Population

The CENTRAL Environmental Issue

The MOST IMPORTANT Environmental Issue

The MOST DIFFICULT Environmental Issue

• Essentially all environmental problems are related directly or indirectly to growth of the human population.

• Most environmental problems can not be resolved without addressing the population issue.

• If growth of the human population is not controlled, then solving the other environmental problems will not matter.
Population
The **MOST IMPORTANT** Environmental Issue
- If we do not control growth of the human population then “nature” will do it for us.

Population
The **MOST IMPORTANT** Environmental Issue
- If growth of the human population is not controlled, then we will exceed **CARRYING CAPACITY**.

Population
**CARRYING CAPACITY**
- The maximum number of organisms an ecosystem can support without damage to the ecosystem.

Population
There are currently more than 7.1 billion people on Earth.

Population
Simple equation for population increase

\[
\text{Increase} = \frac{\text{number of births}}{} - \frac{\text{number of deaths}}{}
\]
World Population Increase
Increase = Births minus Deaths
2.5 more people per second
148 more people per minute

At the current rate of increase, we are adding another ONE BILLION people every 12.8 years.
World population is over 7.1 billion and growing. What is the carrying capacity of Earth for humans?

Every minute we add 148 more people to world population. Each one of these people will need a lifetime of:
- food
- water
- clothing
- shelter
- energy
- natural resources

Every minute we add 148 more people to world population. Each one of these people will need:
- education
- health care
- employment

Rich and Poor Countries

More Developed Countries (MDCs)
-- also called the “Developed” countries
-- are the economically rich countries

Less Developed Countries (LDCs)
-- also called the “Developing” countries
-- are the economically poor countries

Rich and Poor Countries
Population Growth in Rich and Poor Countries

Approximately 10% of the current population growth is occurring in the MDCs

Approximately 90% of the current population growth is occurring in the LDCs

Population Growth in Poor Countries

Population growth is most rapid in the LDCs

Many LDCs are struggling to adequately provide for their current population

These countries are the least able to cope with more people

Why Be Concerned About Population Growth in LDCs?

- Basic Human Compassion
- Economic Interdependence
- Free Trade
- Civil Strife and Armed Conflict
- Environmental Degradation
- Environmental Refuges

Environmental Impacts and Populations

Environmental Impact of a Population = \( \frac{\text{Number of People}}{\text{Resource Use and Pollution Per Person}} \)

Environmental Impacts and LDCs

\[
\text{Large Impact} = \text{Huge} \times \text{Small}
\]

\text{PEOPLE Overpopulation}
Environmental Impacts and MDCs

Environmental Impact of a Population = Number of People \times \text{Resource Use & Pollution Per person}

Large Impact = Small \times \text{Huge}

CONSUMPTION Overpopulation

Reducing the Environmental Impacts of Populations

LDCs
- control population growth
- raise standard of living

MDCs
- control resource consumption & pollution
- maintain standard of living

Growth of World Population

A graph of human population growth resembles a J-shaped curve

Growth of World Population

Human population remained below 1 billion for tens of thousands of years

World population is estimated to have reached 1 billion in 1830.
- 1830 1 billion

World population is estimated to have reached 2 billion in 1930.
- 1930 2 billion

Growth of World Population

1830 1 billion
1930 2 billion
1960 3 billion
1975 4 billion
1987 5 billion
1999 6 billion

thousands of years
100 years
30 years
15 years
12 years
12 years
At the current rate of growth, world population will approach 10 billion by the middle of this century.

Future population size will depend upon our efforts to control the rate of growth of population.

World population is over 7.1 billion and growing

What is the carrying capacity of Earth for humans?

A graph of human population growth resembles a J-shaped curve

J-shaped growth curves are frequently observed by ecologists studying non-human populations.

What do these ecological studies of non-human populations suggest about the future of human population?
**Population Growth Curves**

- **sigmoid growth curve**
  - population could stabilize at or below carrying capacity

- **dome-shaped growth curve**
  - population could briefly exceed carrying capacity but not seriously damage the environment

- **irruptive growth curve**
  - population could grossly exceed carrying capacity and seriously damage the environment

**Population Growth**

**Exponential Growth**
- Increase in a quantity by a constant percentage per unit time
- The human population is currently showing exponential growth
- Human population is growing at the rate of 1.2% per year

**Doubling Time**
- The amount of time required for a quantity to double or increase by 100%
- For quantities increasing by exponential growth, doubling time can be estimated by the “rule of 70”

**The “Rule of 70”**
- A useful algorithm for estimating doubling time under exponential growth

\[
\frac{70}{\% \text{ increase}} = \text{doubling time}
\]
### The “Rule of 70”

