

Population Dynamics

I. **Population Dynamics** - the study of human population and the changes that increasing numbers will have on the Earth. Some people argue that population growth alone is the cause of all our environmental problems

A. **Human Habitat Requirements** - how does population affect the world?

Based on adding approximately 234,000 children each day:

1. **Food** - 1 glass of milk for each child (234,000!!!) = 15,000 cows

1 loaf of bread for each child (234,000!!!)
requires 300 acres of wheat

2. **Water** - 6 to 8 glasses of water per day

3. **Space and Shelter???**

B. **Demography** - the study of population characteristics.

C. **Birth Rate** - the number of children born per 1,000 people each year.

United States BR = 13

D. **Death Rate** - the number of deaths per 1,000 people each year.

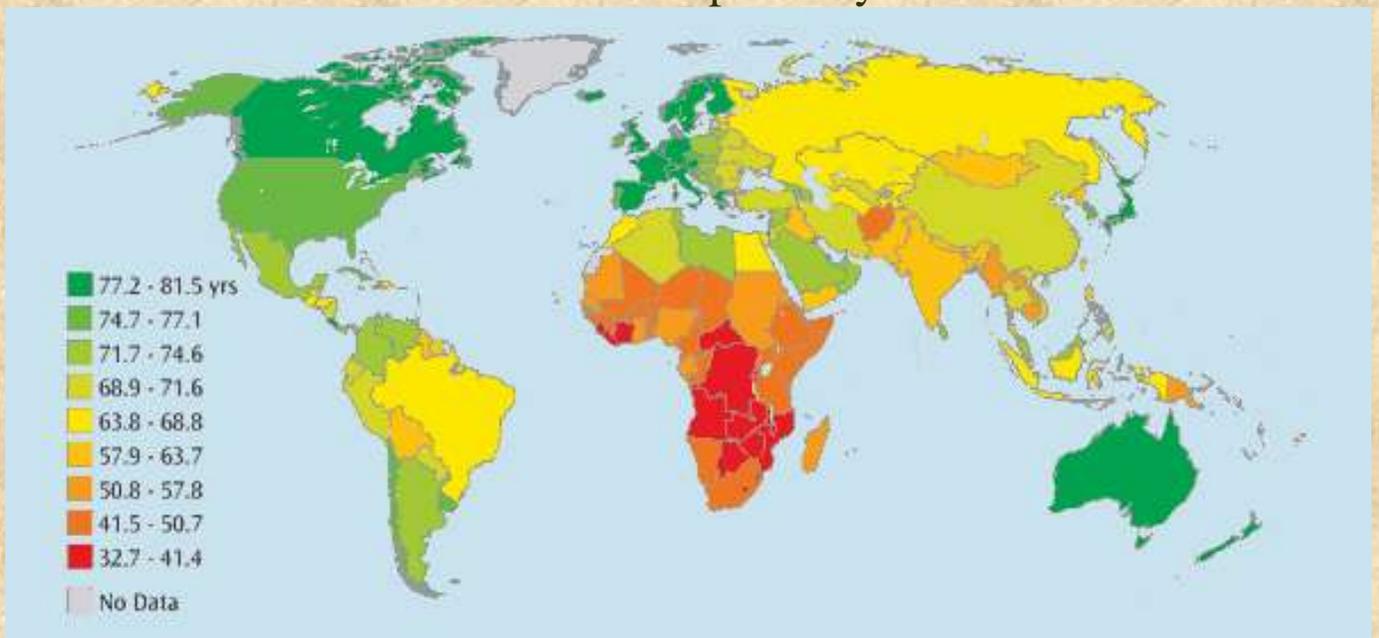
United States DR = 8

- E. Rate of Natural Increase** - the difference between the birth and death rates. The Rate of Natural Increase expressed as a percentage.

