Population

The World Today: Six and a half Billion People

- About 50% of the world's people are urban (living in or near cities).
- 90% of the world's people live north of the equator.
- $^{3}/_{4}$ of the world's people live on 5% of the earth's surface
- 90% live on 20% of the earth's land.
- 80% live at less than 500 meters (1,640 feet) elevation.
- $^{2}/_{3}$ live within 500 km (310 miles) of an ocean.

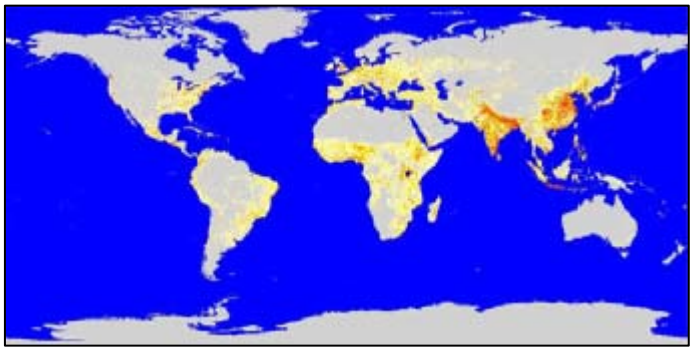
Global Population: 4 (+1) 5 Major population clusters:

- East Asia
  - About 1.4 billion people
  - Nearly 25% of humanity
  - 20% of humanity in China alone (about 1 in every 5 people)
  - About $^{2}/_{3}$ rural (mostly farming)
- South Asia
  - About 1.25 billion people
  - 20% of humanity
  - 15% of humanity in India alone (about 1 in every 6 people)
  - About ¾ rural (mostly farming)
- Southeast Asia
  - About ½ billion people (100 million on the island of Java alone)
  - 8% of humanity
  - Mostly rural
- Europe
  - About $^{2}/_{3}$ billion people
  - 11% of humanity (more than 1 in every 10 people)
  - About ¾ urban

- Eastern North America (just to give us some perspective)
  - About 120,000,000 (major eastern cities of US & Canada)
  - Just 2% of humanity (US & Canada combined are ~5% of world)
  - About 95% urban

The "Ecumene"

- The "ecumene" is the inhabited area of the earth.
- Today, the only areas that aren't inhabited are those that are too hot, dry, cold or at high elevations.



Source: http://www.ornl.gov/gist/landscan/

Population Density

- Remember, density is a measure of "how many per."
- The question is – what are we interested in finding out?
- Different density measures give us different insights, such as:
  - Level of development
  - Type of economy
  - Clues about population growth, health, status of women, etc.