#### Some Practical Application Examples
- The Rule of 70 can be applied to growth of your personal investments

\[
\frac{70}{\% \text{ increase}} = \text{doubling time}
\]

- \( 70 \) \% per year interest = your initial investment doubles in 14 years

\[
\frac{70}{2\% \text{ per year interest}} = \text{doubling time}
\]

- \( 70 \) \% per year interest = your initial investment doubles in 35 years

\[
\frac{70}{10\% \text{ per year interest}} = \text{doubling time}
\]

- \( 70 \) \% per year interest = your initial investment doubles in 7 years

### Population Growth
- Human population is growing at the rate of 1.2\% per year

\[
\frac{70}{1.2\% \text{ per year}} = 58 \text{ years}
\]

- At the current rate of growth, world population will be over 14 billion by the year 2072

### World population over 14 billion by 2072
- What is the carrying capacity of Earth for humans?

### Why the Rapid Increase in Population?
- Increase = births minus deaths

- Due to an increase in births? NO

- Due to a decrease in deaths? YES

### Why the Survival Boom?
-
Why the Survival Boom?

Improvements in Medicine
- germ theory of disease
- antibiotics – topical and systemic
- vaccines and immunizations
- control of dysentery and diarrhea
- more medical personnel

Why the Survival Boom?

Improvements in Nutrition
- more abundant and dependable food supply
- better understanding of nutritional requirements and dietary deficiencies
- better food preservation and storage

Why the Survival Boom?

Improvements in Hygiene
- better sanitation – control of human wastes
- water treatment for control of water-borne disease
- better control of vector-borne disease – pesticides

Studying Population

- Demography – the statistical study of human populations
- Demographics – the statistical data used to describe human populations

Studying Population

Population Histograms
- A useful tool of demography
- A graphical snapshot of a population
- Bar graph that shows number of males and females in five year age blocks

Population Histograms

Provide a rapid visualization of the age distribution of a population
Population Histograms

- Stable Population – histogram is essentially straight up and down
- Shrinking Population – base is smaller than top
- Slowing Growing Population – base is slightly larger than top
- Rapidly Growing Population – base is much larger than top

Population Histograms

- Striking difference in population histograms for MDCs and LDCs
- Population histogram for MDCs indicates relatively stable population
- Population histogram for LDCs indicates tremendous growth in population

Population Histograms

- Pre-Reproductive Age — 0 - 14 years of age
- Reproductive Age — 15 - 64 years of age
- Post-Reproductive Age — over 65 years of age
Population Growth

Post-Reproductive Survival and Longevity
- Contributes very little to population growth
- Relatively small percentage of total population
- No longer adding to population through the birth of children

Pre-Reproductive Survival
- Individuals that survive the pre-reproductive period contribute to population growth through reproduction

Pre-Reproductive Death
- Approximately 90% of the current population growth is occurring in the LDCs
Population Growth

- Why the large difference in population growth rates of MDCs and LDCs?
- MDCs have completed the Demographic Transition

Demographic Transition

- Describes population trends historically seen in the currently More Developed Countries (MDCs)
- Proposed explanation for current low population growth rates of MDCs

Demographic Transition

Four Phases

- Phase 1: Primitive Stability
  - High Birth Rates
  - High Death Rates
  - Little-or-No Population Growth

Phase 2: Epidemiological Transition

- Birth Rates remain high
- Death Rates decline
  - See before on “Why the survival boom?”
- Rapid Population Growth
Demographic Transition

Phase 3  Fertility Transition

- Birth Rates decline
  - Attributed to economic development
- Low Death Rates
- Population Growth slows

Demographic Transition

Economic Development and Birth Rates

- With industrialization and economic development – living standards improved
- Couples realized that fewer children would allow maintenance of higher living standards
- Couples voluntarily limited family size
- Birth rates declined with economic growth

Demographic Transition

Phase 4  Modern Stability

- Low Birth Rates
- Low Death Rates
- Little-or-No Population Growth

Demographic Transition

Phase 2 is the stage of rapid population growth

Demographic Transition

Will the Demographic Transition slow population growth in the LDCs?

- Currently, the LDCs are stuck in Phase 2 of the Demographic Transition
- Phase 2 is the stage of rapid population growth

Demographic Transition

Will the Demographic Transition slow population growth in the LDCs?