$$(5/1000) \times 100 = 0.5\%$$

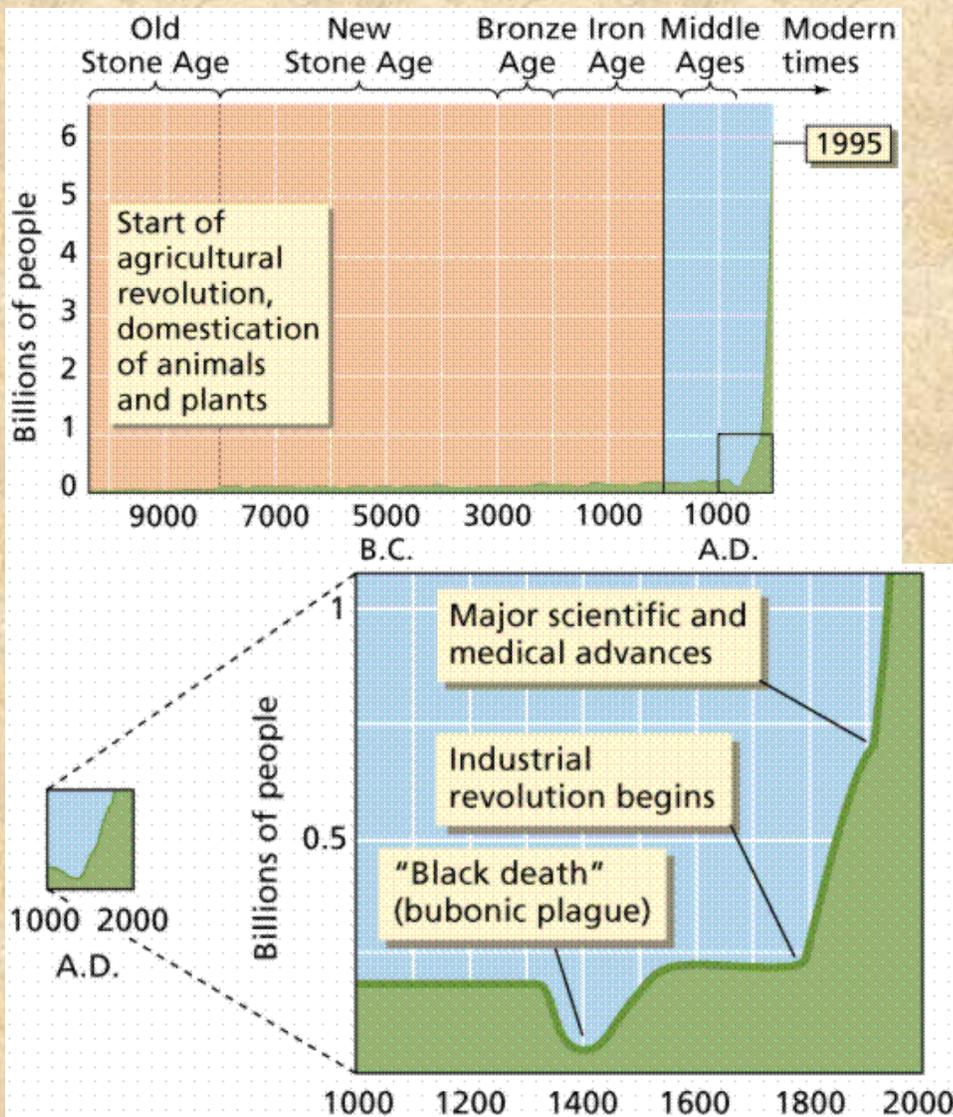
- G. Immigration/Emigration** – immigration acts like a birth rate and emigration acts like a death rate

Life Expectancy



- II. Exponential Growth** - the growth of a population that begins slowly and rapidly increases. The human population has been growing exponentially since the industrial revolution.

