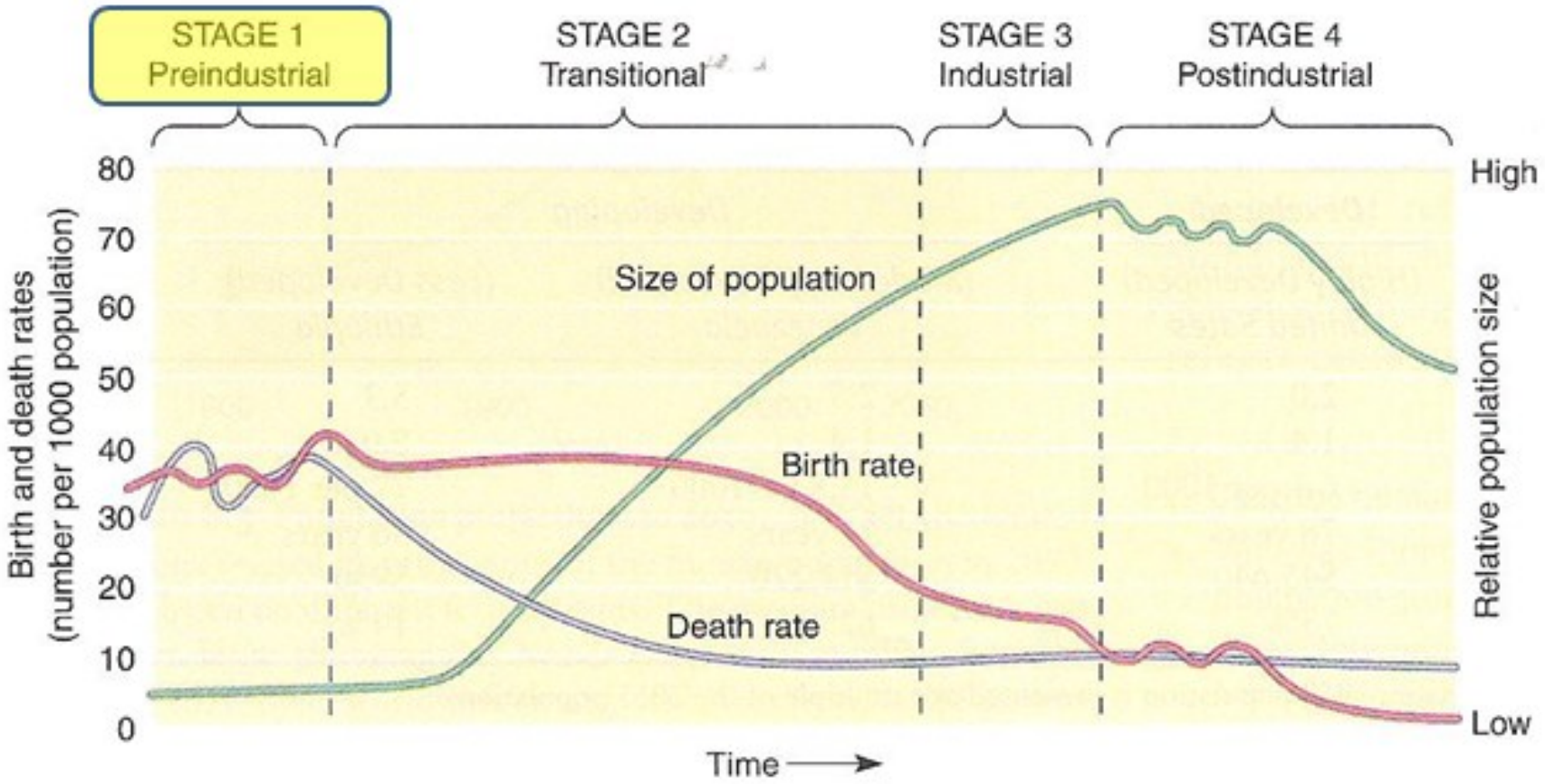
All HDCs and MDCs with more advanced economies have gone through this progression, or demographic transition



