Chapter 13

Lecture Outline

Sustaining Biodiversity: The Ecosystem approach

1

Biodiversity: Preserving Landscapes

© Jacques Jangoux/Getty Images

2

Outline

- World Forests
  - Tropical and Boreal Forests
  - Deforestation
  - Forest Protection
  - Threats to Temperate Forests
  - Fire Management
- Grasslands
- Parks and Preserves
  - Terrestrial
  - Marine

3

World Forests

- Forests cover 30% of the world's land surface.
- Grasslands also cover about 30% of the land.
- Most remaining forests are in tropical and boreal regions.
- These two ecosystems provide many essential resources such as lumber, paper pulp, and livestock grazing.
- They also provide environmental services such as regulating climate, controlling water run-off, purifying water and air, and providing wildlife habitat.
- They also have scenic, cultural, and historic value.

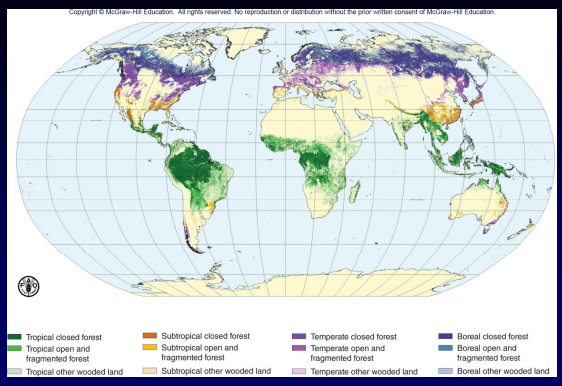
4

Boreal and Tropical Forests are Abundant

- A Forest is defined as any area where trees cover more than 10% of the land.
- The largest remaining forests on the planet are found in and cold high latitude areas and humid equatorial areas.
- This definition covers areas ranging from Open Savannas where trees cover less than 20% of the land to Closed Canopy Forests where tree crowns overlap to cover most of the ground.

5

Major Forest Types



6

Tropical and Boreal Forests

- The largest tropical forests are in South America, which has about 22% of the world's forests and the largest undisturbed tropical rain forest.
- North America and Eurasia have vast areas of unaltered boreal forests.
- Primary Forests or Old Growth Forests are those forests composed primarily of native species in which there is little indication of human activity and ecological processes are not significantly disturbed.
- These areas are home to much of the world's biodiversity, ecological services, and indigenous human cultures.

7

Status of Primary Forests

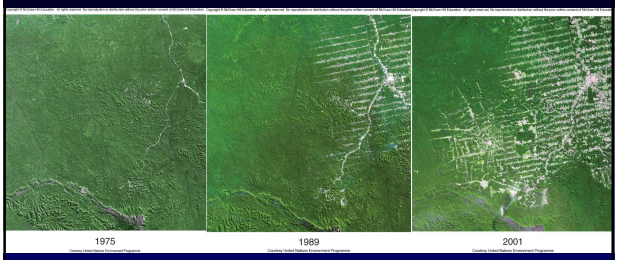
- One third of all the world's forests are Primary Forests.
- Six million hectares of these forests are cleared or heavily damaged each year.
- Nine out of 10 of the countries where 80% of these forests exist are experiencing unsustainable logging rates.

8

50% of Forest Harvests Are For Firewood

9

Forest Destruction in Brazil



10

Forests Provide Products

- Wood and paper
  - Developed countries provide less than half of industrial wood, but 80% of consumption.
  - Paper pulp is 1/5 of all wood consumption.
  - Fuel accounts for 1/2 of global wood use.
  - One quarter of world's forests are managed for wood production, much of it replanted in single species monoculture forestry.
- Successful reforestation programs exist in China, Korea, and Japan

11

Tropical Forests are Being Cleared

- Tropical forests occupy less than 10% of land surface but contain half of all plant, animal, and microbial species on earth.
- 30,000 hectares are deforested every day.
- Replanting or succession accounts for revegetation of 5.7 million hectare per year; this results in a net loss of 7.3 million hectares per year.
- At the current rate of deforestation, no primary forest will be left in most countries, outside of parks or preserves, by the end of this century.