- A. Why Exponential Growth?**



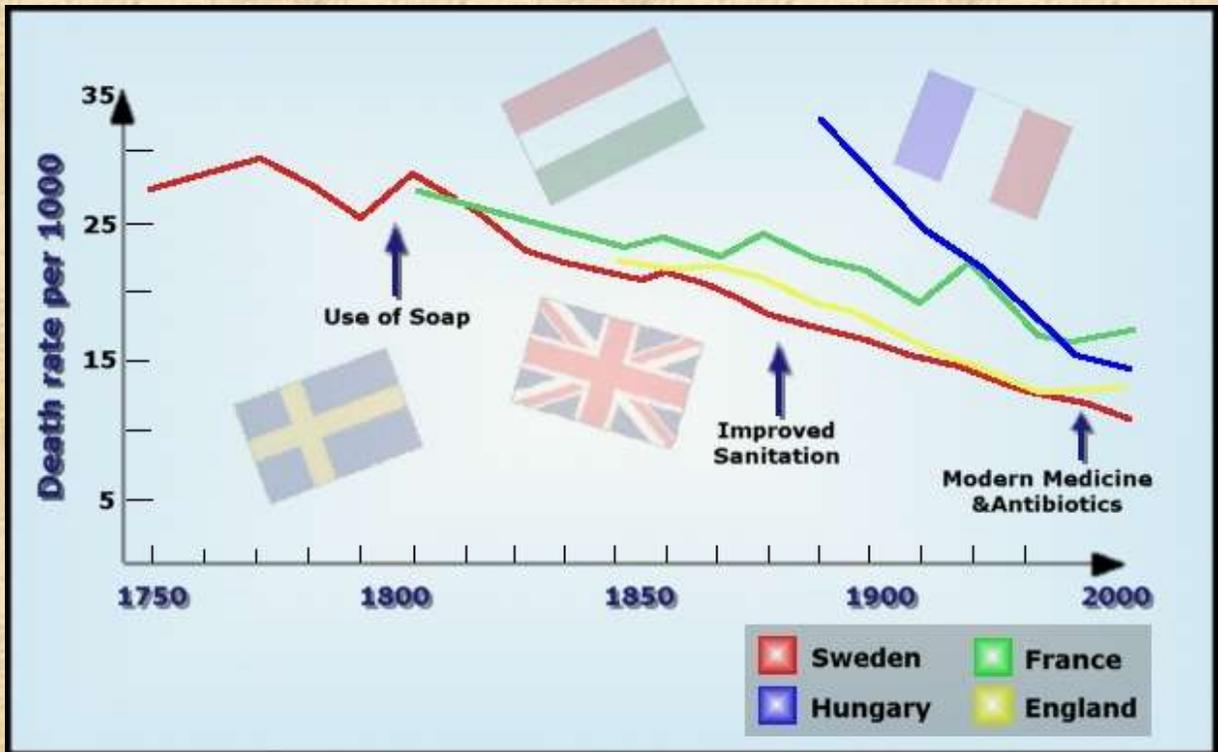
1. **Reduced death rates as a result of medical advances (vaccines, antibiotics), increased nutrition, and sewage treatment.**