Demographic Stages

Preindustrial Stage

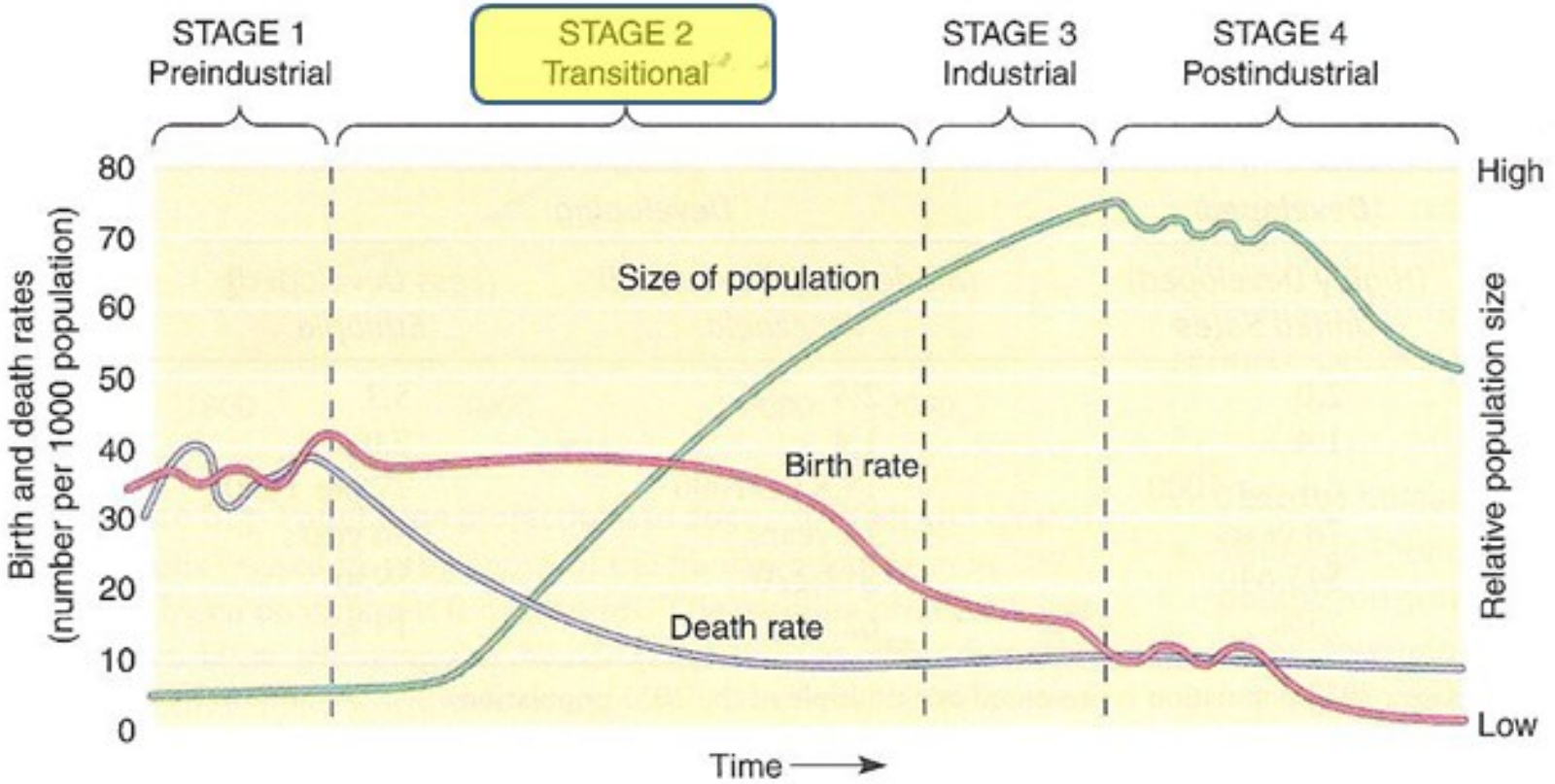
- The first stage
- Birth & death rates are high
- Population grows at a modest rate