12

Causes for Deforestation

- Conversion of forest to agriculture
  - Accounts for 2/3 of destruction in Africa
  - Conversion to cattle ranching and soy farming is most common in Latin America
- Large Scale Commercial Logging
  - Building roads to remove trees also allows entry to forest by farmers, miners, hunters.
- Fires destroy 350 million hectares of forest/year
  - Many of these are set intentionally to clear land for other uses.

13

Rain Forests Burning in Brazil

14

Causes for Deforestation

Biofuel production is responsible for forest destruction in Southeast Asia.

Oil Palm Plantations produce oil for cooking, industrial use and biodiesel production.

15

Forest Protection

- Some places are being reforested.
- About 12% of world's forests are now protected.
  - Africa has the largest protected area (by %).
  - Guanacaste National Park in Costa Rica is a model area for forest guardianship.
  - Brazil is a leader in establishing forest reserves and allows traditional peoples to engage in non-destructive extraction of resources in the forest.

16

Forest Protection

- People are protecting local forests.
  - The Chipko Andolan movement in India. Women hugged trees in a non-violent protest to prevent logging and preserve firewood for their families.
- Debt for Nature Swaps - conservation organizations buy debt obligations, then offer to cancel the debt if the debtor country protects biologically important areas

17

Temperate Forests Are Also Threatened

- Although the total forest area in North America has remained constant for the last several years, forest management policies in the US and Canada continue to be controversial.
- Large areas of the Temperate Rainforest in the Pacific Northwest have been set aside to protect endangered species.
- Logging is still allowed in surrounding lands though, resulting in fragmented old growth forest habitat.
- Road building in wilderness areas is especially controversial as it causes erosion and allows potential access for extractive activities like mining.

18

Other Threats to Temperate Forests

- Climate change, insect threats, and wildfires are also major threats to temperate forests which are interconnected.
- Rising global temperatures can trigger droughts which make trees more vulnerable to insect infestations and fires.

19

Fire Management

- U.S. has had a policy of aggressive fire control for the last 70 years.
- Recent studies indicate many biological communities are fire-adapted and require periodic burning for regeneration.
- Eliminating fires has caused woody debris to accumulate over the years. As a result, many fires are now larger and more severe.
- Today 40% of all federal lands are at risk of severe fires.
- Many Americans are moving to remote areas and 40 million now live in areas of high wildfire risk.

20

Ecosystem Management

- Ecosystem management attempts to integrate sustainable ecological, economic, and social goals in a unified systems approach.
  - Managing across whole landscapes over ecological time scales
  - Considering human needs and promoting sustainable economic development
  - Maintaining biological diversity and ecosystem processes

21

Ecosystem Management (continued)

- Utilizing cooperative institutional arrangements
- Generating meaningful stakeholder and public involvement and facilitating collective decision making
- Adapting management over time based on conscious experimentation and routine monitoring.

22

Grasslands

- Occupy about 1/4 of world's land surface
- Frequently converted to cropland, urban areas, or other human use
- Rate of disturbance is 3 times that of tropical rainforest
- More threatened plants in rangelands than in any other American biome
- Grazing-
  - Can be used sustainably, as pastoralists herd their animals to adjust to variations in rainfall and seasonal conditions.
  - Often overgrazed which can lead to desertification

23

Overgrazing

- 75% of rangelands in the world are degraded; one-third of that is due to overgrazing.
- 55% of U.S. public range lands are in poor or very poor condition.
- Grazing fees charged for use of public lands are below market value and represent a hidden subsidy to ranchers.
- Ranchers claim that without a viable ranch economy, western lands would be further subdivided.