death rate in the U. S. 1935 = 25/1000

death rate in the U. S. 2005 = 8/1000

life expectancy in the U. S. 1935 = 61

life expectancy in the U. S. 2005 = 78



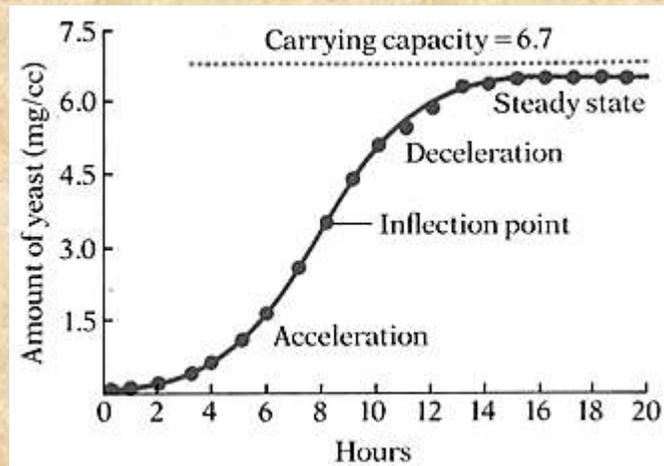
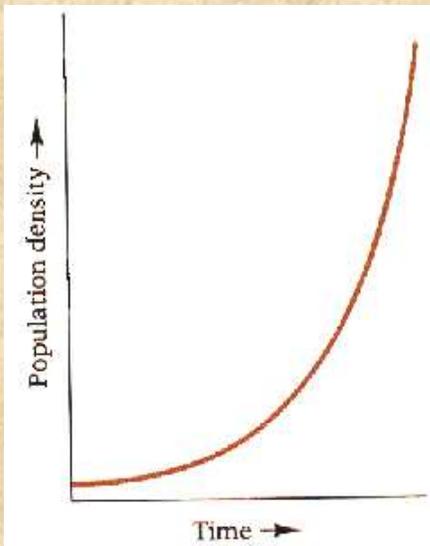
2. Doubling Time - the amount of time it takes to double a population.

The Rule of 70 = $70 / \text{growth rate} = \text{doubling time}$

J-curve

vs.

S-curve



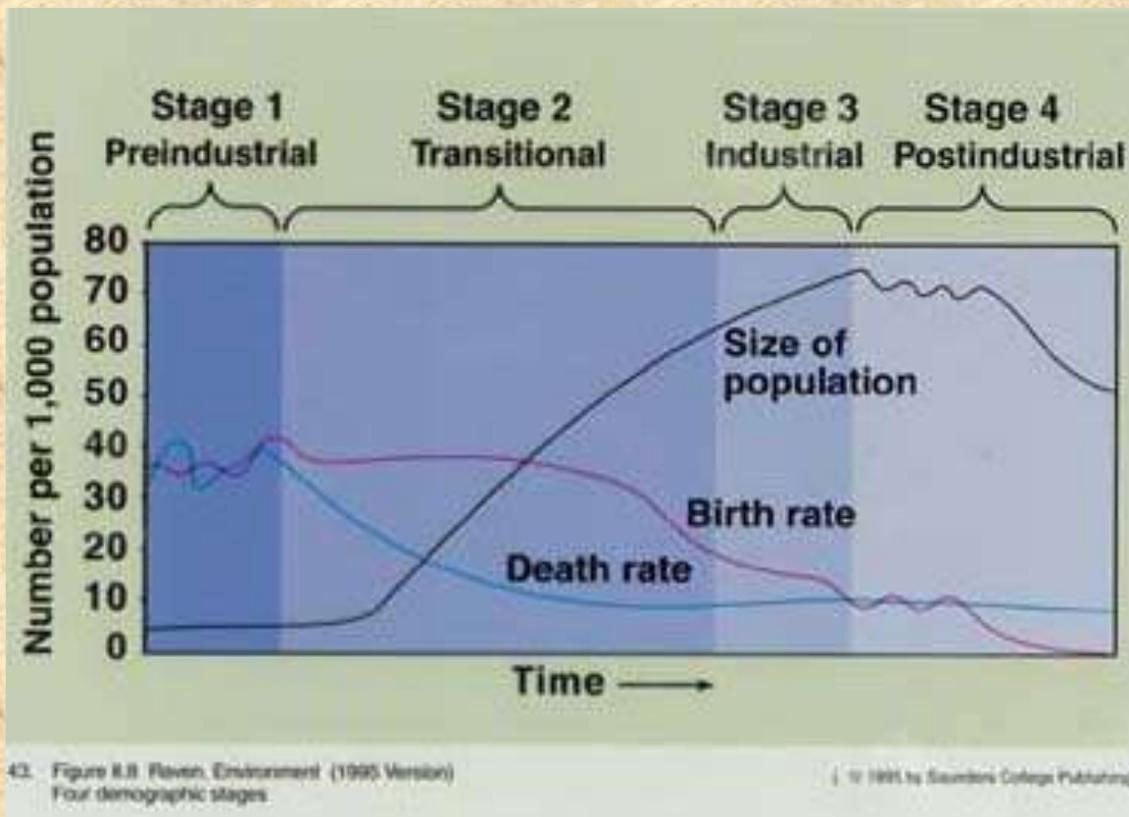
3. Population Density – the number of people per unit area.