Different Density Measures: Examples

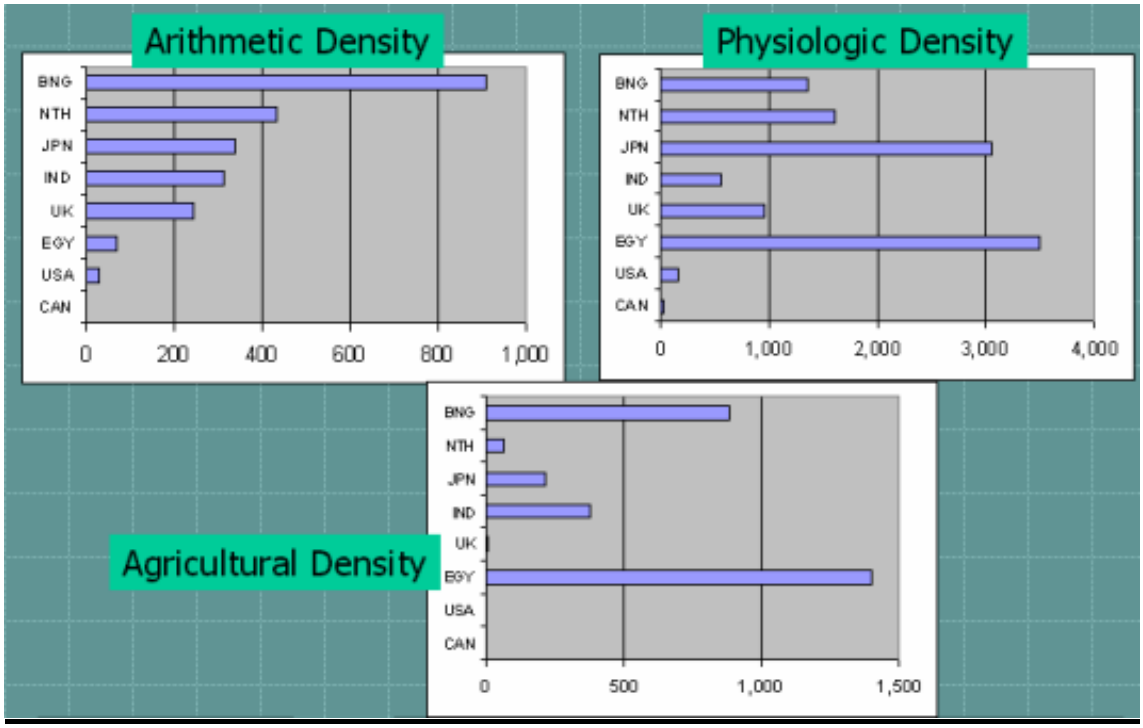
- ARITHMETIC DENSITY ("average density")
  - (total population)/(total land area)
    - US population = ~300,000,000
    - US land area = 9,161,923 km^2
    - (299,000,000)/(9,161,923) = ~32.6
- PHYSIOLOGIC DENSITY ("farmland density")
  - (total population)/(total arable land area)
    - US population = ~300,000,000
    - US arable land = ~1,650,000 km^2
    - (300,000,000)/(1,650,000) = ~181.8
- AGRICULTURAL DENSITY ("farmer density")
  - (total number of farmers)/(total arable land area)
    - US farmers = ~2,100,000
    - US arable land = ~1,650,000 km^2
    - (2,100,000)/(1,650,000) = ~1.27

(data on population, farmers and farmland from the CIA "World Factbook": https://www.cia.gov/cia/publications/factbook/index.html and the USDA Economic Research Service: http://www.ers.usda.gov/StateFacts/US.HTM#FC)

Density: Comparison Table (from textbook)

	Arithmetic	Physiological	Agricultural	% Farmers	% Arable
CAN	3	35	1	4	9
USA	30	156	4	3	19
EGY	70	3,503	1,401	40	2
UK	242	963	11	1	25
IND	325	559	374	67	56
JPN	337	3,054	214	7	11
NTH	398	1,601	64	4	27
BNG	1,020	1,359	883	65	67

Density: Comparisons



Basic Population Measures: Birth, Death & Natural Increase

- Crude Birth Rate
  - CBR = (births per year)/(total population)
- Crude Death Rate
  - CDR = (deaths per year)/(total population)
- Rate of Natural Increase
  - CBR – CDR = NI
- Note: The CBR & CDR are usually expressed in *per thousand*, while NI is usually expressed in *percent.*

Population Rates: Two Examples

- Mexico 2004 (July est., CIA World Factbook)
  - Population: 104,959,594
  - Births: 2,250,334
  - Deaths: 496,459
    - CBR = 2,250,334/104,959,594 = 21.44/1,000
    - CDR = 496,459/104,959,594 = 4.73/1,000
    - NI = 21.44 – 4.73 = 16.71/1,000 = 1.67%
- US 2004 (July est., CIA World Factbook)
  - Population: 293,027,571
  - Births: 4,190,294
  - Deaths: 2,443,850
    - CBR = 4,190,294/293,027,571 = 14.13/1,000
    - CDR = 2,443,850/293,027,571 = 8.34/1,000
    - NI = 14.13 – 8.34 = 5.8/1,000 = 0.58%
- Conclusion: Mexico's NI is about three times the US rate.