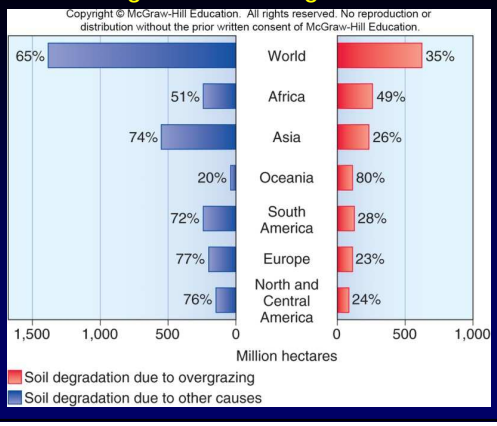
24

New Grazing Methods

- When cattle graze freely, they eat the tender grasses leaving the tough species to gradually dominate the landscape.
- Rotational grazing confines animals to a small area for a day or two before shifting them to a new location.
- Some plant communities (e.g., desert Southwest) cannot tolerate grazing.
- Can raise wild species such as bison, which forage more efficiently and fend off predators, diseases, and pests better than cattle

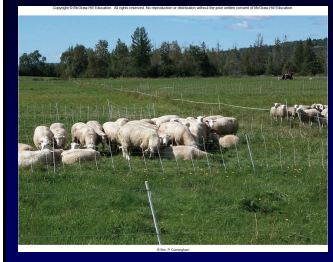
25

Rangeland Soil Degradation



26

Rotational Grazing



- Intensive rotational grazing encloses livestock in a small area for a short time within a movable electric fence to force them to eat vegetation and fertilize the area evenly.

27

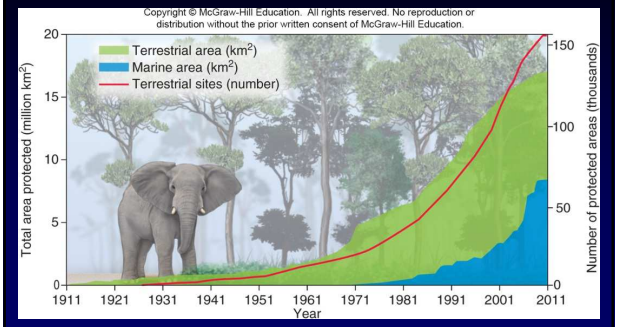
Parks and Preserves

- 12% of Earth's land area is protected.
- Categories of protection are shown below-with Allowed Human Impact or Intervention indicated

1. Ecological reserves and wilderness areas-Little or none
2. National parks-Low
3. Natural monuments and archaeological sites-Low to medium
4. Habitat and wildlife management areas-Medium
5. Cultural or scenic landscapes, recreation areas-Medium to high

28

Growth of Protected Areas Worldwide



29

Parks and Preserves

- In the developing world, some parks exist only on paper because they do not have money for staff and management.
- Brazil has the largest protected area. With more than 25% of the world's tropical forests, Brazil is especially important to biodiversity.
- Some biomes are well represented in nature preserves, while others are underprotected.

30

Preserves Not Safe from Exploitation

- Excessive stock grazing
- Dam building
- Oil drilling
- Mining
- Logging
- Coral reefs damaged by dynamite fishing
- Hunting; eggs from endangered sea turtles are taken by hunters
- Overuse by the public

31

Overuse of National Parks in U.S.

- Entertainment trumped nature protection.
- Fire suppression resulted in large fires.
- Traffic congestion
- Surrounding areas clear cut or mined
- Air pollution and smog
- Parks are profitable, but do not get to keep the money they generate.

32

Visitors at Yellowstone NP Geyser Basin

33

World Conservation Strategy

- Developed by the IUCN
- Has 3 objectives:
  - Maintain essential ecological processes and life support systems
  - Preserve genetic diversity essential to improving cultivated plants and domestic animals
  - Ensure that utilization of wild species and ecosystems is sustainable.

34

Marine Ecosystems Need Protection

- Global fish stocks are becoming depleted and biologists are calling for protected areas where species can be sheltered.
  - 20% of nearshore territory should be marine refuge area.
  - Refuge can replenish nearby areas.
- 90% of coral reefs are threatened by rising temperatures, destructive fishing, coral mining, and sediment runoff.
  - If conditions persist, all will be gone in 50 years.

