

APES CHAPTER 1 NOTES: TOWARD A SUSTAINABLE FUTURE

"We must recognize the earth's limited capacity to provide for us. We must recognize its fragility. We must no longer allow it to be ravaged. This ethic must motivate a great movement, convincing reluctant leaders and reluctant governments and reluctant peoples themselves to effect the needed changes."

-- Union of Concerned Scientists, 1993 (over 1500 people, many Nobel Laureates)

1.1 Notes

I. The Global Environmental Picture:

population growth/economic development, decline of ecosystems, global atmospheric changes, and biodiversity loss

A. Population Growth and Economic Development

1) **Ecological footprint**—*an indicator showing how big an area of productive land and water is needed to produce the resources required to maintain people's standard of living*

a) *Food footprint*

- frequency of animal-based product consumption
- amount of processed, packaged, not locally grown (> 200 mi.) food

b) *Goods footprint*

- amount of trash generated

c) *Shelter footprint*

- number of people in dwelling
- size of dwelling
- type of dwelling
- electrical conservation measures in place

d) *Mobility footprint*

- type of dwelling
- public transportation usage
- vehicle usage
- types of land vehicles used
- mpg of land vehicles used
- frequency of carpooling
- frequency of air travel
- bicycles, walking, or horses

2) Population statistics

World: <http://www.census.gov/ipc/www/popclockworld.html>

U.S.: <http://www.census.gov/popclock/>

3) Various statistics from World-O-Meter: <http://www.worldometers.info/>

B. The Decline of Ecosystems (Ch. 4)

1) *Pilot Analysis of Global Ecosystems (PAGE)* <http://www.wri.org>

a) Collaborative project of scientists (2000-2001)

b) Preview for the Millennium Ecosystem Assessment

c) PAGE assessed five of the world's major ecosystem types:

- Agricultural ecosystems
- Forest ecosystems
- Freshwater systems
- Grassland ecosystems

- Coastal and marine ecosystems
- 2) Focused on major ecosystem services
 - a) food and fiber production,
 - b) water, in sufficient quantity and quality
 - c) biodiversity
 - d) **carbon sinks** – *areas for storage of atmospheric carbon (CO₂)*
 - e) recreation and tourism
 - 3) major finding: human activities are disrupting natural *biogeochemical cycles*
 - 4) Millennium Ecosystem Assessment (MEA), U.N. Project 2001-2005
 - a) integrated assessment and evaluation of the consequences from ecosystem changes
 - b) parts to the MEA
 - ecosystem conditions
 - consequences of ecosystem change
 - options for response.

Key Messages from www.LivingBeyondOurMeans.pdf

- “Everyone in the world depends on nature and ecosystem services to provide the conditions for a decent, healthy, and secure life.
- Humans have made unprecedented changes to ecosystems in recent decades to meet growing demands for food, fresh water, fiber, and energy.
- These changes have helped to improve the lives of billions, *but at the same time they weakened nature’s ability to deliver other key services such as purification of air and water, protection from disasters, and the provision of medicines.*
- Among the outstanding problems identified by this assessment are the *dire state of many of the world’s fish stocks; the intense vulnerability of the two billion people living in dry regions to the loss of ecosystem services, including water supply; and the growing threat to ecosystems from climate change and nutrient pollution.*
- *Human activities have taken the planet to the edge of a massive wave of species extinctions, further threatening our own well-being.*
- The loss of services derived from ecosystems is a significant barrier to the achievement of the Millennium Development Goals to reduce poverty, hunger, and disease.
- The pressures on ecosystems will increase globally in coming decades unless human attitudes and actions change.
- Measures to conserve natural resources are more likely to succeed if local communities are given ownership of them, share the benefits, and are involved in decisions.
- Even today’s technology and knowledge can reduce considerably the human impact on ecosystems. They are unlikely to be deployed fully, however, until ecosystem services cease to be perceived as free and limitless, and their full value is taken into account.
- Better protection of natural assets will require coordinated efforts across all sections of governments, businesses, and international institutions. The productivity of ecosystems depends on policy choices on investment, trade, subsidy, taxation, and regulation, among others.”