III. Demographic Transition - the change in population as a result of industrialization and changing birth and death rates.

- A. Stage I - Pre-industrial Stage** - large families to support family farms, and aid parents in old age. Birth rates and death rates remain high causing a fairly stable population.
- B. Stage II - Transition Stage** - Industrialization begins economic growth and improved living conditions. Death rates begin to drop, birth rates remain high causing population to grow rapidly.
- C. Stage III - Industrial Stage** - Increasing industrialization causes birth rates to begin to drop, but population is still on the rise.

1. Families move from rural areas to cities, large families no longer needed.
2. Increasing education and employment opportunities for women delay marriage and child bearing.

D. Stage IV - Post Industrial - birth rates and death rates become equal, stabilizing population, or birth rates drop below death rates causing population to decline.



IV. Age Structure Diagrams - the number of people in specific age classes within a population.

Pre-reproductive ~ 1 - 15
Reproductive ~ 16 - 45
Post-reproductive ~ 46+

Raven/Berg, Environment, 3/e
Figure 8.14

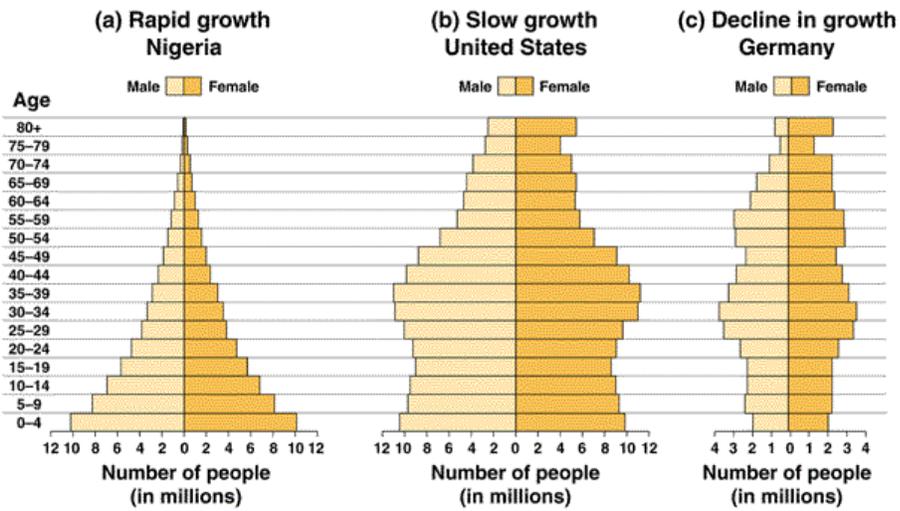
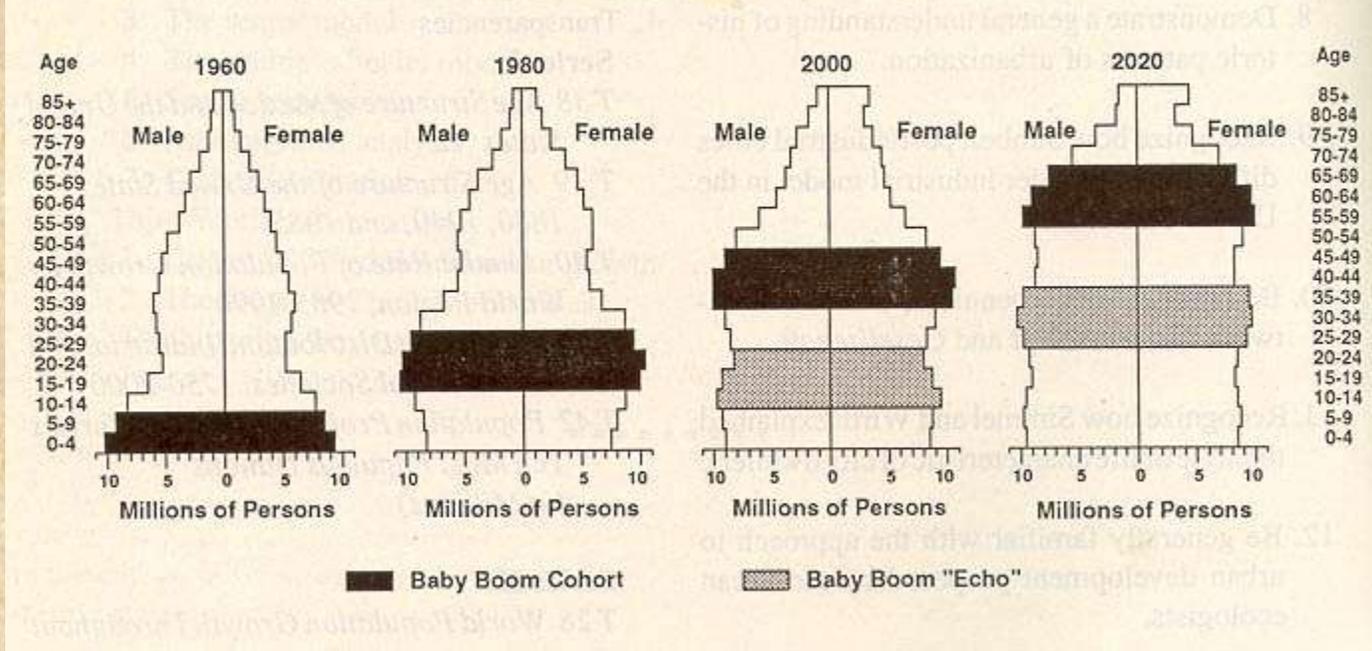


