

Question

◆ If a large piece of paper could be folded in half 44 times, how thick would it be?

- A. 1/2 inches
- B. 1/2 foot
- C. 1/2 mile
- D. 1/2 million miles

Chapter 2

HUMAN POPULATION GROWTH

Introduction

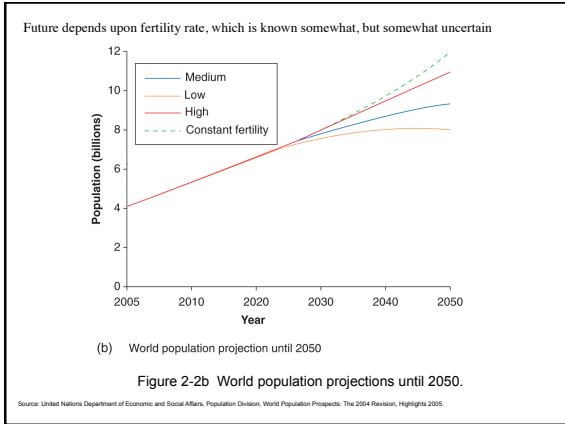
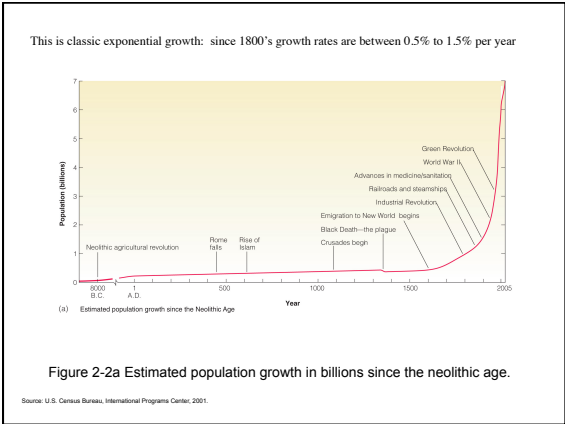
- The current world population of more than 6.9 billion people is a cause for concern among many.

- Although the exponential world population growth rate has declined recently, world population continues to grow rapidly.
- Will the world be able to feed and support the 8 to 10 billion people that will be on Earth by the middle of the twenty-first century?
- At what cost to the environment and standards of living?
- How many people can the Earth comfortably support?

Population History

- The total human population on the planet was small and increased slowly through most of human history. Maybe 1 million humans 125,000 years ago, growing only to 5-10 million by 10,000 years ago
- The population started to grow more rapidly due to human inventions: first agriculture, then industrial technology, and finally fertilizers and mechanized agriculture

- 1000 BCE	50 million (0.05 billion)
- 0 CE	0.15 billion
- 1000 CE	0.25 billion
- 1500 CE	0.5 billion (r < 0.1%: 8000BCE to 1650 CE: t _{1/2} =1000yr)
- 1800 CE	1 billion (r = 0.46%: 1650CE to 1800 CE: t _{1/2} =150yr)
- 1930 CE	2 billion (r = 0.54%: 1800CE to 1930 CE: t _{1/2} =130yr)
- 1960 CE	3 billion (r = 2%: 1960's and 70's: t _{1/2} =35yr)
- 1974 CE	4 billion
- 1987 CE	5 billion
- 1999 CE	6 billion
- 2009 CE	6.79 billion (r drop to 1.1%: 1970's to now)
- 2010 CE	6.9 billion



Population increase depends upon: number born – number dying.

Number born is related to TFR (total fertility rate) = average of number of children women bear:

TFR=2.1 will keep population constant. TFR>2.1 => exponential increase

To place this in perspective currently Roughly equivalent to:

360,000 people born every day	Anaheim
150,000 people die every day	Oceanside
210,000 people added to the heap every day	Irvine

AND, if population continued to double every ~40 years (1%/year growth rate) ...

