

Chapter 13

FORESTS, PARKS AND LANDSCAPES

CASE STUDY: Wildfires Raise Questions about how to manage parks and preserves

Wildfires are a common and natural feature of wild lands. In 2005 there were 66,552 wildfires in the U.S. that burned more than 8.6 million acres. Two alternative strategies have been promoted as policies for managing public lands: manage for fire prevention (the Smokey Bear tradition), or manage with fire, recognizing that fire is a natural process and has benefits. Fuel builds up in the absence of fire in the form of understory vegetation and dead wood, increasing the opportunity for catastrophic fire. Allowing fire or even promoting periodic ground fires will prevent the buildup of fuel and keep fire to a manageable size. Both strategies have been controversial.

Bottomland hardwood forest once occupied more than 8 million ha (the size of Conn., MA, NH and VT combined) in the lower MR floodplain. Since the European colonization, 96% of this area has been converted to agriculture or flood control projects. The remaining forest is polluted with nitrogen fertilizer. A new approach referred to as a '**landscape perspective**' is being promoted as a solution to the problem of how to conserve and protect the remaining forest. The approach is holistic and encompasses **reclamation** (conversion back to forest of agricultural land), **mitigation** for forest land taken for other uses, restoration of wildlife habitat, and connecting isolated parcels of forest in order to provide corridors for migration of flora and fauna. This example illustrates a number of issues raised in the chapter including:

& ecological services

& landscape ecology

& basic principles and history of forest management

& importance of parks to the conservation of wilderness and biodiversity

13.1 MODERN CONFLICTS OVER FOREST LAND AND FOREST RESOURCES

- The forestry profession is an old one, and the commercial growing of trees is termed **silviculture**. Silviculture has become an exact science like the cultivation of food crops. Conflicts arise over the management of forests:
- Should forests be managed solely for wood production or for conservation of biodiversity, or can forests serve both purposes? Should we preserve our remaining old growth forest?
- How? How do you balance the need for a resource (wood) with the objectives of maintaining habitat quality for wildlife, water quality, and the spiritual needs of people. If we set aside habitat for wilderness, how much is enough?
- What roles do forests play in a global ecological perspective?

13.2 THE LIFE OF A TREE

- Tree growth – like other plants, trees grow by absorbing and fixing carbon by photosynthesis than they lose by respiration. They make the biochemicals they require (amino acids and proteins) by combining the carbon that they fix with minerals that they absorb through their roots. Trees have a vascular transport system consisting of **phloem**, which transports sugars and other organic compounds down, and **xylem**, which transports water and inorganic minerals up. Water moves up through the xylem to **stomata** on the leaves. The driving force for the movement of water through the xylem is the evaporation of water from the stomata (termed **transpiration**).
- Niches – Like all species, tree species each have their own unique ecological niches. Some specialize on dryer soil, some on colder climates, some on richer soils, some on shady habitats, and so on. Knowing what the specific requirements of a species are is of obvious practical importance. Some of the most interesting adaptations are found among fire tolerant species. Long leaf pine, for example, is a fire-adapted tree that produces a cone that opens and releases its seed only after a relatively cool ground fire has passed through the area. Ask your students what are the survival values of this strategy?

13.3 A FORESTER'S VIEW

- Traditionally forester's managed 'stands'. Stands are either **even-aged** (when all individual trees germinate in approximately the same year) or uneven-aged stands. Trees are harvested periodically, and the time between harvests is termed the **rotation time**. If managing for **maximum sustained yield**, then the rotation time will be short, relative to the life span of the tree. A forest that has never been cut is referred to as a **virgin** or **old-growth forest**. They are quite rare. A forest that has regrown is called a **second-growth forest**. A forest will include canopy trees (the trees that form the crown, and an understory. Understory vegetation will typically include shade tolerant species and will have a density that varies with climate, fire history (both managed and unmanaged), and grazing pressure. Forest productivity will vary with climate and soil fertility. The history of the growth of forest trees is preserved in their growth rings.

13.4 APPROACHES TO FOREST MANAGEMENT

- Different harvest techniques include clear-cutting – cutting all trees in a stand; shelterwood-cutting – cutting dead and less desirable trees first and later cutting mature trees; seed-tree cutting – removing all but a few seed trees; selective cutting – taking individuals selectively; thinning – selectively removing smaller, poorly formed trees.
- The alternative to clear-cutting is selective cutting. Variations on the practice of selective cutting are shelterwood cutting (removing the dead and less desirable trees first), seed-tree cutting (remove all but a few seed trees), and strip-cutting (leaving narrow rows).
- Controlling diseases and pests - Trees are subject to serious fungal diseases, some which have led to the near extinction of tree species (e.g. chestnut blight), and damage by insects (e.g. Gypsy moths).
- Ecological effects of clear-cutting – experimental data show that clear-cutting causes a release of nutrients. The decay process continues in the soil, and is accelerated by the input of roots, leaves and branches. Initially there is little vegetation to absorb these

nutrients, and they tend to migrate in surface and groundwater into nearby streams. Erosion is also a problem on steep slopes.