Demographic Stages

Transitional Stage

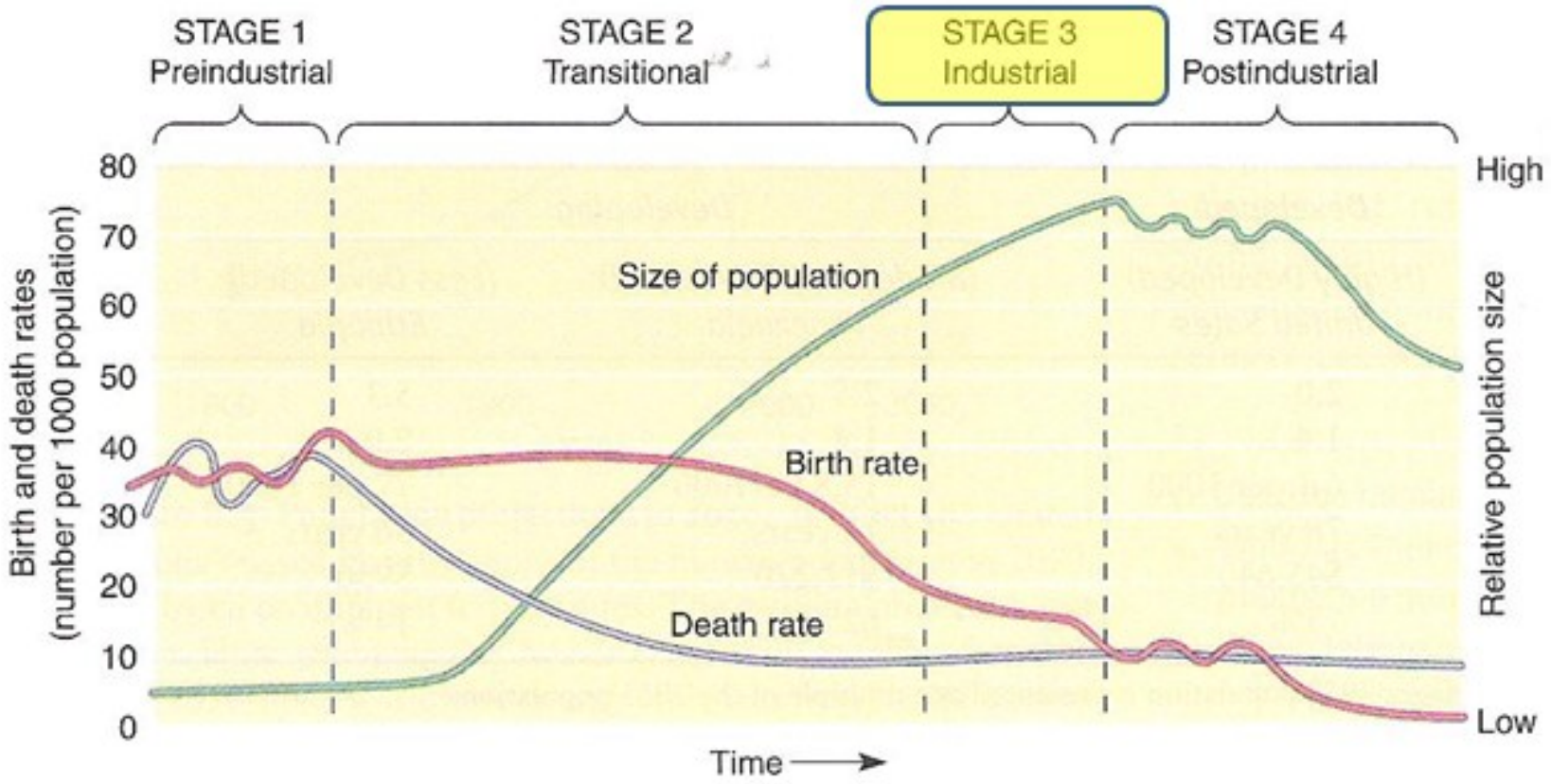
- A lowered death rate
  - Improved healthcare
  - More reliable food & water supplies
- Population grows rapidly because the birth rate is still high



