

1 Environmental Problems and Sustainability

Chapter 1

2 What is environmental science?

- What do environmental scientists do?
- Environment is abiotic and biotic factors that affect a living organism.
- Ecology is a BIOLOGICAL science that studies relationships. It is part of environmental science.
- Other natural sciences are part of envs.
- Social sciences are part of envs because we are part of a living system and because we are altering our own living system. Consequently, economics, politics and ethics will shape some of the interactions we have with our environment.

3 capital

- Our solar capital is unlimited-perpetual resource.
- Our natural capital is limited-some is renewable and some is nonrenewable.
- How governments use their capital affects growth; how peoples use their capital affects growth.

4 World Population – J growth curve

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6 SUSTAINABLE

- To use resources in such a way as to meet needs now and provide for needs in the future.
- Sustainable society:
- Meets basic needs-food, clean water and air (SOIL?), shelter

7 Sustainable means providing for the indefinite future

- Without depleting or degrading the earth's natural resources
- PROTECT CAPITAL
- Balance capital w growth-current and future growth

8 RULE of 70

- (you should KNOW this)
- Way to estimate population growth
- Doubling time is years for population to double its size
- Rule of 70: $70/\text{percentage growth rate} = \text{doubling time in years}$
- US: $70/0.92$ (2005 est.) = 76 years
- India: $70/1.4 = 50$ years
- Sweden: $70/.17 = 412$ years

9 What is the current world population?

- About 6 billion. You should know this.
- If our growth rate is 1.28%, when will the world population double? Is it within your life time?

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11 Economic growth

- Increase in capacity to provide people with goods and services
- Population growth (more consumers and producers)
- More consumption per capita

12 Economic growth indices

- GNI: gross national income (was GNP: gross national product)
- GNI PPP: gross national income in purchasing power parity
- GDP: gross domestic product
- GWP: gross world product
- Per capita GNI (calculated at midyear)
- Per capita GNI PPP

13 Economic development

- Improvement of living standards by economic growth
- Developed and developing countries

14 Developed countries

- US, Canada, Japan, Australia, New Zealand, all countries in Europe
- Highly industrialized
- Per capita GNI PPP > \$10,750/year
- 19% of world population
- 85% of world's wealth
- Use 88% of world's resources
- Generate 75% of pollution and waste of world

15 Developing countries

- Africa, Asia and Latin American countries
- Middle income per capita GNI PPP ~\$3-11K
- Low income per capita GNI PPP <\$3K
- 81% of population
- 15% of world wealth
- 12% of world resources
- 25% of world pollution and wastes
- Increase by 1 million people every 5 days-why?

16 Economic Development

17 Past/project Population Size

18 More people, more disturbance

- Natural resources support all life
- Currently natural resources are being used unsustainably
- Premature extinction of growing number of the world's plant and animal species (100-1000x faster)
- Destruction or degradation of ecosystems
- Depletion of aquifers

19 Human Disturbance of Land Area

20 Anthropogenic changes contribute to global change

- 73% of habitable land has been disturbed
- Gases emitted into atmosphere largely from burning fossil fuels also from other anthropogenic sources have altered climate: global warming at an increased rate
- Alterations in climate include shifting arable areas or reduction in arable land
- Alteration of precipitation by amount, location, and phase
- Alteration of community structure
- Sea level rise

21 Global Economic Growth

22 globalization

- Integrated world view and environmental world change as a function of social and economic forces

23 Economic Globalization

- GNP
- >international trade
- >transnational corporations

24 Information and Communication

•Internet

25 Environmental Effects

- Global transmission of infectious diseases
- Invasive aliens
- Global transport of natural and chemical pollutants-air and water

26 Resources

- Anything from environment to meet our needs
- Food, water, air, soil, shelter, good, transportation, communication and recreation
- 3 categories: perpetual, renewable, nonrenewable

- 27 **Perpetual resource**
- Singular-sun
 - On human time scale renewed continuously
- 28 **Renewable Resources**
- Replenished within our life time (less than decades, less than 100 years)
 - Not sustainable if used more rapidly
 - Forests, grasslands, wild animals, fresh water, fresh air, arable soil
 - Depletion vs degradation
 - Highest rate at which it can be used INDEFINITELY without depleting or degrading resource is sustainable yield
- 29 **Environmental degradation**
- Urbanization of productive land
 - Waterlogging or salinization
 - Deforestation
 - Aquifer depletion/contamination
 - Overgrazing grasslands
 - Reduction of biodiversity
 - pollution
- 30 **NONrenewable resources**
- Fixed quantity
 - Energy resources: coal, oil, natural gas
 - Metallic and nonmetallic minerals
- 31 **What are alternatives once a nonrenewable resource becomes economically depleted?**
- Costs of extraction and using what is left exceed its economic value.
 - Find more
 - Recycle or reuse existing supplies
 - Waste less; use less
 - Try to develop substitute
 - Wait millions of years for more to be made
- 32 **Recycle versus reuse**
- Recycling: products collected and reprocessed into new products
 - Reuse: products are used over and over again-like refilling a water bottle instead of making a new water bottle from recycled products or newly acquired resources
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37 Ecological footprint

- Amount of land needed to produce resources needed by an average person in a country
- It is a way to express environmental impact
- Hectare metric = 100 acres

38 Relative ecological footprints per person

39 Relative ecological footprints by country

40 pollution

- Any addition to air, water, soil, or food that threatens the health, survival or activities of living organisms
- Point sources of pollution emanate pollution from a single, identifiable source
- Nonpoint pollution emanates from many possible sources and are dispersed over a large area land or in water or air
- Most regulations apply to point pollution sources

41 Pollution Prevention

- Once pollutants have entered water, soil, or air in harmful levels, it is usually too costly to reduce the pollutants to an acceptable level (*superfund* sites)
- The best solutions would be to prevent pollutants from reaching environment or to reduce the amount of pollutants

42 5 R's

- Refuse: do not use
- Replace: find a less harmful substitute
- Reduce: use less
- Reuse
- Recycle

43 Tragedy of the commons

- Degradation of common property or free access resources
- Air, water, migratory birds, wildlife species, publicly owned lands, space
- Everyone contributes to degradation and no one feels responsible for conservation or restoration

44 Major Environmental Problems

- Air pollution
- Water pollution
- Food supply problems
- Waste production

- Loss of biodiversity

45 Main Causes of Environmental Problems

- Rapid population growth
- Unsustainable resource use
- Poverty
- Not including the environmental costs of economic goods and services in their market prices
- Trying to manage and simplify nature with too little knowledge about how it works

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Environmental Wisdom Worldview

- Nature does not exist for use and we are not in charge.
- There is not always more.
- Some forms of technology and economic growth are environmentally beneficial. Those that are not should be discouraged.
- Our success depends on learning how the earth sustains itself and adapting to that pattern.

47 Environmentally Sustainable Economic Development

- Economic rewards (gov. subsidies, tax incentives, emissions trading) to encourage environmentally beneficial and sustainable forms of economic development
- Economic penalties to discourage env harmful economic growth

48 Shifting the dominant paradigm

- From pollution clean up to prevention
- From waste disposal to waste prevention
- From protecting species to protecting places
- From env degradation to env restoration
- From increased resource use to more efficient resource use
- From population growth to population stabilization by decreasing birth rates

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