- Plantation Forestry- Forest plantations consist of rows of a monoculture (single species) of trees planted like crops. Forest plantations are managed for maximum productivity. According to some estimates, if more forest land were managed in this way, the demand for wood products could be satisfied using much less total forest area than is possible with the current mix of management practices.

13.5 SUSTAINABLE FORESTRY

- A sustainable forest is one that will supply wood products at a rate that does not diminish future capacity. However, there are two concepts of sustainability, the one that considers only the sustainability of the resource and the one that includes the sustainability of ecosystem structure and functions.
- Sustainability- how would we know and how can we achieve it? Yet a formal process called “certification of forestry” is charged with certifying that a given operation is sustainable. It is more art than science. There is a trend toward dropping the ‘sustainable’ from the certification process and adopting ‘well-managed’ or ‘improved management practices’ instead. However, uniform criteria have not been established.
- Some European nations have banned the import of certain tropical woods from regions where sustainable forestry is not practiced. Scientists are now calling for a new kind of forestry that increases the likelihood of sustainability, including an acknowledgement that forests are dynamic ecosystems that change.
- A larger view of ecological organization advocated by some scientists as a better approach to management, is one that encompasses a large spatial dimension of interacting ecosystems. The study of how spatial patterns and distributions of different ecosystems interact to control the ecological functions at the scale of the landscape is referred to as **landscape ecology**. In order to preserve biodiversity and function, it is important to know what size of landscape needs to be preserved, what spatial patterns work best, and how should the spatial elements be connected? The answers will vary depending on the type of biome, the amount of wild areas available, and patterns of land use.

13.6 A GLOBAL PERSPECTIVE

- Vegetation of any kind can affect the atmosphere in four ways:
 1. By changing the color and therefore albedo of the earth’s surface. In general vegetation makes the surface darker, which absorbs more light.
 2. By increasing the amount of water transpired and evaporated to the atmosphere.
 3. By changing absorbing CO₂, the most important greenhouse gas in terms of total quantity, and by affecting the release of other greenhouse gases.
 4. By changing the ‘surface roughness’, which affects wind speed and turbulence.
- World forest area, global production, and consumption of forest products –

| | |
|-------------------|---|
| Forest area circa | 1980: 4 billion ha |
| | 1990: 3.45 billion ha |
| | 2000: 3.87 billion ha or 14.7 million mi ² or ca. 1 acre/person. |

Ten nations hold 2/3 of total forest area, in order of decreasing importance: Russia, Brazil, Canada, USA, China, Australia, Congo, Indonesia, Angola and Peru.

- Total consumption is about 1.5 billion m³ annually. (Think: 1 billion m³ would enough wood to cover 5 million football fields with 1 yard of wood!). Developed countries account for 70% of total production and consumption. Timber for construction, pulp and paper accounts for about 90% of the timber trade. North America is the world's dominant supplier.
- The U.S. has 212 million ha of commercial grade forest (forest capable of producing >1.4 m³ ha⁻¹ yr⁻¹), 75% of which is in the east. About 70% of this land is privately owned, 15% are on U.S. Forest Service land and 15% is owned by other federal agencies.
- Future demand for wood will likely grow with human population and with development of poor nations.

13.7 DEFORESTATION: A GLOBAL DILEMMA

- Deforestation has increased erosion and loss of 562 million ha of soil worldwide. The annual rate of loss is estimated to be 5-6 million ha. Nepal has lost >1/2 of its forest cover between 1950-1980. Such changes in land cover affect nations downstream. Sediments choke rivers, fill reservoirs, and the frequency and severity of flooding downstream increases. Unsound forestry practices can also render large tracts of land unproductive, which can have geopolitical consequences and robs future generations of a share of the natural wealth.
- History of deforestation – the old world has a long history of deforestation beginning at least as early as ancient Greece and Rome. Some ecologists think deforestation around the Mediterranean led to a permanent climate change in the region. Western Europe too has a history of deforestation. Forests in Great Britain were cut, and many eliminated, in medieval times. Following the colonization of North America by Europeans, much of the east coast was cleared. Thoreau referred to it as a wasteland. Much of the deforestation today is in developing countries. Between 1960 and 1990 20% of tropical forests were cleared. Recent data suggest that clearing rates in tropical areas have slowed (good news).
- Causes – Most deforestation is for lumber, paper, fuel, or agriculture. Agriculture is the major cause in Brazil and Nepal.
- Firewood shortage – About 63% of wood produced in the world is used for firewood. Wood provides 2% of the commercial energy production in developed nations, but 15% in developing nations. As human populations grow, mostly in developing nations, the demand for firewood grows.
- Indirect Deforestation – due to tree mortality from pollution or disease. Pollution problems include acid rain, which is blamed on the death of entire forests in Germany and in Central Europe. Global warming is also a threat. Climate warming will change the regional water balance and modify the growth ranges of forests. The introduction of disease organisms and pests also threatens forests.