Demographic Stages

Industrial Stage

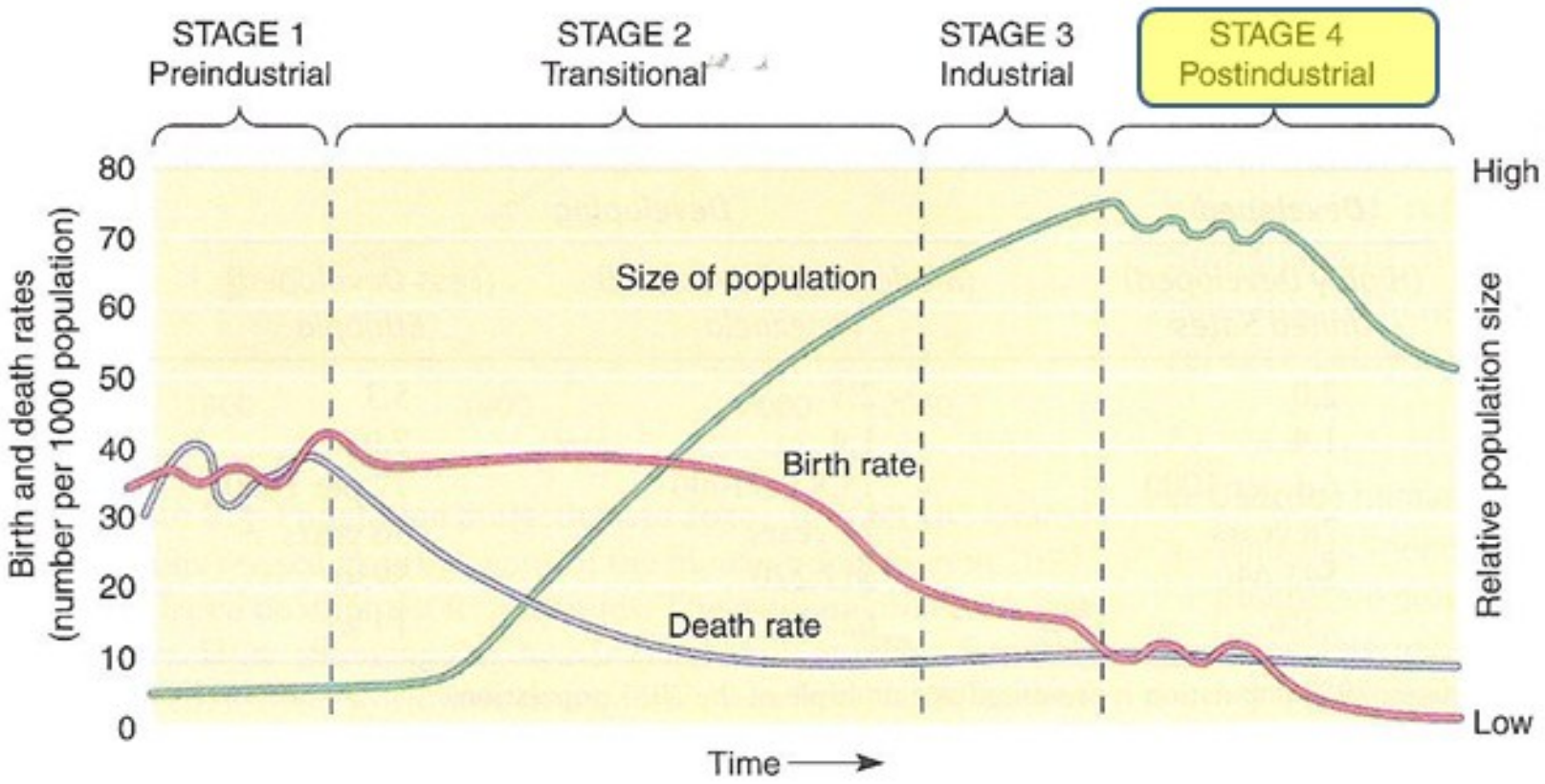
- Characterized by a decline in birth rate
- Decline in birth rate slows population growth



Demographic Stages

Postindustrial Stage

- In heavily industrialized countries, people are better educated and more affluent; they tend to desire smaller families
- The population grows slowly or not at all in this stage



Age Structure

The number & proportion of people at each age in a population

We must know the age structure of a population to predict its future growth

Age structure diagram:

- The number of males and females at each age, from birth to death
- Overall shape inducates whether the population is increasing, stable, or shrinking

Age Structure

Population Growth Momentum

The potential for future increases or decreases in a population based on the present age structure