Doubling Time: Interest

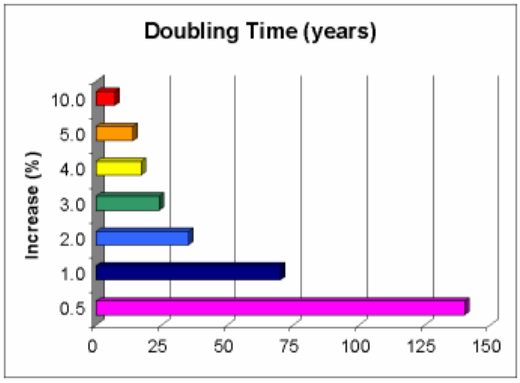
- Simple vs. Compound Interest
- Initial amount: $100 Interest: 10%

Simple	Compound
$100.00 + $10.00 = $110.00	$100.00 + $10.00 = $110.00
$110.00 + $10.00 = $120.00	$110.00 + $11.00 = $121.00
$120.00 + $10.00 = $130.00	$121.00 + $12.10 = $133.10
$130.00 + $10.00 = $140.00	$133.10 + $13.31 = $146.41
$140.00 + $10.00 = $150.00	$146.41 + $14.64 = $161.05
$150.00 + $10.00 = $160.00	$161.05 + $16.10 = $177.15
$160.00 + $10.00 = $170.00	$177.15 + $17.72 = $194.87
$170.00 + $10.00 = $180.00	$194.87 + $19.49 = $214.36

- Conclusion: At 10% it takes less then 8 years for compound interest to double the initial amount. If we continued, we'd find that the amount tripled in 12 years, quadrupled in 15 years, etc.

Doubling Times & Population Growth

- The rate of natural increase declined between 1950 and 2000 – but the number of people added to the world's population each year has remained fairly steady for about 40 years.
- Why? Because global population increased from 2.5 billion to over 6 billion during this time period!



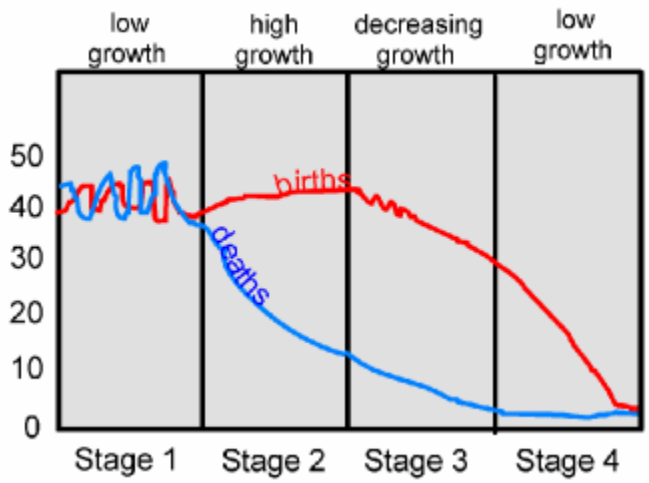
Other Population Measures

- Total Fertility Rate (TFR)
  - An estimate of how many children a woman will have during her childbearing years.
  - Assumes women in the future will act exactly as women today do.
- Infant Mortality Rate (IMR)
  - Deaths of infants less than 1 year old, divided by total births per year.
  - (total infant deaths)/(total births) = IMR
- Life Expectancy
  - An estimate of the number of years a child born today can expect to live at current mortality levels.

The Demographic Transition

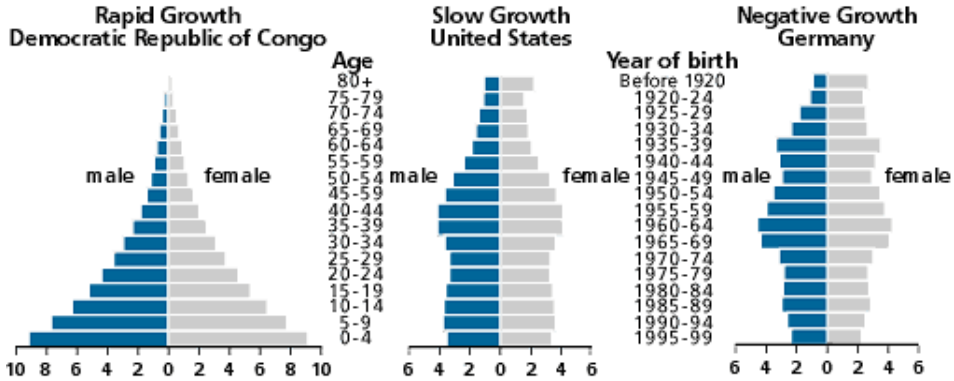
- ***Q:*** Why do the US and Mexico have different rates of natural increase and different fertility rates? Why do these rates change?
- ***A:*** The Demographic Transition
- The demographic transition is a **model** of how birth and death rates change over time
- Birth and death rates change because of
  - Changes in the economic system (from traditional to post-industrial)
  - Changes in information about health and health care (sanitation, etc.)
  - Changes in people's attitudes about family size