Figure 1 Progress of Baby Boom and Baby Boom Echo Cohorts Through U.S. Population Age-Sex Pyramid: 1960-2020



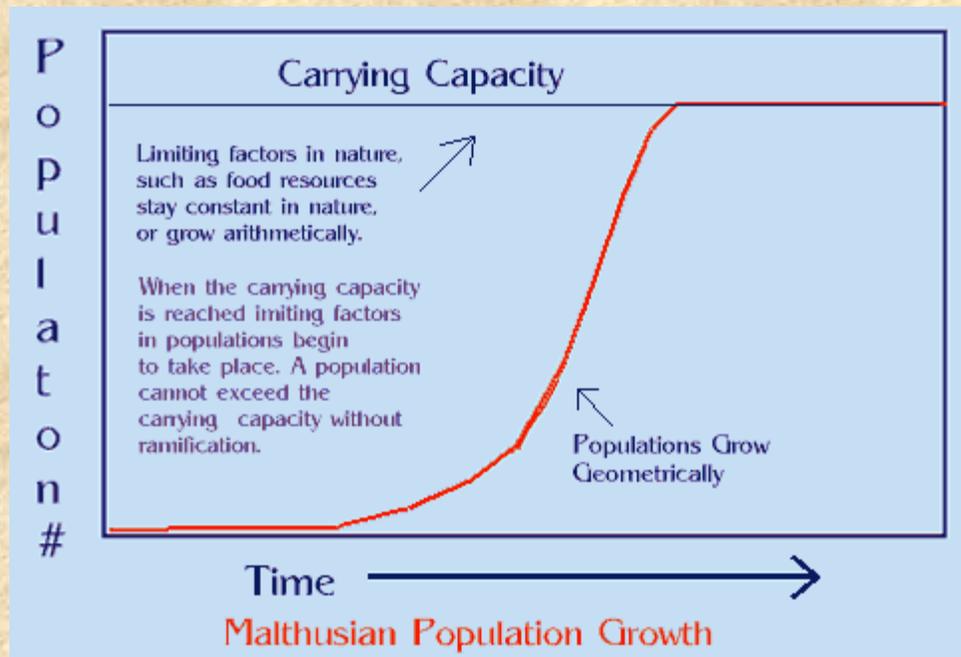
V. Overpopulation

A. Carrying Capacity - the ability for an ecosystem to support a population.

B. Earth's Carrying Capacity - 500 million - 50 billion ?
 Cultural carrying capacity is based on standards of living (ecological footprint).

C. Malthusian Overpopulation - population exceeds resources resulting in starvation, disease, war, which causes rapid decline in population.

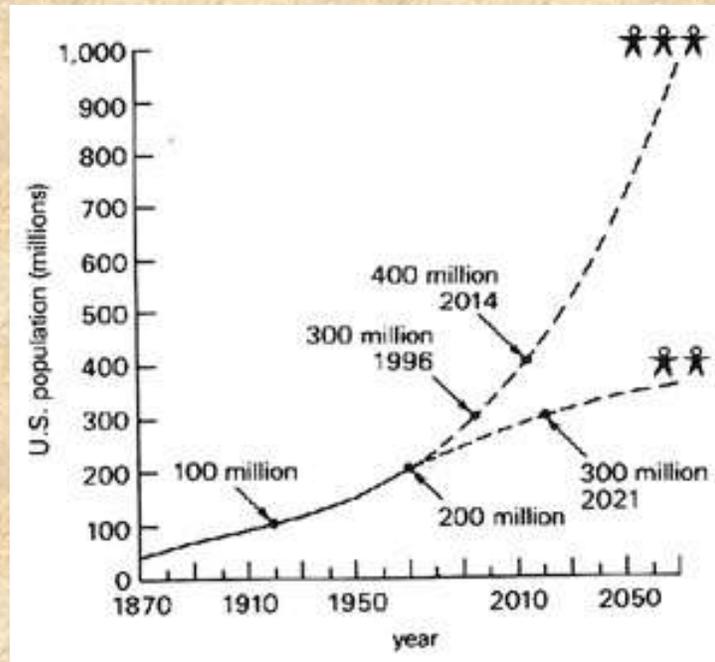
D. Technological Overpopulation - technology degrades environment causing decline in population.



VI. Population Control - keys to controlling population growth based mainly on lowering the birth rate and fertility rate.

A. Education, empowering women, and family planning.

U.S. Population Growth based on 2 or 3 children in the



B. China- from 1958-1962 30 million people died from famine as a result of overpopulation.

The State Birth Planning Commission was formed, and lowered birth rates from 36.9 to 18.4.

How did they do it?

Mass education about the negative effects of overpopulation.

Cultural emphasis on postponing marriage and the one child family.

Couples who committed to having only one child received cash payments, free family planning education, better housing

and employment, larger old age pensions, free schooling for child.

Birth control options were encouraged and made available.

Penalties were imposed on people with more than two children: increased taxes, compulsory sterilization, reduction of food, housing, employment, and education benefits for both parents and children.

C. Cairo Conference – 1994 International Conference on Population and Development (ICPD). World meeting to address population issues.

The ICPD's Twenty-Year Goals, 1995-2015

Provide universal access to a full range of safe and reliable family planning methods and related reproductive health services.

Reduce infant mortality rates to below 35 infant deaths per 1,000 live births and under-5 mortality rates to below 45 deaths of children under age 5 per 1,000 live births.

Close the gap in maternal mortality between developing and developed countries. Aim to achieve a maternal mortality rate below 60 deaths per 100,000 live births.

Increase life expectancy at birth to more than 75 years. In countries with the highest mortality, aim to increase life expectancy at birth to more than 70 years.

Achieve universal access to and completion of primary education; ensure the widest and earliest possible access by girls and women to secondary and higher levels of education.