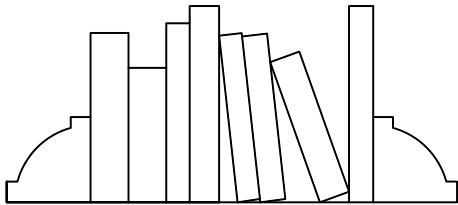


Biodiversity

Lecture Outline:

6. BIODIVERSITY
 - A. Wild Nature
 - B. Value of Natural Species
 - C. Biodiversity
 - D. Loss of Biodiversity
 - E. Saving Wild Species
 - F. Ecosystems Under Pressure



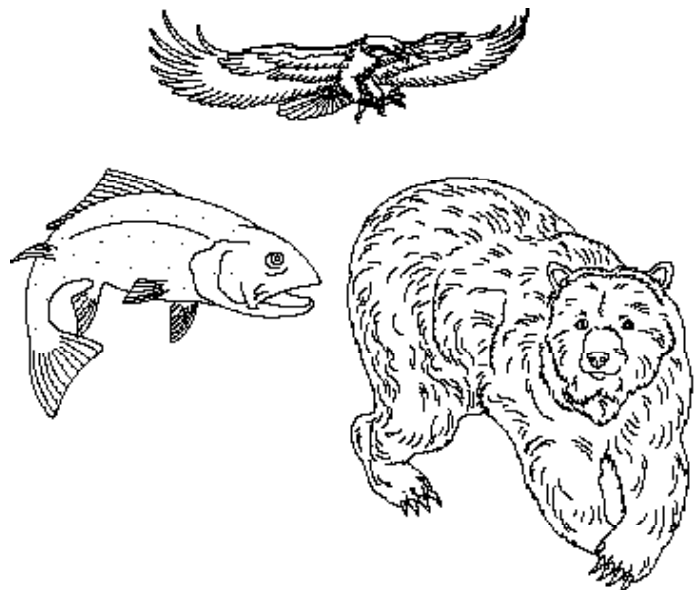
Learning Objectives:

When you are finished with this unit you should be able to:

1. Distinguish between instrumental and intrinsic value in assigning worth to natural species.
2. Explain how biodiversity is important for agriculture, forestry, aquaculture, and animal husbandry; medicine; recreation, science, and aesthetic enjoyment; and commercial trade.
3. Define biodiversity and estimate the diversity of species on Earth.
4. Document the extent of bio-diversity losses, both known and unknown.
5. Analyze the ways in which physical alteration of habitat affect biodiversity.
6. Explain how the human population explosion impacts biodiversity.

Terms You Should Know:

- ❖ Biological wealth
- ❖ Instrumental value
- ❖ Intrinsic value
- ❖ Cultivar
- ❖ Gene bank
- ❖ Biodiversity
- ❖ Simplification of habitat
- ❖ Fragmentation of habitat
- ❖ Conversion of habitat
- ❖ Endangered Species Act
- ❖ Endangered species
- ❖ Exotic species
- ❖ Lacey Act
- ❖ Ecotourism
- ❖ Keystone species



Reading Assignment:

Brennan and Withgott:
Chapter 12; pages 313-340.

6. BIODIVERSITY

A. WILD NATURE

INSTRUMENTAL VALUE—a species or individual organism has instrumental value if its existence or use benefits some other entity (monetary value)

ANTHROPOCENTRIC—beneficiaries are humans

INTRINSIC VALUE—value for its own sake; does not have to be useful to possess value

How would a cornucopian think?

B. VALUE OF NATURAL SPECIES

5 areas of value:

1. Sources for Agriculture, Forestry, Aquaculture, and Animal Husbandry

-

- Take a native plant,

grow as a Cultivar (for cultivated variety)

-

- Potential:

- 10,000 species in legume family

-

2. Sources for Medicine

- Periwinkle of Madagascar
 - one of over 800 species used in medicine
 - two important medicines
 - ✓
 - ✓
 -
 - no \$ to Madagascar
- Pacific yew— produces taxol; a compound used in cancer treatment
- 25% of the pharmaceuticals used today are plant derived

3. Recreation, Aesthetic, and Scientific Value

- Sport fishing
-
- Hiking
-
-
-
- Very important source of support for maintaining wild species

4. Commercial Value

INDIRECT:

- recreational value to support commercial values
- sporting goods stores
-

ECOTOURISM — the enterprise involved in promoting tourism of unusual or interesting ecological sites

- Non-consumptive use of wildlife
-

Rwanda —

Kenya —

Costa Rica —

Dominica —

DIRECT:

- commercial logging
-

5. Intrinsic Value

- Basic right to exist
- Large vs. small animals?
-

C. BIODIVERSITY

2,300,000 known species

270,000 flowering plants

950,000 insects

- 70% of the world's biological diversity is concentrated in 17 countries

The big 5 countries:

–

–

–

–

–

The next 5:

–

–

–

–

–

11 through 17:

–

–

–

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–

A. Predicting Biodiversity

3 factors in order:

1.