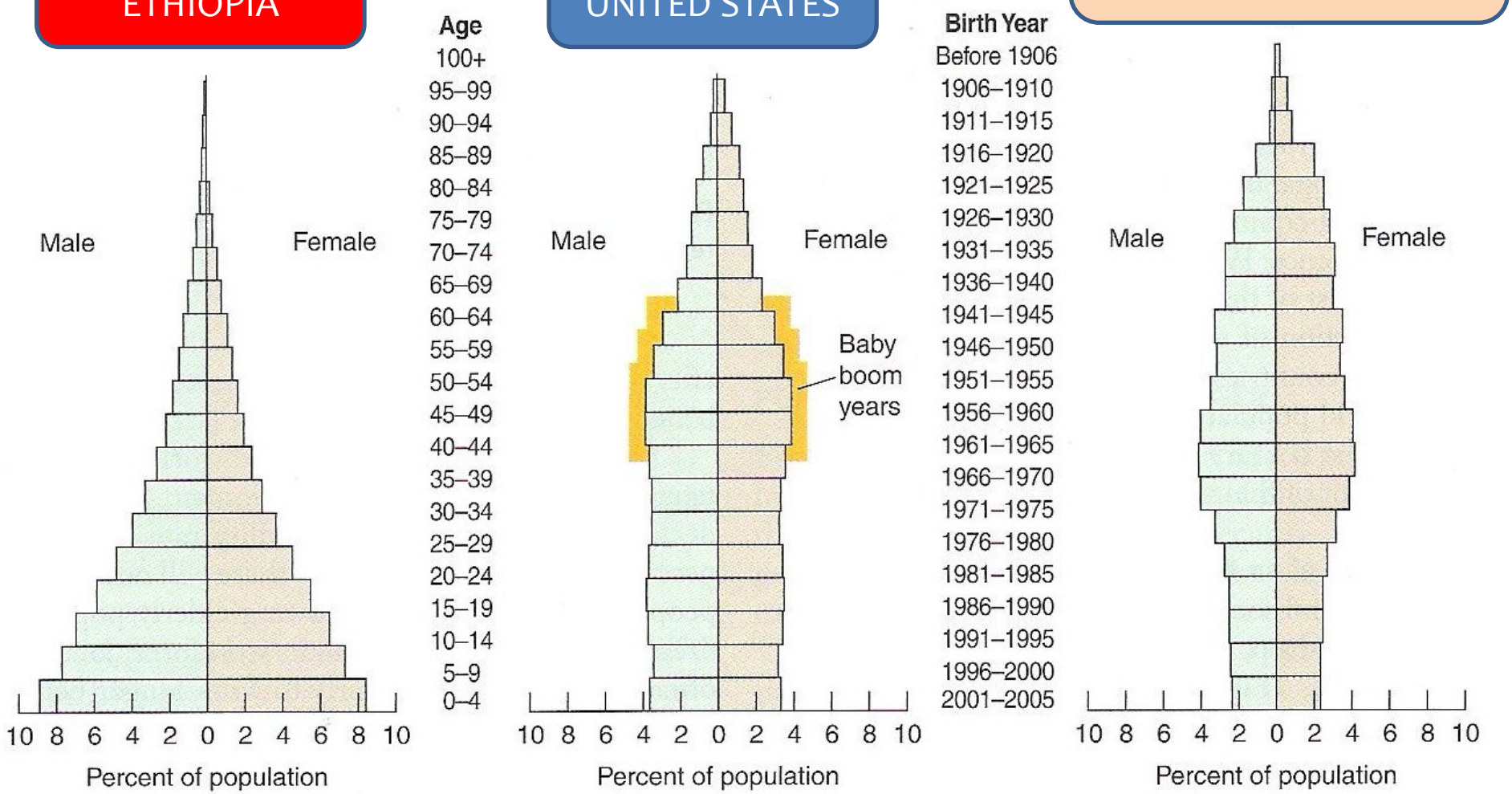
Could be positive or negative, explains how the present age distribution affects the future growth of a population

