

HWC 201 -- UNIT II -- THE ENVIRONMENT

Outline for LECTURE 3 -- BIODIVERSITY AND THE EXTINCTION CRISIS

"The worst thing that can happen -- will happen -- is not energy depletion, economic collapse, limited nuclear war, or conquest by a totalitarian government. As terrible as these catastrophes would be for us, they can be repaired within a few generations. The one process ongoing...that will take millions of years to correct is the loss of genetic and species diversity by the destruction of natural habitats. This is the folly our descendants are least likely to forgive us. - E. O.

Wilson, *Harvard Magazine*, January-February 1980

I. OVERVIEW

A. Worldviews (ways of looking at the world):

1. "Anthropocentric" (human-centered) or "Frontier" Worldviews

- the Earth is an unlimited supply (frontier) of resources for exclusive human use
- humans are apart from nature rather than a part of nature
- human success is best achieved through the domination & control of nature

Problem: The future of people and nature are closely intertwined

Estimated that humans are now using 40% of Earth's terrestrial net 1° productivity; Global grain production per person has decreased since the peak year of 1984; more than 100 countries now import food; U.S. agriculture (world's breadbasket) is not sustainable, soil & water "mining," "fossil water," Great Plains of the U.S. have lost 1/3 of their topsoil in the past 150 years

2. "Sustainable Earth Worldview" or "Non-anthropocentric" Worldviews (earth-centered)

e.g. "Evolutionary/Ecological/Environmental Worldviews"

- the earth has a limited supply of resources to be used by all species
- humans are a **part of nature** rather than apart from nature
- for long-term success we must understand and cooperate with nature

Core value: all species have intrinsic value & an inherent right to live

This worldview would say we're part of nature & need to act in a manner so we don't wipe out our fellow passengers on this small planet.

B. Rate of extinction/evolutionary crisis - the exploding human population (currently > 6.3 billion, increasing at ca. 80 million per year) is degrading the environment at an accelerating rate causing the irreversible loss of biodiversity through extinction. A **quarter** of all species may be lost in the next several decades. This is an extinction event unequalled in 65 million years. Humans are thus altering the course of evolution. Destruction of the world's genetic library -- "folly" of the 21st century

II. BIODIVERSITY - the term used to describe the biological diversity of life on earth; the variety of organisms considered at all levels, from genetic variation within species, to the variety or number of species, to the level of ecosystems

- levels of biological diversity: within species; species richness & evenness; ecosystem level
- often used as a **shorthand expression for species richness = the number of species**
- How many species are there?: 1.4 million species named; # poorly known, estimates up to 100 million; but best estimate is approx. **10 million**
 - 20,000 or more species of ants from arctic circle to the equator
 - ca. 300,000 species of beetles known & who knows how many undescribed; Haldane quote; "bug bomb" (fogging) experiments by Terry Erwin in Panama - 18,000 beetle species in one hectare (2.5 football fields) - incredible diversity in the tropics, beetles mostly unknown
 - ca. 4,000 species of mammals; ca. 9,000 species of birds

III. EXTINCTION AND ITS CAUSES

A. OVERVIEW - natural process, more than 99% of all species that ever lived are now extinct

- we can estimate the natural rate of extinction from the fossil record
- current (anthropogenic or human caused) rate is probably **1,000 to 10,000 times the natural rate**
- more than 10% of species have already become extinct or are so reduced that they're doomed
- we're in danger of losing 25% or more of the world's species within the next few decades

B. CAUSES OF EXTINCTION

- GLOBAL FACTORS** - *potentially the most important future cause* of extinction; could result in ecosystem disruption or collapse and massive extinction; ex. **Global warming** - worldwide decline in amphibians, **ecological indicators** ("canary in coal mine")
- HABITAT DESTRUCTION (currently the major cause of extinction)**
(causes: **overpopulation**, unequal distribution of wealth, greed); when habitats are destroyed, the animals and plants inhabiting them are lost; e.g. 1940's to 1980's there was a 50% drop in migratory bird populations in mid-Atlantic U.S. due to deforestation of tropical wintering grounds

2. HABITAT DESTRUCTION (continued)

- **centinela extinctions** (named after Centinela Ridge in western Ecuador) - anonymous extinctions; extinctions of species unknown before their demise and hence unrecorded; *species lost before they're even classified or catalogued*, before we can evaluate their uses. Centinela Ridge - 90 species of endemic plants found there (& found no where else); by 1986 completely cleared and planted in cacao & other crops; 96% of forests on Pacific side of Ecuador already cleared for crops
Rio Palenque Reserve (less than one square kilometer) - populations not large enough to reproduce; **"living dead"** = *species reduced to a population too small to reproduce*
95-96 % of the vegetation of the Philippines has been destroyed
less than half of the world's tropical rainforests left; being reduced at nearly 2% per year
tropical deforestation has been a major contributor to atmospheric CO₂ increase
95-98% of old growth forests in the continental U.S. have been cut
emphasis on saving **entire ecosystems**, not just **charismatic** or high "cuddle factor" species