The Demographic Transition Model



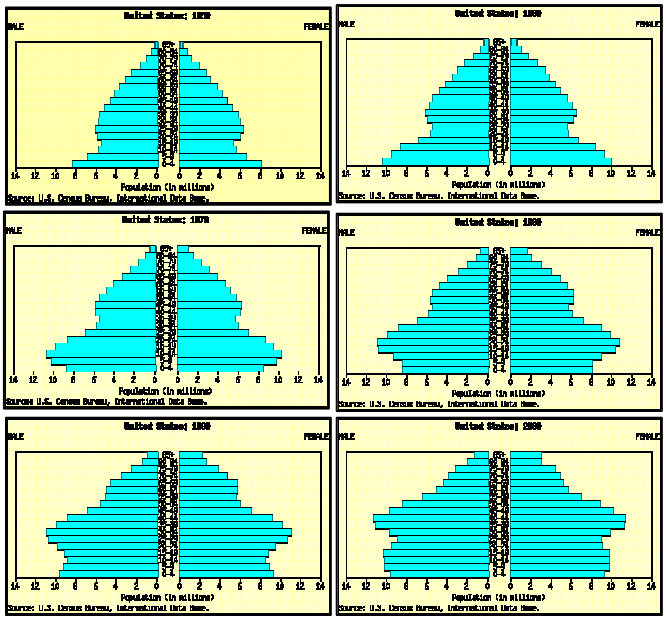
Population Pyramids

- One way of visualizing how a country is changing (and how it may change in the future) is by using a population pyramid, a kind of bar chart that shows the **age** and **sex** structure of the population.



Source: http://www.prb.org/

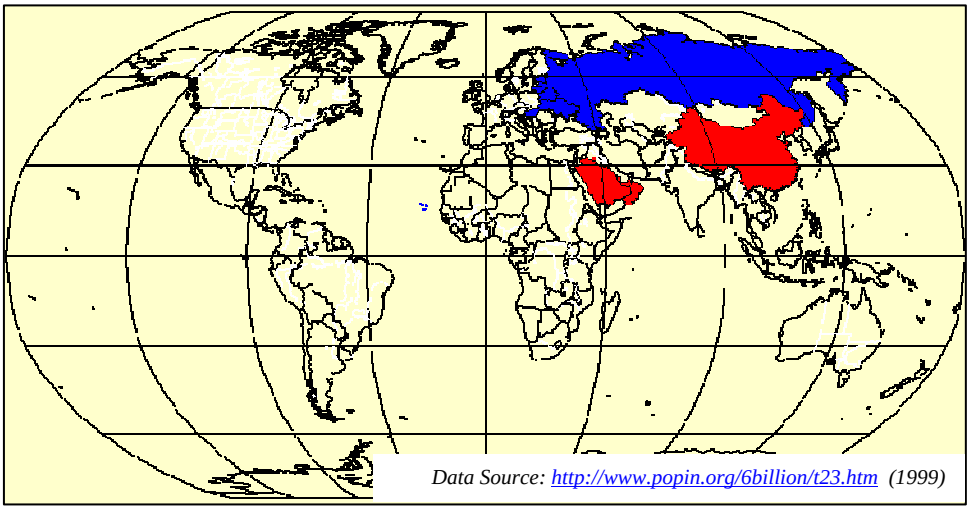
US Population Pyramids: 1950-2000



- Note how the "bulge" of the Baby Boom shifts through decades.