Age Structure Diagrams

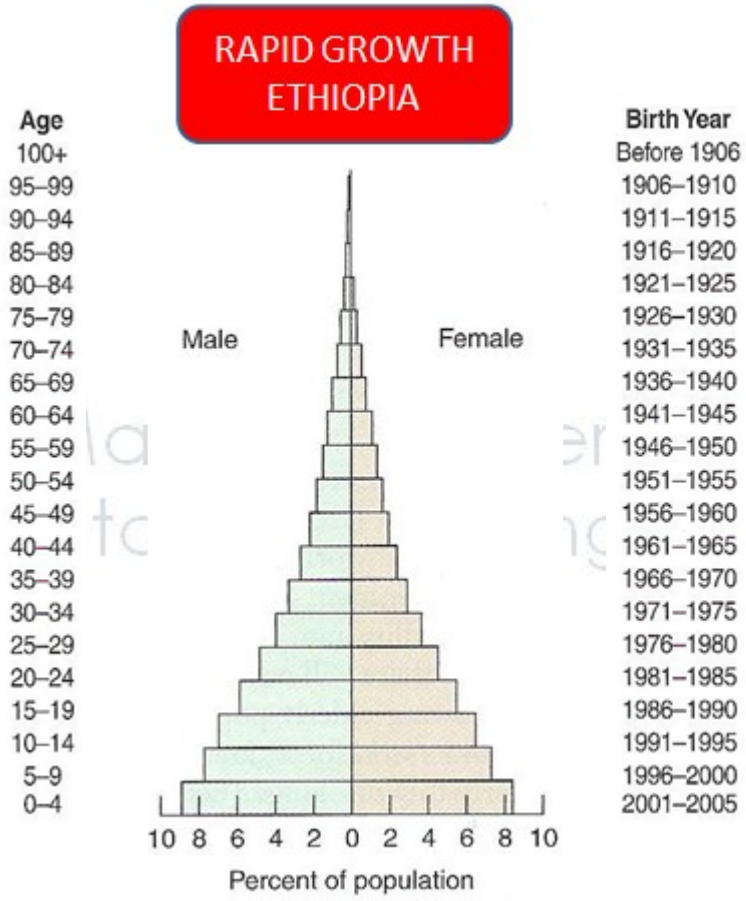
RAPID GROWTH
ETHIOPIA

SLOW GROWTH
UNITED STATES

NO GROWTH OR
DECLINE IN GROWTH
ITALY



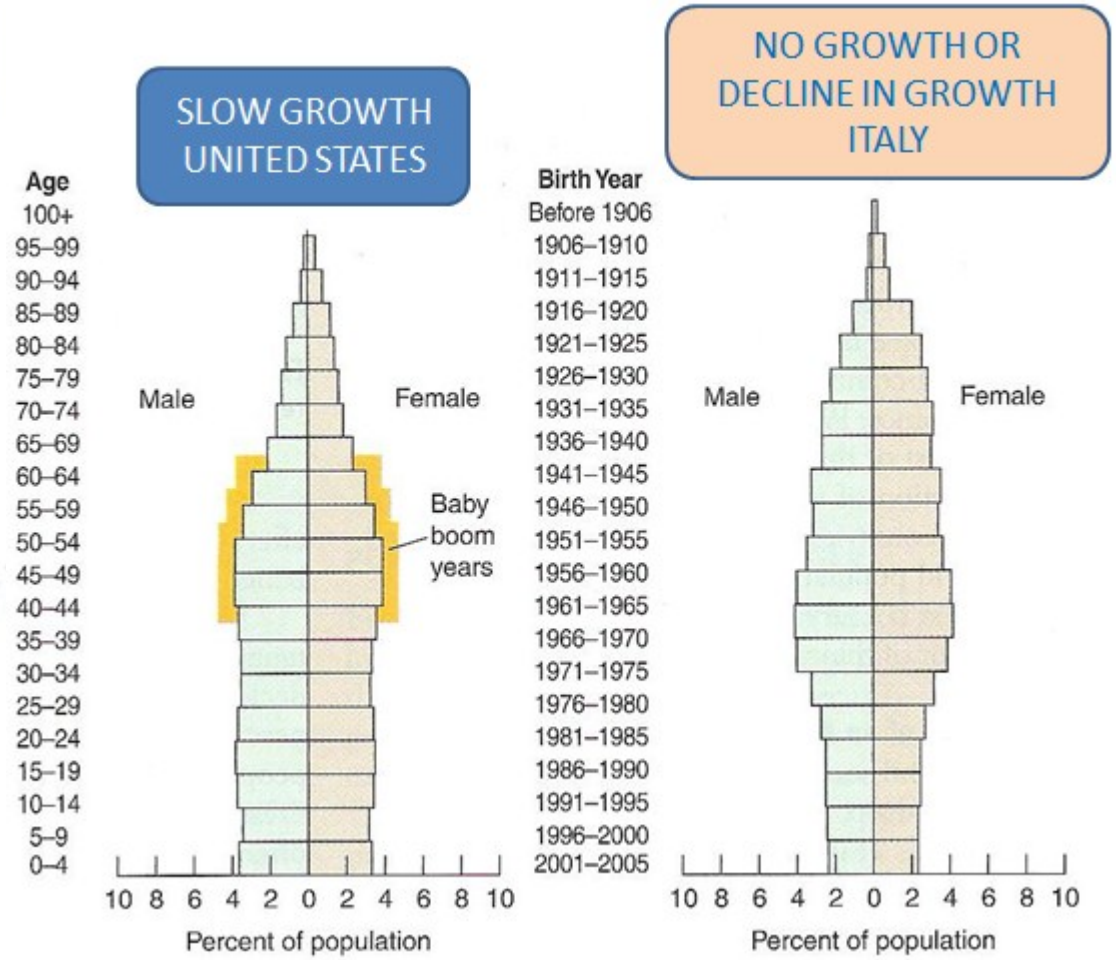
Age Structure Diagrams



Shaped like a pyramid

A country with a high growth rate based on high fertility rate

Age Structure Diagrams



Countries with slowly growing, stable, or declining populations

- More tapered bases of the age structure diagrams
- A smaller proportion of the population will become the parents of the next generation