2.

3.

B. Ranking states

Example 1 — Rank from most to least biodiverse

- Indiana
- Iowa
- North Carolina

Example 2 — Rank from most to least biodiverse

- Idaho
- Montana
- Wyoming

Example 3 — Rank from most to least biodiverse

- Alaska
- California
- Texas

Example 4 — Rank from most to least biodiverse

- Nebraska
- North Dakota
- Oklahoma

C. Ranking countries

Example 1 — Rank from most to least biodiverse

- Cuba
- Dominican Republic
- Haiti

Example 2 — Rank from most to least biodiverse

- Chad
- Niger
- Uganda

Biodiversity in the USA:

Mammals

Birds

Amphibians

Reptiles

Fish

Plants

1. Decline of Biodiversity**a. Losses**

Idaho: Endangered species

USA:

– 9,000 species at risk

–

–

Bad Signs:

– commercial fish catch down 42% since 1982

–

– song bird and frog numbers are declining

Worldwide:

-
- in the past most extinctions have been on small islands
- Recent concern in tropics:
 -
 -
 - if deforestation rate is 1.8% per year — tropics lose 40,000 species a year
 - potential loss of 320,000 species between 2008 and 2016 AD

MAMMALS IN DECLINE

Conservation Status of the World's Mammals:

Category	Number	%
Extinct		
Extinct in wild		
Critically endangered		
Endangered		
Vulnerable		
Lower risk/conser. dept.		
Near threatened		
Data deficient		
Low level of concern		

TOTAL

Specific Problems

-
-
-

Endangered Snails

- 463 species of snails are considered endangered

Location	Number of species
Idaho	
Hawaii	
Galapagos Islands	
Madagascar	
French Polynesia	

- 33% of species
- Invasion by alien species!

D. Loss of Biodiversity

Scientists have coined an acronym to describe the five primary causes of biodiversity losses:

H I P P O

1. H. I. P. P. O.

H — Habitat alteration

I — Invasive species

P — Pollution

P — Population growth

O — Overexploitation

a. Habitat Alteration

i. CONVERSION

forests →

forests →

ii. FRAGMENTATION

- minimum area required to support a critical number of individuals

–

–

iii. SIMPLIFICATION

- Human use simplifies habitats

–

–

–

b. Invasive / Exotic Species

EXOTIC SPECIES—is one introduced into an area from somewhere else

–

–

- occasionally disrupts ecosystems and wipes out native species

c. Pollution

- Causes or is a form of habitat destruction or alteration

–

–

–

–

–

d. Population Growth

- Increasing human population puts pressure on biodiversity

-
-
-

e. Overuse / Overexploitation

- Over-fishing, over-logging, over-whaling
-
-
- Exotic pets

f. Examples of Conversion, Fragmentation, and Simplification

i. Conversion in Idaho

-
-
-

ii. Fragmentation in Idaho

-
-

iii. Simplification in Idaho

-
-

iv. Change in the Pacific Northwest

-

-

v. Change in the USA

-
-
-

vi. Change in the World

-
-
-
-

2. Consequences of Biodiversity Losses

- Lose one at a time, not very important
- Loss of **KEYSTONE** species may result in the collapse of an ecosystem

KEYSTONE SPECIES — a species whose role is absolutely vital for the survival of many other organisms in an ecosystem

—

—

3. International Efforts to Protect Biodiversity

a. Trade in Endangered Species

- CITES—Convention on Trade in Endangered Species of Wild Fauna and Flora

—

- international agreement signed by 118 nations

–

b. Convention on Biological Diversity

- One of two agreements to come out of 1992 Earth Summit in Rio de Janeiro
-
- USA did not sign because of industry objections
- Treaty does the following:
 - funds move from HDCs to LDCs to protect biodiversity
 - genetic resource access rests with host countries
 -

E. SAVING WILD SPECIES

1. Game Animals in USA

- Most game animals are in good shape
-
- There have even been some successes at reintroductions
 -
 - 1930s — 30,000 total in USA — almost extinct
 - 1990s —
- Hunting fees help
-

-

-

- Emerging problems:

- road kills

- urban invasion:

- lack of predators

2. Endangered Species Act

Lacey Act—enacted in 1900, forbids interstate commerce in illegally killed wildlife

Endangered Species Act of 1973 (reauthorized in 1988)

ENDANGERED SPECIES — one that has been reduced to the point where it is in imminent danger of becoming extinct without protection

Where species have become endangered the law provides:

- Substantial fines for any killing, trapping, uprooting (plants) or commerce

-

- Habitats must be mapped and a program designed for preservation and management

- over 900 species listed

-

Problems with act:

- Protection not provided until species is almost gone
- Spotted owl is threatened (6,000-8,000 individuals)
- Insufficient funding for adequate enforcement — poaching, trapping, etc..
- Political problems with some species:
 -
 -
 -

ESA is the formal recognition of the importance of preserving wild species regardless of economic importance (intrinsic value)