Sex Ratios: (number of males per hundred females)

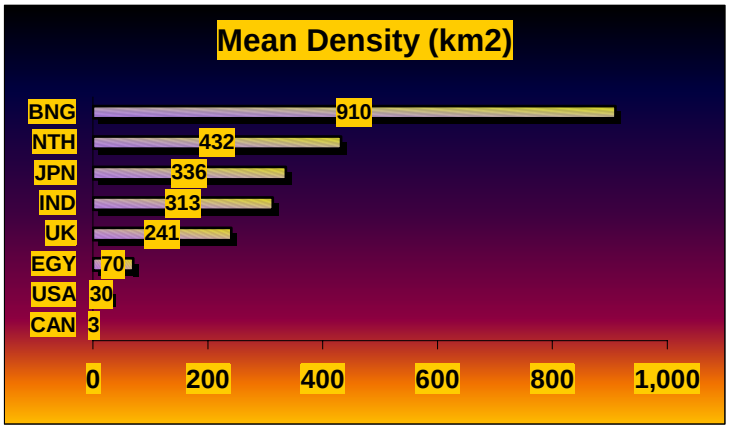
- 10 **Highest**
  - 189 Qatar
  - 174 UAE
  - 133 Bahrain
  - 124 Saudi Arabia
  - 113 Oman
  - 112 China
  - 111 Guam
  - 110 Brunei
  - 109 Samoa
  - 109 Kuwait
- 10 **Lowest**
  - 83 Latvia
  - 87 Ukraine
  - 87 Cape Verde
  - 88 Russia
  - 89 Belarus
  - 89 Estonia
  - 89 Lithuania
  - 92 Georgia
  - 92 Hungary
  - 92 Moldova



- What do the countries with the **highest** numbers of men to women have in common? Almost all are countries where there are enormous numbers of workers in male-dominated industries (oil, fishing). The only exception: China (see below).
- What do the countries with the **lowest** numbers of men to women have in common? Almost all were part of the former Soviet Union (or were dominated by the Soviet Union), and have experienced social, medical and economic disruption during the last 20 years. The only exception: Cape Verde, where a large percent of the male population has traditionally gone overseas, looking for work.

Overpopulation?

- The only rational way to define over-population is to say that if the population is too great for the local environment to support it, a place is overpopulated.
- Any other definition is based on cultural values.

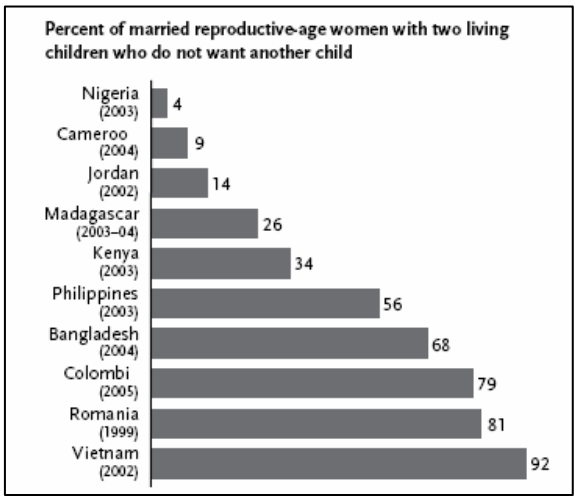


Thomas Malthus

- Thomas Malthus (1766-1834), British clergyman and economist.
- Published An Essay on the Principle of Population in 1798.
- Crucial insight: ***Population tends to grow faster than the food supply.***
- Population growth can be stopped:
  - FAMINE
  - "MORAL RESTRAINT"
- Was Malthus right?
  - For animal populations – yes.
  - For people – not so far!
- "Neomalthusians" vs. "cornucopians"