C. Global Atmospheric Changes (Ch. 20)

- 1) **greenhouse effect**—heating up of the earth’s atmosphere
 - a) *incoming solar radiation is absorbed by the earth’s surface*
 - b) *infrared radiation (IR) is radiated out from the ground as heat*
 - c) *IR is absorbed and back-radiated by greenhouse gases and is trapped in the Troposphere (lower atmosphere)*

- 2) **The Kyoto Protocol**
 - a) an international treaty which is an addendum to the 1992 United Nations Framework Convention on Climate Change (UNFCCC)
 - b) adopted in 1997
 - c) endorsed by 192 parties
 - d) first commitment period – 2008-2012, binding members to reduce Greenhouse gas emissions by specific amounts
 - e) U.S. never ratified it and dropped out in 2001
 - f) Kyoto Protocol extension (“Doha amendment,” Qatar) – 2012-2020
 - does not have enough U.N. member acceptance to implement at this time
 - countries with first-round commitments that did not commit now: Japan, New Zealand, Russia, Canada (dropped out in 2011)
 - Lima 2014 – negotiations for a post-Kyoto legal framework mandating all major polluters to pay for CO₂ emissions.
 - China, India, and the U.S. have said that they will not ratify any treaty that will commit them legally to reduce CO₂ emissions.
 - 3) **The Montreal Protocol, AKA “The Montreal Protocol on Substances That Deplete the Ozone Layer”**
 - a) *international treaty designed to protect the stratospheric ozone layer*
 - b) *originally signed in 1987, amended through 2003*
 - c) called for phasing out production of substances that are responsible for ozone depletion
 - d) U.S. signed and ratified
 - 4) **Intergovernmental Panel on Climate Change (IPCC)** <http://www.ipcc.ch/>
 - a) established in 1988 to assess the risk of human-induced climate change
 - b) annual assessment reports provide a update of scientific knowledge related to climate change
- D. *Biodiversity Loss* (Ch. 10)
- 1) **biodiversity**—the variety of living organisms on the planet
 - estimate of number of species on Earth: range from 2,000,000–50,000,000
 - many say ~8.7 million
 - 2) causes of biodiversity loss
 - a) *population explosion*
 - b) *increased demand for resources*
 - c) *ignorance about species and their relationships to ecosystems*
 - d) *policies enacted without ecological ramifications being considered*
 - e) *global trading effects*
 - f) *pollution*
 - g) *biodiversity being devalued*
 - 3) risks of biodiversity loss
 - a) the ultimate consequence: species **extinction**, accelerated by human presence (*extinct*: eliminated vs. *extant*: existing)
 - b) **habitat alteration**, disruption of food chains and food webs, etc.
 - c) agriculture uses genetic engineering with wild species’ genes
 - d) depletion of plants—root of modern medicine

1.2 Notes

II. Three Strategic Themes: **Sustainability, Stewardship, and Sound Science**

- A. **sustainability** (in environmental science)—*long-term solutions having the least environmental impact as possible*
- 1) sustainable systems can keep themselves going without depletion
 - 2) **sustainable yields** in commercial fishing and forestry
 - 3) **sustainable agriculture** – *promotes environmental health, economic profit, and social and economic equity*
 - 4) **sustainable ecosystems** *use solar energy, recycle nutrients and maintain biodiversity*
 - 5) **sustainable societies**— societies that are in balance with nature
 - 6) **sustainable development**—(from the U.N.) *“development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”*
 - a) development – improvement of the standards of living
 - b) harmony of **ecology, sociology, and economics**
 - 7) An Essential Transition
 - a) *stabilize the global population*
 - b) *decrease pollution*
 - c) *societal priorities to focus on conservation*
 - d) *eliminate large-scale poverty*

B. **Stewardship**— ethical and moral framework

from <http://www.sarep.ucdavis.edu/sarep>

“Stewardship of human resources includes consideration of social responsibilities such as working and living conditions of laborers, the needs of rural communities, and consumer health and safety both in the present and the future. *Stewardship of land and natural resources involves maintaining or enhancing this vital resource base for the long term.*”