3. The ESA Today

- In July 2012 there were 1,394 species listed by the ESA
 - were animals
 - were plants
- Another 316 species are considered threatened
 - animals
 - plants

F. ECOSYSTEMS UNDER PRESSURE

- The decline of biodiversity is linked to the welfare of all the Earth's ecosystems

1. Forests and Woodlands

- approximately 35% of the area in woodland worldwide is now devoid of trees

Negative impacts of losing a forest:

-
-
-

–
–
–

Tropical rain forest loss:

Region	Original Area	Loss		
		1980-89	1990-99	2000-09
----- million ha -----				
Americas	2,100	140	170	
Asia	1,200	40	73	
Africa	900	32	60	

Forest Losses

- Earth's forest cover is down 50% in last 8,000 years

–
–

- Deforestation rates greatest in:

–
–

- Country deforestation:

– Indonesia

✓

✓

- Brazil

✓

- Indonesia
 - 1.3% of world's land area

BUT:

–

–

–

Deforestation

- Reduce tree cover

Why are we losing forests?

–

–

–

2. Wetlands — drying up

-

- Disproportionate portion of biodiversity

-

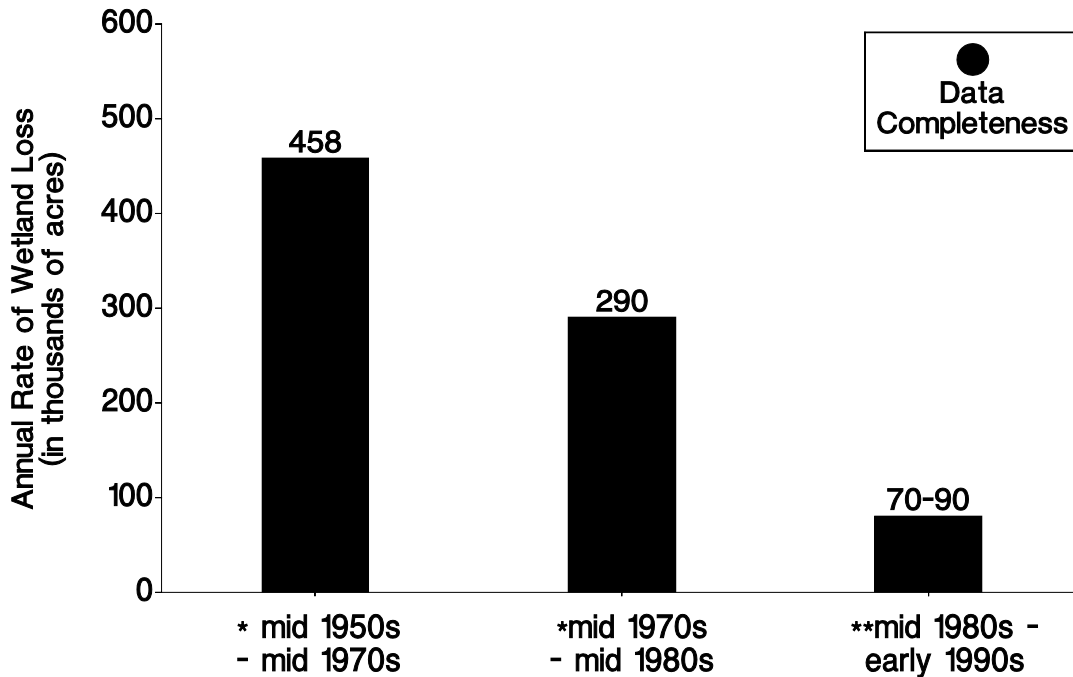
USA – wetland losses:

-

-

- In the USA there is currently a reduction in the rate of loss
 - figure below shows the annual rate of wetland loss in the USA between the mid-1950s and the mid-1990s (source: *EPA report 841-F-96-001*)

INDICATOR 9: Wetland Acreage



Sources: * U.S. Fish and Wildlife Service, 1990 (Data include federal lands)

** U.S. Department of Agriculture, 1992 (Data exclude federal lands)

Proposed Milestone: By 2005, there will be an annual net increase of at least 100,000 acres of wetland, thereby supporting valuable aquatic life, improving water quality, and preventing health- and property-damaging floods and drought.

3. Mangroves

- Huge losses world-wide
- Barbados as an example

4. Public Lands in the USA

Protect habitats →

- 4,500 protected areas worldwide
- In USA 40% of the land is publicly owned

Wilderness Act of 1964:

—

—

- Federal Management:

BLM —

Forest Service —

Fish and Wildlife —

National Park Service —

Dept. of Defense —

5. Diversity in National Forests

- Over 190,000,000 acres in National Forests
-
- Within the Caribbean National Forest in Puerto Rico is the nation's only tropical rainforest

—

—

—

IDAHO:

- 33,000,000 acres are federally owned
- 62.6% of state
- only Alaska, Utah, and Nevada have a higher percentage of land that is federally owned