Age Structure Diagrams

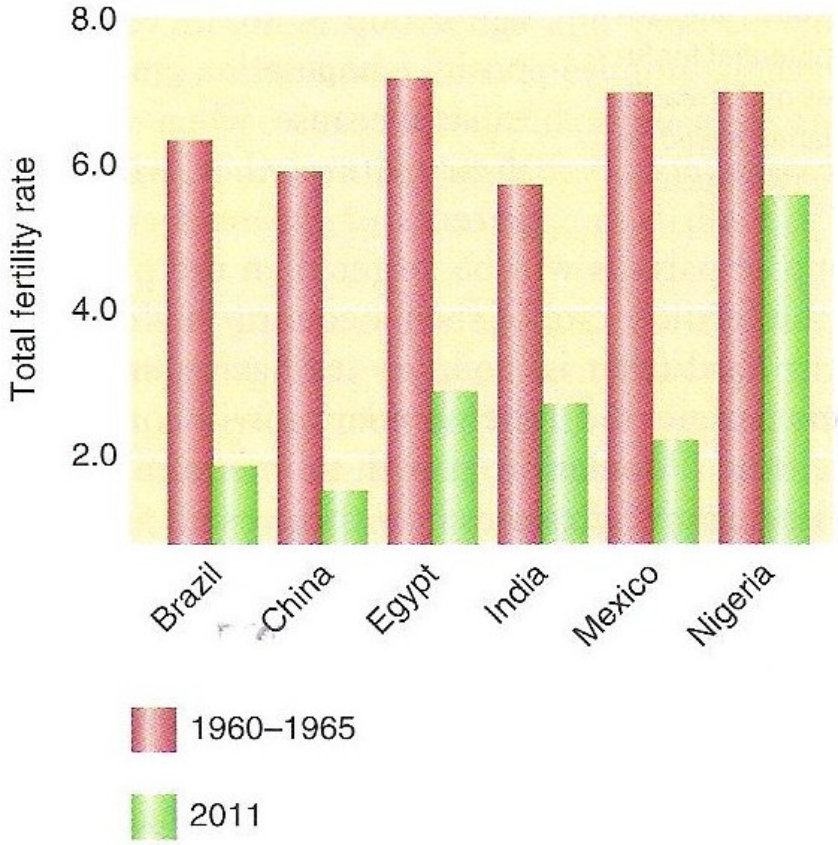
Age structure diagram of a stable population

- Numbers of people at preproductive and reproductive ages are approximately the same
- Many countries in Europe

A population shrinking in size

- Preproductive age group is smaller than either the reproductive or postreproductive group
- Russia, Ukraine, Germany: slowly shrinking populations

Age Structure Diagrams



Fertility changes in selected developing countries (Population Reference Bureau)

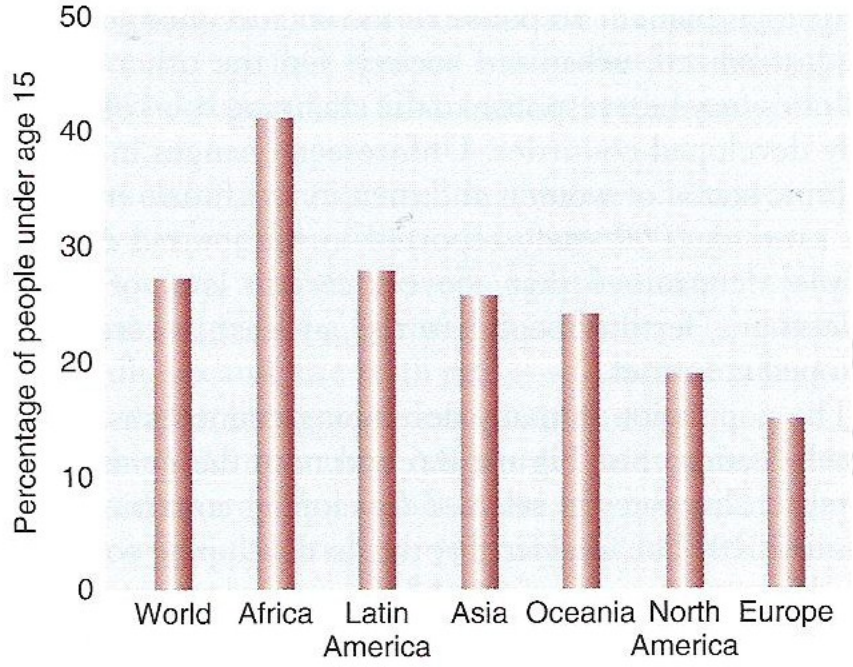
Age Structure: Effects on an Aging Population

- Higher percentage of people who are chronically ill or disabled, and these people require more healthcare and other social services
- The elderly produce less wealth (most are retired) → An aging population reduces a country's productive workforce