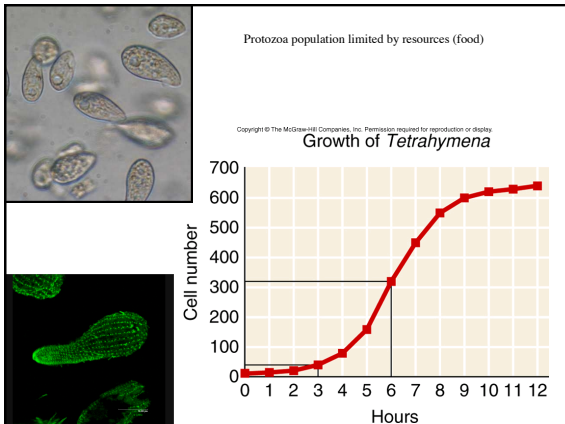
2045– 13 billion *Can human population continue to grow like this? Do we want this?*
 2085– 26 billion
 2125– 52 billion
 2165– 104 billion

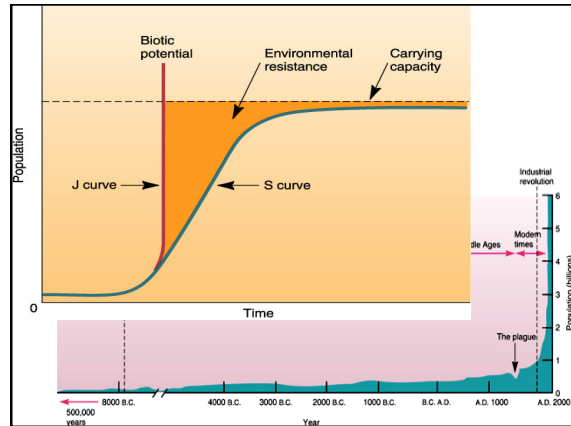
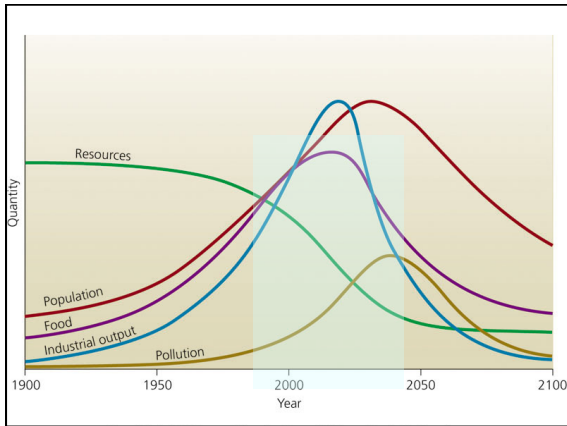
Carrying Capacity

- Carrying capacity is the number of individuals of a certain population that can be supported in a certain area for a prolonged period of time by the resources of that area.
- When a population lives within its carrying capacity, it does not degrade the resources upon which it depends.

Carrying Capacity

- While we are degrading our resources, we are globally producing enough food to feed our current population (although 15% of it is undernourished).
- Some observers speculate that we have already overshoot our carrying capacity.
- What is carrying capacity?, i.e. how many humans on Earth is the right number? Long term, certainly not above the carrying capacity.





Question

What do you think is the right final number for humans on Earth?

- A. About 6 billion (what we have now)
- B. About 12 billion (double current)
- C. Maybe about 1/2 billion so we can all have more space and resources
- D. Can't say
- E. Other, or no viewpoint at this time

4) Human Demography

- **Demography** - vital statistics about people, such as births and deaths
- Two demographic worlds
 - Less-developed counties represent 80% of the world population, and more than 90% of projected growth
 - Many richer countries have zero or negative growth rates



Fertility and Birth Rates

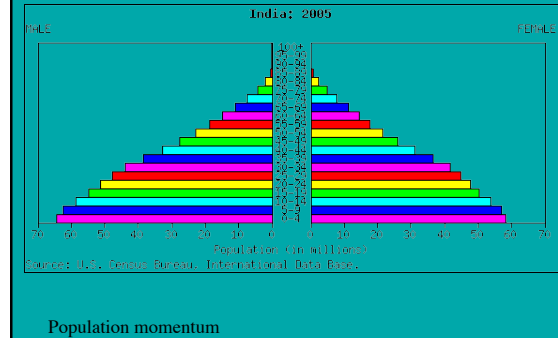
- **Fecundity** - physical ability to reproduce
- **Fertility** - the actual production of offspring
- **Crude birth rate** - number of births per year per thousand people
- **Total fertility rate** - number of children born to an average woman during her reproductive life
- **Zero population growth (ZPG)** - occurs when births + immigration just equal deaths + emigration