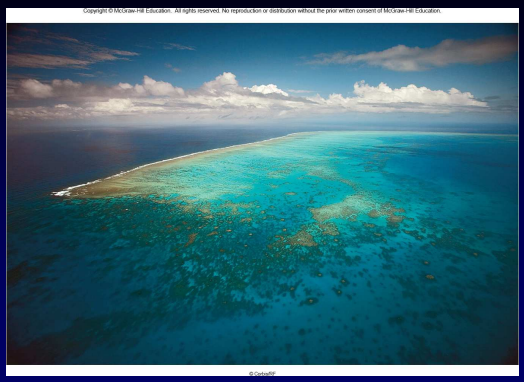
35

Marine Reserves Protect Ecosystems

- Some countries are establishing large marine reserves especially to protect coral reefs.
- Australia has the largest marine reserve: The Great Barrier Reef Marine Park.
- In 2007 the U.S. declared 3 new National Marine Monuments in US territorial waters in the Pacific.
- Altogether though, marine reserves only make up 10% of the world's protected areas even though oceans cover 70% of the earth's surface.

36

Great Barrier Reef Marine Park



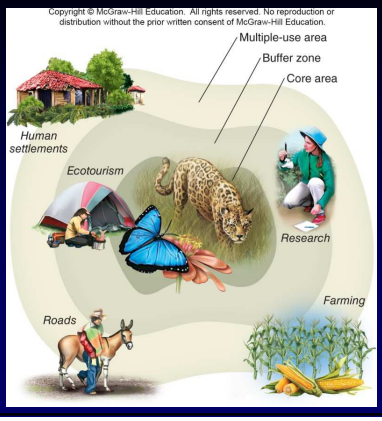
37

Conservation and Economic Development

- Struggle to save ecosystems cannot be divorced from struggle to meet human needs.
  - Ecotourism - tourism that is ecologically and socially sustainable
  - Native people have valuable ecological knowledge that can be used in ecosystem management.
  - UNESCO initiated “Man and Biosphere” program (MAB) calling for the establishment of biosphere reserves, protected areas divided into zones with different purposes.

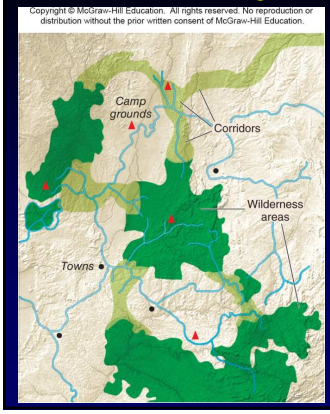
38

A Model Biosphere Reserve



39

Size and Design of Nature Preserves



SLOSS debate - Is it better to have single large or several small reserves?

Edge effects

Corridors of natural habitat essential

40

Size and Design of Nature Preserves

- One of the reasons that large preserves are considered better than small reserves is that they have more core habitat, areas deep within the interior of the habitat that have better conditions for specialized species.
  - As human disturbance fragments the ecosystem, habitat is broken into increasingly isolated islands with less core and more edge, supporting fewer rare species.

41

Landscape Ecology

- Landscape ecology - science that examines the relationship between spatial patterns and ecological processes such as species movement or survival

- Variables:
  - Habitat size
  - Shape
  - Relative amount of core and edge
  - Kinds of land cover surrounding habitat

42

How Small Can a Habitat Be?

Courtesy of R.O. Bierregaard

43

What Can You Do?

Be a Responsible Ecotourist

- *Pre-trip preparation.* Understand the do's and don'ts that will keep you from violating local customs.
- *Environmental impact.* Take only photographs and memories
- *Resource impact.* Do you know where your wastes and garbage go?
- *Cultural impact.* Be as aware of cultural pollution as you are of environmental pollution.
- *Wildlife impact.* Modern cameras make it possible to get good photos from a respectful, safe distance.
- *Environmental benefit.* Can you combine ecotourism with work on cleanup campaigns or delivery of educational materials or equipment to local schools or nature clubs?
- *Advocacy and education. A*fter you get home inform your friends and neighbors about what you have learned.

44