Reducing Natural Increase

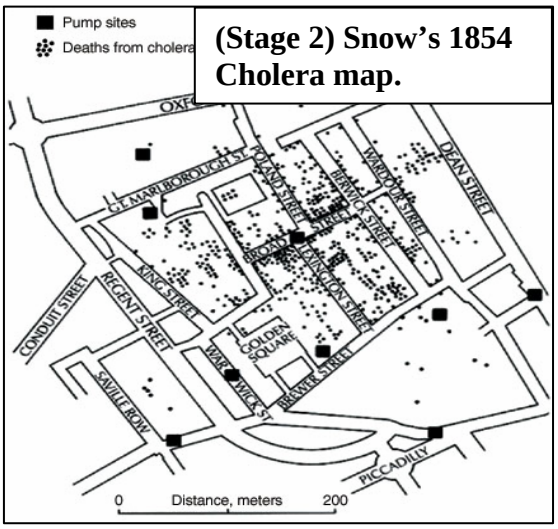
- The rate of natural increase can only decline if either birth rates decline or death rates increase. Of the two, most normal people prefer the first – but even this approach is controversial!
- Reducing birth rates:
  - Economic development (as the economy changes from traditional to advanced, countries go through the Demographic Transition, and birth rates will fall)
  - Contraception (in many – but not all – countries, women wish to limit family size).



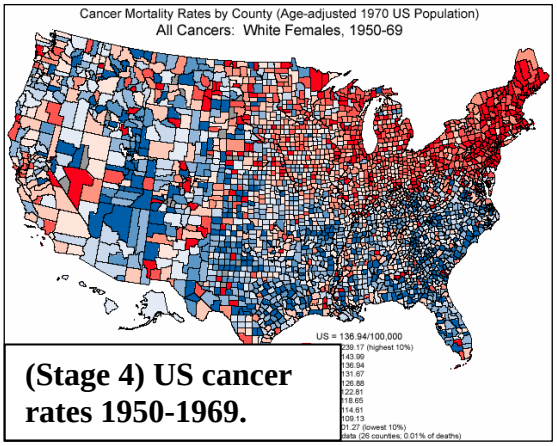
Source: http://www.prb.org/pdf06/06WorldDataSheet.pdf

The Epidemiologic Transition

- At different stages of development there are different processes that affect the death rate.
- Different countries have different levels of technological development – and different health problems.
  - Stage 1: Pestilence & famine ("Black Plague")
  - Stage 2: Receding pandemics ("Cholera")
  - Stage 3: Degenerative & human-caused diseases ("heart attack & cancer")
  - Stage 4: Delayed degenerative diseases ("cardiovascular disease & ontology")
  - Stage 5: Emergence & reemergence of infectious & parasitic diseases ("AIDS," "SARS," "TB," "Ebola," etc.)



(Stage 2) Snow's 1854 Cholera map.

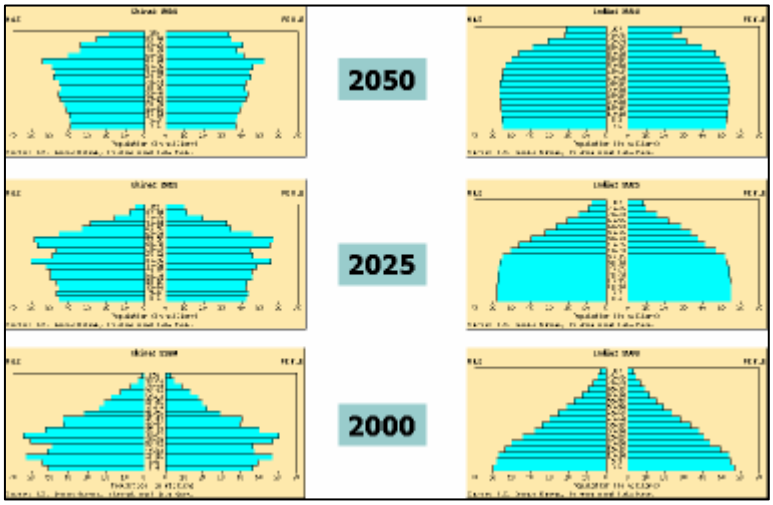


(Stage 4) US cancer rates 1950-1969.

Sources: http://www.llnl.gov/str/September02/Hall.html ; http://dceg.cancer.gov/cgi-bin/atlas/avail-maps?site=acc

China vs. India: Population Growth and Change

- By 2050 India will probably have a population of 1.6 billion, a large percentage of whom will be in (or entering) the child-bearing years.
- China will probably have a population of 1.4 billion, but with a much smaller percentage in (or entering) the child-bearing years, and a much older population overall.



Source: http://www.census.gov/ipc/www/idbpyr.html