1) examples of environmental activists and stewards

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|-----------------------------|--------------------------|--------------------------|
| • Edward Abbey | • William O. Douglas | • Sigurd Olson |
| • John James Audubon | • Rene Dubos | • Ruth Patrick |
| • Archie "Grey Owl" Belaney | • Rosalie Edge | • Gifford Pinchot |
| • David Brower | • Ira Gabrielson | • Ed Ricketts |
| • John Burroughs | • Lois Gibbs | • Jerome Irving Rodale |
| • Rachel Carson | • Sir Albert Howard | • Theodore Roosevelt |
| • George Washington Carver | • Celia Hunter | • Ken Saro-Wiwa |
| • Alan Chadwick | • Aldo Leopold | • Gary Snyder |
| • John Clarke | • Wangari Maathai | • Wallace Stegner |
| • Anna Botsford Comstock | • George Perkins Marsh | • Ernest Swift |
| • Jacques Cousteau | • Robert “Bob” Marshall | • Henry David Thoreau |
| • Jay N. “Ding” Darling | • Stephen Mather | • Morris Udall |
| • John Denver | • Rodolfo Montiel | • Barbara Ward |
| • Marjory Stoneman Douglas | • Farley Mowat | • Terry Tempest Williams |
| | • John Muir | |
| | • Margaret "Mardy" Murie | |
| | • O.J. Murie | |

2) Justice and Equity: the **environmental justice movement**

from <http://nonoise.org/library/execords/eo-12898.htm>

“*Environmental justice is a movement promoting the fair treatment of people of all races, income, and culture with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.* Fair treatment implies that no person or group of people should shoulder a disproportionate share of the negative environmental impacts resulting from the execution of this country's domestic and foreign policy programs. (The environmental justice movement is also occasionally referred to as **Environmental Equity**—which EPA defines as the equal treatment of all individuals, groups or communities regardless of race, ethnicity, or economic status, from environmental hazards).” (combating **environmental racism**)

3) Justice for the Developing World:

“No one is free when others are oppressed.” (author unknown)

- a) over 1 billion people in the world live in extreme poverty
- b) political corruption
- c) U.N. resolutions

C. Sound Science

1) “sound science” vs. “junk science”

a) *junk science* or *bunk science* is a term used to describe purportedly scientific data, research, analyses or claims which are perceived to be driven by political, financial or other questionable motives (invalid experimentations, falsifying or distorting data, not following the scientific method)

b) *pseudoscience*—body of alleged knowledge, methodology, belief, or practice that is portrayed as scientific but diverges from the required standards for scientific work or is unsupported by sufficient scientific research

c) *controversial science*—ideas and theories at odds with mainstream science; often advanced by individuals either from outside the field of science or by scientists outside the mainstream of their own disciplines

2) Science and the Scientific Method

a) **scientific method**—a systematic way of solving problems

- well-known steps: *observe, hypothesize, experiment, theorize...*
- human thought processes: *drawing conclusions, gaining insights, posing questions, testing and re-testing ideas...*

b) experimental and control setups

- **experiment**— a controlled test of a hypothesis
- *experimental* group: the variable being tested is present
- *control* group: the variable being tested is absent

c) variables

- anything affecting the outcome of the experiment
- only one can be tested at a time for the experiment to be valid
- **independent variable** is changed by the experimenter (x)
- **dependent variable** changes based on what the independent variable does (y)

d) **hypothesis**—an educated guess; can be accepted or rejected

e) **observation**—direct or indirect *recording of information*

- **direct observation**— made with the *senses*
- **indirect observation**—made with *measuring instruments*

f) **data**—*verbal (words) or numerical (numbers) information*

- descriptive research contains verbal data

- data handling must be accurate
- **factual information** has been reconfirmed
- graphs, tables, charts, etc.
- g) **research**
 - review the existing literature
 - experimental results are shared with the **scientific community**
 - *repeat experiments to see if results are consistent*
- h) **theory**
 - *repeatedly and thoroughly tested; substantial scientific evidence*
 - long description which tells *why*
 - cannot be proven
 - constructed with *objectivity* and *rationality*
- i) **scientific law**
 - concise statement which tells *what*
 - can be proven
- 3) Scientific Controversies: fueled by new information, complex phenomena, bias, and subjective values
- 4) Evaluating Science
 - a) Can the data be verified?
 - b) Check the rationale: is the explanation logical?
 - c) Is the explanation objective, taking into account all observations?
 - d) Is the conclusion widely accepted by the scientific community?