3. **OVEREXPLOITATION** - this term covers a variety of things - overuse as food, material, sport hunting (ex. elephants - shoot to kill policy, rhinos, gorillas, passenger pigeons, macaws, cactus "rustling", wild cats and other animals hunted for their fur; buffalo (biol. warfare) ca. one-fifth (20%) of bird species have been eliminated by humans over the past 2000 years; 11% of the remaining approx. 9,000 species are endangered

4. INTRODUCTION OF FOREIGN (EXOTIC or ALIEN) SPECIES; ecological release

-examples: chestnut blight; Dutch elm disease; Nile perch in Lake Victoria, >300 native species believe half will be lost; 20% of world's freshwater fish now extinct or in dangerous decline; Hawaiian birds - accidental introduction of mosquitoes & mosquito borne diseases; Native Americans & Old World diseases; Kudzu vine; Galapagos tortoises; rabbits in Australia

5. IMPACTS OF TECHNOLOGY

-examples: bald eagle, brown pelican, peregrine falcon - DDT, U.S. export of chemicals; aurora trout in Canada -**acid rain**; Uganda Rwenzari Park 1979 - high tech weapons, 30% of animals killed by out of control troops; corals and silt in Hawaii

6. **INCOMPATIBILITY WITH HUMANS** e.g. grizzly, wolf, Carolina parakeet, prairie dogs

IV. WHY SHOULD WE BE CONCERNED?

A. COMPASSION, CONSIDERATION

B. **AESTHETIC VALUE** - example: blue whale, depauperate planet, loss for all future generations

C. **ETHICS** - "**ultimate arrogance**," anthropocentric vs. biocentric or ecocentric viewpoints;
Sustainable Earth Worldview - something is ethical when it tends to maintain Earth's life support systems for us & other species

D. **DIRECT ECONOMIC BENEFITS** - tangible benefits: medicines & chemical prospecting (e.g. Pacific Yew, Madagascar periwinkle, up to 40% of U.S. prescriptions are derived from organisms; genetic resources for crops, 3 plants, wheat, corn, & rice, provide nearly half of all human food;

Costa Rica -tourism (**ecotourism**) is now most important source of income

E. **ECOSYSTEM SERVICES/LIFE SUPPORT SERVICES**; Ehrlich airplane analogy

V. **WHAT CAN WE DO?** "**think globally, act locally**" (energy habits, pesticides, native plants in your landscape, recycling, help educate others, support local parks, save water, etc.); organizations – power in numbers (great variety---Nature Conservancy, Sierra Club, World Wildlife Fund, Greenpeace, Natural Resources Defense Council); volunteer activities; political action (make yourself aware, vote, write representatives); economic voice (e.g., "dolphin safe" tuna; choice of other products—consider the impact); financial support

"We are only fellow voyagers with other creatures in the odyssey of evolution." - Aldo Leopold

"Only in the last moment of human history has the delusion arisen that people can flourish apart from the rest of the living world."
- E.O. Wilson in *The Diversity of Life*

"Conservation is sometimes perceived as stopping everything cold, as holding whooping cranes in higher esteem than people. It is up to science to spread the understanding that the choice is not between wild places or people. Rather it is between a rich or an impoverished existence for Man." - Thomas E. Lovejoy, Foreword to M. Soule and B. Wilcox, *Conservation Biology*, 1980

"We have not inherited the Earth from our parents, we have borrowed it from our children." -IUNC, *World Conservation Strategy*, Intro.

"All things are connected. What befalls the Earth befalls the sons of the Earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself." - Chief Seattle, Pacific Northwest

"The evidence of swift environmental change calls for an ethic uncoupled from other systems of belief. Those committed by religion to believe that life was put on earth in one divine stroke will recognize that we are destroying the Creation, and those who perceive biodiversity to be the product of blind evolution will agree. Across the other great philosophical divide, it does not matter whether species have independent rights or, conversely, that moral reasoning is uniquely a human concern. Defenders of both premises seem destined to gravitate toward the same position on conservation.

The stewardship of environment is a domain on the near side of metaphysics where all reflective persons can surely find common ground. For what, in the final analysis, is morality but the command of conscience seasoned by a rational examination of consequences? An enduring environmental ethic will aim to preserve not only the health and freedom of our species, but access to the world in which the human spirit was born."

- E.O. Wilson in *The Diversity of Life*