Top Ten Contributors

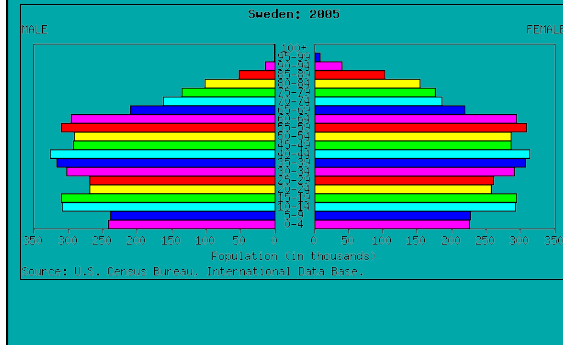
No.	Country and 2001 Population	Net Addition	Percentage	Cumulative Percentage
1.	India, 1,008 billion	15,929	20.7	20.7
2.	China, 1,275 billion	9,246	12.0	32.7
3.	Pakistan, 141 million	3,818	5.0	37.7
4.	Nigeria, 113 million	3,172	4.1	41.8
5.	Bangladesh, 137 million	3,023	4.0	45.8
6.	Indonesia, 212 million	2,679	3.4	49.2
7.	United States of America, 283 million	2,567	3.3	52.5
8.	Brazil, 170 million	2,136	2.8	55.3
9.	Democratic Republic of the Congo, 50 million	1,852	2.4	57.7
10.	Ethiopia, 62 million	1,611	2.1	59.8
	Subtotal	46,033	59.8	59.8
	World total	76,857	100	100

Source: United Nations Population Division, *World Population Prospects: The 2004 Revision, February 2005*.

India Demographics



Sweden Demographics



Consequences of Overpopulation

- Overpopulation is putting an increasing burden on the Earth's natural resources and environment.
- Resources which take millennia (soils) to hundreds of millions of years (ores, fossil fuels) to accumulate are being consumed and dispersed on time-scales of centuries (fuels, ores) to decades (water, soils, species).

Consequences of Overpopulation

- Persons in rich, industrialized nations create a much bigger per capita impact on the environment than persons in poor, non-industrialized countries.
- The U.S. has less than 5% of the world's population but consumes about 25% of the world's natural resources and produces about 25% of the world's pollution.
- Even if U.S./European populations do not grow, impact can grow if consume more

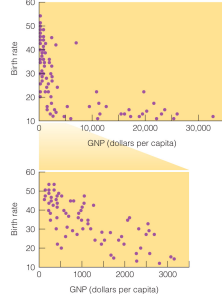
Social Effects of Overpopulation

- Rapid population growth and overpopulation lead to increased urbanization, increased unemployment, and spreading poverty as well as putting the earth under increasing strain.
- Projections indicate that 60% of the world's population will live in urban areas by 2025.
- Increasing population pressures lead to political instability and political and civil rights abuses.

Why lower pop growth in rich countries?

Demographic Transition?

- The theory of demographic transition implies that as a nation undergoes technological and economic development, its population growth rate (birth rate) will decrease.



Source: Pulliam, H. R. and N. M. Hassall, "Human Population Growth and the Carrying Capacity Concept" Bulletin of the Ecological Society of America, September 1964:141-157.

Question

◆ Is Demographic transition theory a manipulative scientific theory or a correlational scientific theory?

- A. Manipulative
- B. Correlational
- C. Not actually scientific since it can't be disproved
- D. Can't say from information given
- E. Other, or no viewpoint at this time

Problems with the Demographic Transition Model

- Most developed nations achieved development by degrading their environments and exploiting resources from other parts of the world.
- The Earth does not have sufficient resources to permit the developing nations to reach the developed nations' level of affluence.

Reducing Population

- There does not appear to be a necessary causal relationship between development, industrialization, and fertility rates.
- Partial or stalled development leaves countries with populations growing faster than the nation's resources can support.
- Evidence suggests that fertility rate declines are caused primarily by rising levels of education, nutrition, and infant survivorship.