A CLOSER LOOK 13.1: Community Forestry

- The term refers to the harvest of nearby forests by small communities for meeting their needs, usually energy and firewood and usually in developing nations. There is a critical need to bring sustainable forestry practices to such communities.

13.8 PARKS, NATURE PRESERVES, AND WILDERNESS

- Landscapes are protected from development, including harvest, by public (government) ownership and regulation. Public land in the U.S. is managed in different ways ranging from national forests, which can be harvested and grazed, to wilderness areas that allow only very limited activity. These areas have finite boundaries and sizes. They are ecological islands, and the concepts of island biogeography apply. The boundaries and geometries of parks and preserves rarely are established so as to maximize the ecological benefits, e.g. providing enough area for a viable population of top carnivores. The boundaries of parks are usually arbitrary or are dictated by factors such as the mosaic of private ownership prior to public acquisition. However, there are public agencies and NGOs (e.g. Nature Conservancy) that have a track record of identifying and purchasing critical habitats for rare and endangered species. There has also been some success in persuading developing nations into setting aside preserves in exchange for debt relief.
- Conflicts in park management – conflicts arise over what types of activities to allow in parks and preserves. For example, snow mobiles were banned from wilderness areas by the Clinton administration, but to howls of protest from the conservation community, was allowed by the Bush II administration. The management practices in National Forests is also a source of conflict, for example, whether to allow harvest of our remaining old growth forest. Should we reestablish predator populations on public grazing land?
- How much land should be set aside? About 11.2% of the total U.S. land area is protected to some degree, but the amount differs greatly among the states. Most is in the west. The amount of protected area also varies globally. France and Germany allocate <0.5% to parks and <1% to wilderness.
- Conserving wilderness – In the U.S., wilderness is a legal concept. It is an area undisturbed by people. The idea of conservation of wilderness was a 20th century reality 19th century conceptual origins. The U.S. Wilderness Act of 1964 was a landmark piece of legislation, establishing for the 1st time anywhere that wilderness was recognized by law as a national treasure to be preserved. Many countries have no wilderness left to preserve, e.g. Switzerland and Denmark.
- Conflict in managing wilderness – today there are 633 legally designated wilderness areas in the U.S. comprising about 4% of the U.S. land area. Other areas almost double in total area what is currently designated as wilderness, meet the legal requirements and could be protected by the Wilderness Act. Half of this is in Alaska. This naturally has raised a storm of controversy between those who want to develop and those who want to preserve. Management has two sides. One is management of the natural resources (e.g. using fire to manage undergrowth, or controlling natural populations). The other is management of the people who would use the resources (visitors, developers). Wilderness is one end of the spectrum of management options.

A CLOSER LOOK 13.2 A Brief History of Parks

- Victoria Park in Great Britain authorized in 1842 was the first. The first national park was Yosemite in California by an act signed by Lincoln in 1864. Yellowstone was established in 1872. The original purpose of these was to preserve examples of magnificent landscapes or “monumentalism”. Today we recognize parks as an increasingly important part of strategy to protect biodiversity. The number of parks around the world continues to expand, with the Congaree National Park in South Carolina being the most recent (2003) addition in the U.S.

CRITICAL THINKING ISSUES

- Wilderness

The conservation movement in the United States has a long history that has led to the creation of our system of natural parks and wilderness areas. The concept of wilderness is a peculiar one. Roderick Nash notes that wilderness is an important biblical theme, and according to Nash, the Bible consistently characterizes wilderness as "cursed" land, "the environment of evil," a "kind of hell" on earth. How then, considering our Puritan origins, did our nation come to recognize wilderness as something that needed to be preserved? Is it odd that we, especially early in our history, would be motivated to set aside land that cannot be populated or developed, land that is to be left forever in a wild state? Is this rationale? Was this motivated by science or spirituality?

Nash, Roderick. *Wilderness and the American Mind*. New Haven: Yale University Press, 1982.

- Conservation versus Preservation

What is the distinction between these two concepts? Would you favor one approach over the other? Why?

- Our remaining old growth forests. The forest industry is moving quickly to harvest the remaining old growth forest in the northwest. They argue that jobs and the economic vitality of communities are at stake. The environmental movement would like the logging of old growth forest to cease. We all have seen the images of protestors chained to a tree or camped high in the branches of some majestic tree. What is your view? Note that the issue here concerns the management of *public* land.

Web Resources

<http://www.nhc.rtp.nc.us/tserve/tserve.htm> This is the TeacherServe web page of the National Humanities Center where you will find links to essays about nature, wilderness, the transcendental movement, etc.

<http://www.epa.gov/esd/land-sci/index.htm> This is the home page of the EPA Landscape Ecology group. Included are good descriptions of the science, its importance, and links to case studies.