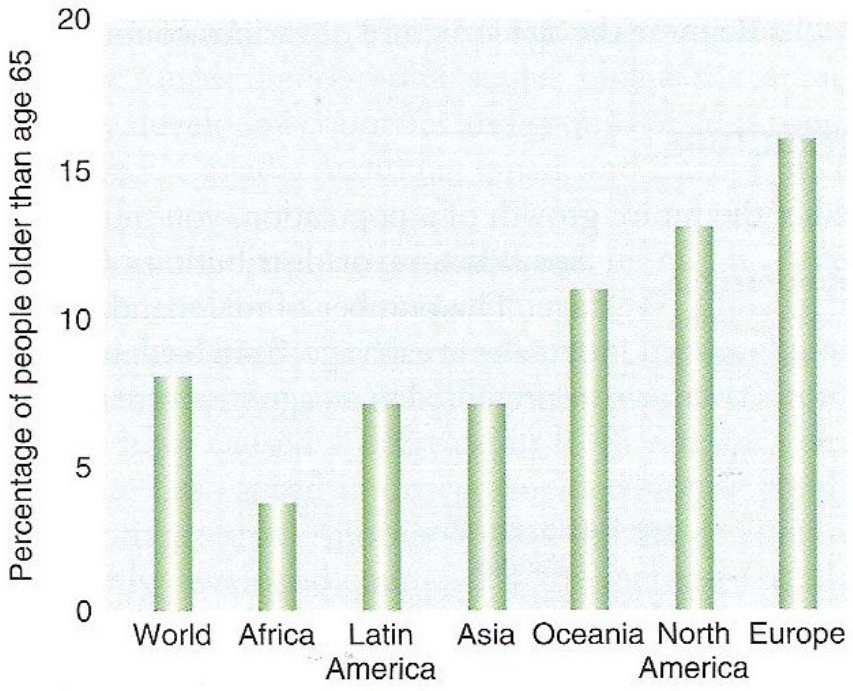
Examples
Japan, Russia

No country has been faced with an aging population before now, and the answer to the question 'how aging populations will function?' is not known

Age Structure: Effects on an Aging Population



Percentages of the population under age 15 for various regions in 2011
The higher this percentage, the greater the potential for population growth



Percentages of the population older than 65 in 2011
Lower fertility rates lead to aging populations

Age Structure: Effects on an Aging Population

According to the most policy analysts

Countries with higher proportions of elderly will probably have to increase the age of retirement & decrease benefits for the elderly.

Young people begin to save aggresively for their retirements early in their careers instead of after their children have grown

Population & Quality of Life

Meeting the basic needs will be difficult especially in countries that have not achieved population stabilization

82% of the world's population live in LDCs
If their rate of population growth continues, many of these countries will double their populations by 2050

Challlenges as our numbers increase during the 21st century

- Environmental degradation
- Hunger
- Poverty
- Economic stagnation
- Urban deterioration
- Health issues

Population & Chronic Hunger

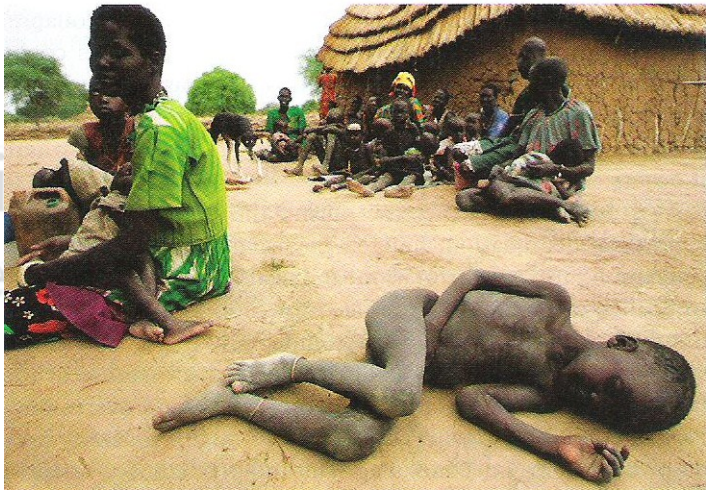
Food insecurity:

The condition in which people live with chronic hunger and mulnutrition

> 1 billion people live under the treat of starvation

These people do not get enough food

In certain areas, especially children still starve



- 86 countries are considered low income & food deficient
- 2 billion people face food insecurity intermittently as a result of poverty, drought, or civil strife

Source: *U.N. Food and Agriculture Organization (FAO)*

Economic effects of continued population growth

- Population growth affects economic developlent and economic development affects population growth
- The degree to which each affects the other is unclear

Reducing the Total Fertility Rate

- Culture & Fertility
- The Social & Economic Status of Women
- Marriage Age & Fertility
- Educational Opportunities & Fertility
- Family Planning Services

Government Policies & Fertility

Laws determine

- Minimum age at which people may marry
- Amount of compulsory education

Governments may allot portions of their budgets to

- Family planning services
- Education
- Healthcare
- Old-age security
- Incentives for smaller or larger family size