Factors that Reduce Fertility Rates

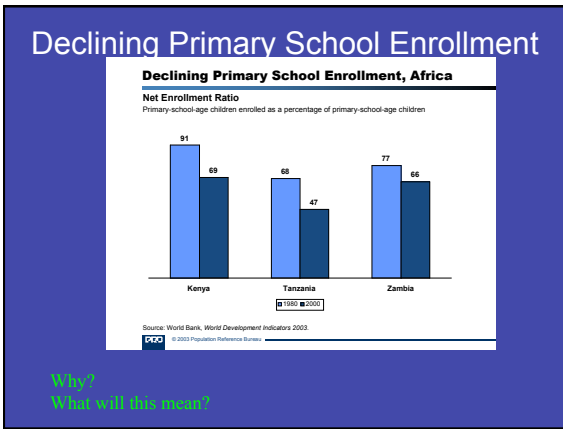
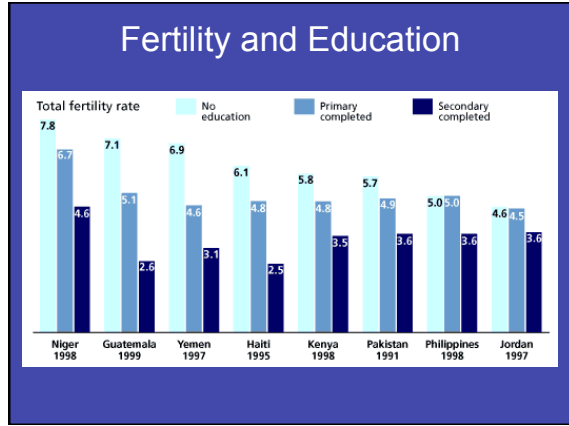
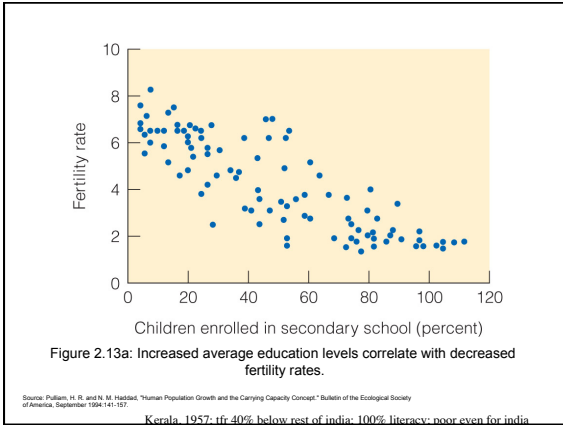
- Education, especially for young girls and women
- Family Planning availability and affordability
- Employment opportunities, economic security
- Access to the "means of production" (e.g. land, financial capital)
- Health and nutrition, better pre- and post-natal care and reduced infant mortality
- Urbanization, modernization
- Improved "status" of women in society, changes in societal definitions of what a "successful" woman is.

Education of Women

- Perhaps best ways to decrease the growth rate of a particular population is to increase the average educational and societal status of women.
- Improved education results in better healthcare and nutrition, effective contraceptive use, and increased status and prestige.



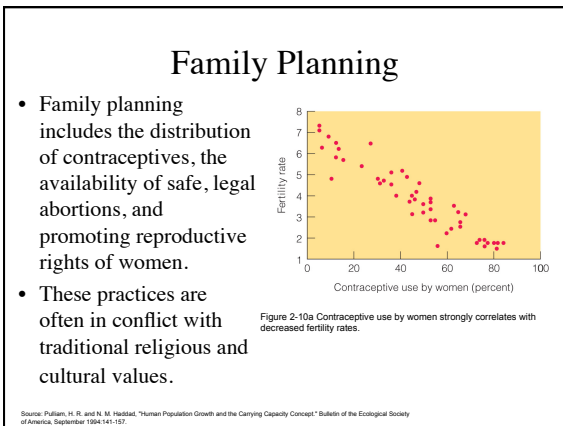
Figure 2-13b: Women attending class in Afghanistan.



Is educating the world's girls possible?

One estimate is that it would cost around \$6.5 billion/year to bring all women to the same educational level as men.

That is less that is spent on lawn care in the U.S., and small fraction of what is spent on video games each year. It is less than is spent in one month of war in Iraq and Afghanistan.



Family Planning Availability is Not Enough

A study done in the 1990s compared fertility rates in a number of African and Caribbean countries with similar access to contraceptives (Handwerker, B.P. 1991). Women's power and fertility transition: the cases of Africa and the West Indies. *Population and Environment* 13(1): 53-78).