- It can contribute, **BUT**
- the demographic transition **alone** is not sufficient, **AND**
- there is TOO MUCH at stake to assume that it will succeed
Demographic Transition

- The Demographic Transition alone is not sufficient to slow population growth in the LDCs?
  1. It may take too long
     - it took 200 years for the current MDCs
     - we can’t wait that long – when some countries are doubling in population every 20 years

Demographic Transition

- The Demographic Transition alone is not sufficient to slow population growth in the LDCs?
  2. Economic development requires monetary capital
     - many LDCs are desperately poor
     - many LDCs owe vast sums to MDCs

Demographic Transition

- The Demographic Transition alone is not sufficient to slow population growth in the LDCs?
  3. Economic development requires natural resources
     - many LDCs lack abundant natural resources

Demographic Transition

- The Demographic Transition alone is not sufficient to slow population growth in the LDCs?
  4. Economic development requires energy
     - many LDCs lack fossil fuel energy supplies
     - the days of cheap fossil fuels are ending

Demographic Transition

- The Demographic Transition alone is not sufficient to slow population growth in the LDCs?
  5. Economic development requires an educated and trained workforce
     - many LDCs struggle to provide even minimal education for their people

Demographic Transition

- The Demographic Transition alone is not sufficient to slow population growth in the LDCs?
  6. Real economic growth must outpace population growth
     - in many LDCs, population growth is faster than economic growth – they are actually losing ground
Controlling Population Growth

- If the Demographic Transition alone is not sufficient, how can population growth be controlled?
  - **Family Planning** is the best answer

Family Planning

- Information and technology that allows a couple to determine the number and the spacing of their children

Family Planning

- Contraception prevention of a pregnancy
- Birth Control prevention of a birth

Family Planning

Types of Family Planning Programs

- Voluntary
- Extended Voluntary
- Forced

Family Planning

Voluntary Family Planning Programs

- Information and technology is available
- Government provides neither incentives nor punishments
- United States

Family Planning

Extended Voluntary Family Planning Programs

- Information and technology is available
- Government encourages and provides positive incentives for participation
- India
Forced Family Planning Programs

- There is no single approach that works for all countries
- Each country has unique challenges and must develop a program that succeeds for that country
- There are numerous obstacles to the success of family planning programs

Obstacles to Success of Family Planning Programs

1. Religious Beliefs
   - Some major religions, Catholic and Islamic, oppose artificial control of reproduction
   - Many LDCs have large Catholic or Islamic populations

2. Cultural Tradition
   - Some cultures value large families
   - A large family may be seen as part of fulfillment of ethnic heritage

3. Personal Tradition and Desire
   - Some individuals value large families
   - A large family may be seen as part of personal fulfillment

4. Extra Children Assure That Some Will Survive
   - Where infant and childhood death have been common, parents may have “extra” children to offset the potential death of some children
Obstacles to Success of Family Planning Programs

5. Children As Source of Labor and Income
- in rural areas, more children means more helpers in the fields
- in urban areas, more children means more wage earners for the family

6. Children As Old Age Security
- most countries lack “social security” programs for the elderly
- traditionally, children care for their elderly parents
- more children means better probability of care in elder years

7. Macho Attitude
- some men may see the number of children fathered as a measure of their masculinity
- more children shows that he is “more of a man”

8. Lack of Knowledge
- many individuals lack basic reproductive knowledge, such as
- days of the menstrual cycle when pregnancy is most likely
- proper use of contraceptive devices such as a condom

9. Costs of Materials
- contraceptive materials may cost a substantial fraction of a poor family’s income
- limited funds may go for food or medicine, rather than contraception

10. Availability of Information
- mass media may be lacking or unavailable to many individuals
- printed materials may not help illiterate individuals
11. Availability of Materials
- in rural areas, the nearest distribution site may be a day's walk away
- quantities of available supplies may be inadequate to meet the needs

12. Program Costs
- informative materials, contraceptive supplies, and personnel are expensive
- these expenses may drain the budgets of poor governments or aid agencies

13. Status of Women
- in some cultures, women are second class citizens
- in some cultures, women are not allowed to make decisions about family size – it is the man who has the say
- in some cultures, women are often denied educational opportunities
- one of the few steps in slowing population growth that has been found effective across cultures is increasing female literacy and education
How can MDCs assist LDCs in family planning programs?
- direct financial aid
- provision of supplies & materials
- skilled personnel to help train local family planning workers

What is your opinion?
- How do you feel about the availability and effectiveness of family planning programs in the United States?

Population Terms
- Replacement-Level Fertility
  - when couples have only two children – exactly replacing themselves
- Zero Population Growth
  - when there is replacement-level fertility AND net emigration and immigration is equal to zero

Emigration
- movement out of a country or region
- E = Exit = Emigration

Immigration
- movement into a country or region
- I = Into = Immigration

U.S. Population Growth
- A substantial part of United States population growth is due to immigration – both legal and illegal

What is your opinion?
- What do you think should be the immigration policy of the United States?