1.3 Notes

III. Three Integrative Themes: Ecosystem Capital, Policy/Politics, and Globalization

A. Ecosystem Capital

- 1) **natural capital**—*natural resources*
- 2) **economics** deals with the *production and distribution of goods and services*
- 3) goods and services <http://www.mcwdn.org/ECONOMICS/GoodService.html>
 - a) *goods—anything that people want or need*

“Consumer goods are those such as food and clothing, that satisfy human wants or needs.

Producer goods are those such as raw materials and tools, used to make consumer goods. Capital goods include machinery, used in the production of commodities or producer goods.”

b) *services— the performance of any duties or work for another; helpful or professional activity (educational, health, communication, transportation, social services...)*

- 4) *Exploitation of natural systems is widespread and nonsustainable.*
- 5) Protecting Ecosystem Capital: a partnership between the private sector and government

Ecosystem services (R. Costanza): Soil formation, Recreation, Nutrient cycling, Water regulation/supply, Climate regulation, Habitat, Flood and storm protection, Food production, Raw materials production, Genetic resources, Atmospheric gas balance, Pollination, etc.

B. Policy and Politics

- 1) environmental public policy goals: *to improve the human condition and protect the environment*
- 2) main categories: *to reduce pollution and regulate use of natural resources*
- 3) policies may be implemented on a local level to address specific issues
- 4) environmental policies have changed dramatically since 2001

- C. *Globalization*—the *interconnectedness* of human activity
- 1) Economic Changes
 - a) globalization of communication, transportation, and finance
 - b) international trade agreements
 - c) emergence of international mega corporations
 - d) spread of Western culture
 - 2) *Environmental Changes*
 - a) *pros: easier exchange of information, goods, and services*
 - b) *cons: quicker dissemination of contagious diseases, dispersion of exotic species, hazardous waste movement, spread of POPs (persistent organic pollutants), etc.*
 - 3) Protests (for more info on the modern environmental protest movement, see <http://www.inter-disciplinary.net/ptb/ejgc/ejgc4/halbert%20paper.pdf>)

1.4 Notes

IV. The Environment in the Twenty-First Century

A. Examples of World Summits

1) **United Nations Conference on Environment&Development (UNCED)**, Rio 1992

Some of the principles from <http://www.un.org/documents/ga/conf151/aconf15126-1annex1.htm>

“Principle 1: Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 3: The right to development must be fulfilled so as to *equitably meet developmental and environmental needs of present and future generations.*

Principle 4: In order to achieve *sustainable development*, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Principle 5: All States and all people shall cooperate in the essential task of *eradicating poverty* as an indispensable requirement for sustainable development...

Principle 10: Environmental issues are best handled with the participation of all concerned citizens, at the relevant level...

Principle 11: States shall enact effective environmental legislation...

Principle 15: In order to protect the environment, the *precautionary approach* shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Principle 17: *Environmental impact assessment*, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

Principle 25: Peace, development and environmental protection are interdependent and indivisible.”

2) WSSD (World Summit on Sustainable Development): Johannesburg, 2002

http://www.un.org/jsummit/html/documents/summit_docs/2309_planfinal.htm

B. A New Commitment

- Good News: some declining population growth rates, decreased malnutrition, increased environmental awareness, species conservation, increased availability of environmentally-friendly goods and services...
- People are realizing that they can be a source of powerful, positive change

“There are no passengers on spaceship Earth. We are all crew.”

--Marshall McLuhan, Canadian philosopher (1911-1980)