Caribbean	Africa
Dominican Republic TFR = 2.8	Benin TFR = 6.1
Jamaica TFR = 2.5	Chad TFR = 6.7
Trinidad and Tobago = 1.7	Mali TFR = 7.0

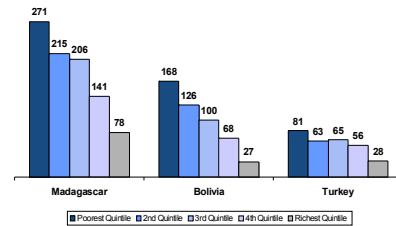
Economic Incentives and Government Regulation of Childbearing

- Some governments have used economic incentives and disincentives to promote population control.
- Another approach is increasing accessibility to modern birth control methods and family planning information without mandating the number of children a family may have.
- Strict government policies have been mandated at times; for example, in 1979 China implemented a one child per couple policy.

Employment Opportunities and Economic Security

Adolescent Fertility Rate

Births per 1,000 Women Ages 15-19



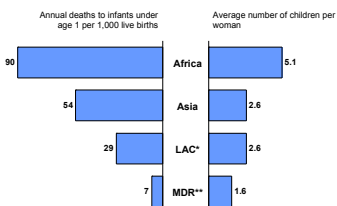
Source: D.R. Gwatkin, S. Rutstein, K. Johnson, E.A. Sulman, and A. Wagstaff, *Initial Country-Level Information about Socioeconomic Differences in Health, Nutrition, and Population, Volumes I and II* (Washington, DC: The World Bank, November 2003).

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Health Care and Reduced Infant Mortality

Infant Mortality and Childbearing, by Region

Infant Mortality Rate and Total Fertility Rate



* LAC=Latin America and the Caribbean; ** MDR=More Developed Regions.
Source: Population Reference Bureau, 2004 World Population Data Sheet.

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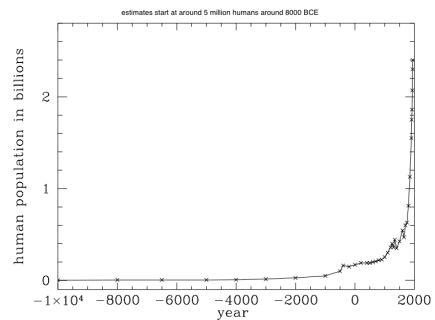
Population Counter

<http://www.ibiblio.org/humankind/workshop>

Question

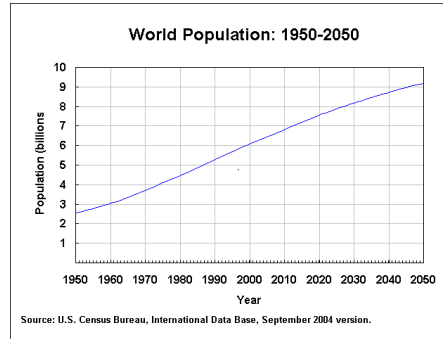
What do you think will ultimately limit human population?

- A. Disaster, starvation, disease, or war
- B. Education, family planning, public policies, etc
- C. Common sense among the population
- D. Technology will mean that the population can continue to grow
- E. Other, or no viewpoint at this time



Population Changes Over Time

- World population reached:
 - 1 billion in ~1800
 - 2 billion in 1930 (130 years later)
 - 3 billion in 1960 (30 years later)
 - 4 billion in 1974 (14 years later)
 - 5 billion in 1987 (13 years later)
 - 6 billion in 1999 (12 years later)
- World population may reach:
 - 7 billion in 2013 (14 years later)
 - 8 billion in 2027 (14 years later)
 - 9 billion in 2045 (18 years later)



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TABLE 4.1

World Population Growth and Doubling Times

Date	Population	Doubling Time
5000 B.C.	50 million	?
800 B.C.	100 million	4,200 years
200 B.C.	200 million	600 years
A.D. 1200	400 million	1,400 years
A.D. 1700	800 million	500 years
A.D. 1900	1,600 million	200 years
A.D. 1965	3,200 million	65 years
A.D. 2000	6,100 million	51 years
A.D. 2050 (estimate)	8,920 million	215 years

Source: United Nations Population Division.

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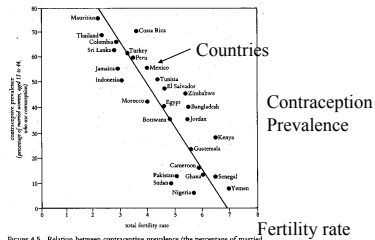
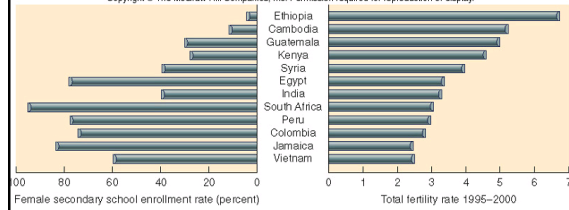
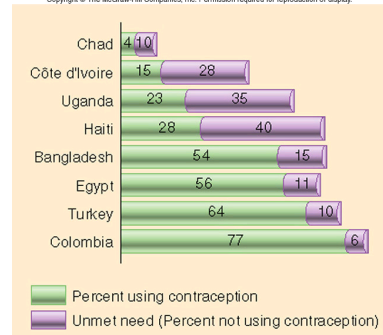


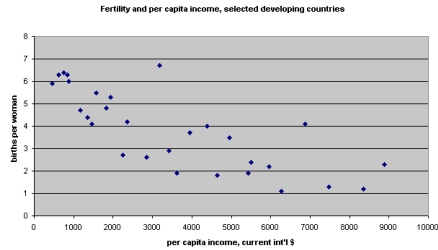
Figure 4.5 Relation between contraceptive prevalence (the percentage of married women, aged 15 to 44 years, who use any form of contraception) and the total fertility rate (the average number of children a woman bears in her lifetime, at current age-specific fertility rates) in some developing countries, 1984-92. Source: Roybey et al. (1993), p. 60.

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Statistical Interlude: correlation \neq causation

Decreasing poverty works

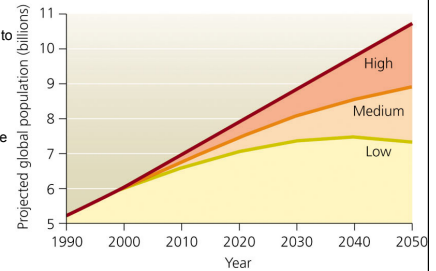


The UN program to reduce population growth.

1998 UN Population Projections:

The UN, through the late 90's kept reducing the time to population stabilization, and the level of that predicted population. What factors drove these reduced predictions?

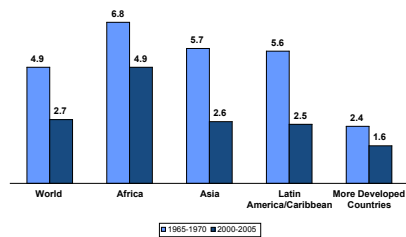
1. Higher mortality
2. Lower fertility



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Trends in Childbearing, by Region

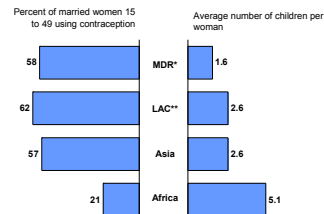
Average number of children per woman



Source: United Nations, *World Population Prospects: The 2002 Revision (medium scenario)*, 2003.
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Contraceptive Use and Childbearing

Contraceptive Prevalence and Total Fertility Rate



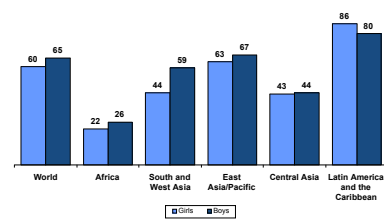
* MDR=More Developed Regions; ** LAC=Latin America and the Caribbean.
Source: Population Reference Bureau, 2004 World Population Data Sheet.
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Secondary Enrollment Boys v. Girls

Secondary School Enrollment, by Region

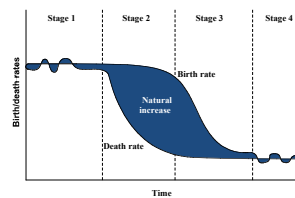
Ratio of Enrollees to Enrollment-Eligible Population, 1999-2000

Percent



Source: UNESCO Institute of Statistics, *The 2002 Education for All Global Monitoring Report*.
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The Classic Stages of Demographic Transition



Note: Natural increase is produced from the excess of births over deaths.
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