12

Resource Management, Forestry, Land Use, and Protected Areas

Chapter Objectives

This chapter will help students:

Identify the principles, goals, and approaches of resource management

Summarize the ecological roles and economic contributions of forests, and outline the history and scale of forest loss

Explain the fundamentals of forest management, and describe the major methods of harvesting timber

Analyze the scale and impacts of agricultural land use

Identify major federal land management agencies and the lands they manage

Recognize types of parks and reserves, and evaluate issues involved in their design

Lecture Outline

I. Central Case: Battling Over the Last Big Trees at Clayoquot Sound

A. The largest act of civil disobedience in Canadian history occurred on Vancouver Island, British Columbia, in 1993, over forest management. Protesters chose direct action to block logging roads and chain themselves to gates across access points. Of the 12,000 protesters, 850 were arrested.

B. Opponents of **clear-cutting,** the removal of all the trees from an area, were trying to protect the forests of Clayoquot Sound, which is one of the largest undisturbed stands of temperate rainforest left on the planet.

C. When the government halted clear-cutting at Clayoquot Sound, they found that ecotourism dollars surpassed logging as an important local economic force—the trees were worth more standing than cut down.
D. The United Nations designated the site an international biosphere reserve, encouraging land protection and sustainable development.
E. In recent years the government has reversed its logging regulations, and new logging companies are harvesting in areas near park and biosphere reserve boundaries.
F. As long as our demand for lumber, paper, and forest products keeps increasing, pressures will keep building on the remaining forests on Vancouver Island and around the world.

II. Resource Management

1. **Resource management** is the practice of harvesting resources in ways that do not deplete them.

A. Several natural resources are vital to us.
   1. Soils, particularly topsoil, are of direct importance to us because they support the plants we grow for food and fiber, and thus play a central role in agriculture.
   2. Each of us depends directly on freshwater, so assuring a dependable supply of drinking water is a life-or-death issue. Freshwater also is necessary for agriculture and for waterways and wetlands.
   3. Wildlife and fisheries management is important to maintaining properly functioning ecosystems, as well as to preventing the decline of the organisms that we harvest for food, materials, and medicines.
   4. Range managers are responsible for regulating ranching on public lands, and advise ranchers on sustainable grazing practices on private lands.
   5. Although we rely on mineral resources, we do not manage their extraction as we do with the aforementioned resources.
      a. Minerals are nonrenewable resources, so the mining industry has no built-in incentive to conserve.
      b. Instead, it benefits by extracting as much as it can as fast as it can, and then moving on to new sites once extraction at existing sites has become too inefficient to be profitable.
      c. Mining removes vegetation, causes erosion, and produces acidic runoff that poisons area waterways.
      d. Public pressure and government legislation are important in minimizing environmental impacts from the mining and smelting of minerals.

B. Managers have tried to achieve **maximum sustainable yield.**
   1. The maximum amount of resource extraction possible without depleting the resource from one harvest to the next is known as the maximum sustainable yield.
   2. While this approach produces large amounts of short-term products, reexamining the overall ecosystem impacts of this management system indicate that long-term health and productivity of the system will be impaired if maximum sustainable yield principles are followed.

C. Today many managers pursue **ecosystem-based management.**
   1. Ecosystem-based management attempts to manage the harvesting of resources in ways that minimize impacts on the ecosystems and ecological processes that provide the resource.

D. **Adaptive management** evolves and improves.
   1. Systematically testing different management approaches with the aim of improving methods as time goes on, including changing practices in midstream if necessary, is the basis of adaptive management.
   2. Monitoring the impact of management practices is an essential component of adaptive management. Science, not politics, should be the final judge of these practices.

III. Forest Management

1. **Forestry** balances the importance of forests as ecosystems with civilization's demand for wood products.

A. Forests are ecologically valuable.
   1. Most of the world's forests occur as boreal forest and tropical rainforest. Forests cover roughly 30% of the Earth's surface.
   2. Because of their structural complexity and ability to provide many niches for forest organisms, forests comprise some of the richest ecosystems for biodiversity.
   3. Much of a forest's diversity resides in the forest floor, where the soil is generally nourished by leaf litter and many soil organisms are present to decompose plant materials and cycle nutrients.
   4. Forest systems provide many vital ecosystem services such as stabilizing soil, preventing erosion, regulating the hydrologic cycle, lessening flooding, purifying water, storing carbon, releasing oxygen, and moderating climate.

B. Forest products are economically valued.
   1. Wood fuels our fires, keeps us warm and well fed, and provides housing and paper.
   2. Most commercial logging today takes place in Canada, Russia, and other nations that hold large expanses of boreal forest, and in tropical countries with large amounts of rainforest, such as Brazil.
   3. In the United States most logging takes place on land both private and public, primarily in the conifer forests of the West and the pine plantations of the South.
   4. There is growing awareness that forests also provide other "products" like watershed protection, protection for biological diversity, and "social services" such as recreation, education, and protection of culturally important sites.

C. Demand for wood has led to **deforestation.**
   1. We have cleared forests for millennia to use wood for fuel, to make paper, or to make way for agriculture.
   2. Deforestation has altered ecosystems and has caused soil degradation, population declines, and species extinctions.
   3. Deforestation has occurred on all continents, and in some cases has helped to bring entire civilizations to ruin.

4. Today, forests are being felled at the fastest rates in the tropical rainforests of Latin America and Africa.

D. The growth of the United States and Canada was fed by deforestation.
   1. Deforestation for timber and farmland propelled the growth of the United States throughout the population's phenomenal expansion across the continent over the past 400 years.
   2. By the early 20th century, very little virgin timber was left in the lower 48 U.S. states. The largest trees found in eastern North America, and even most redwoods in California, are **second-growth** trees—all that remains after the old-growth timber was cut.
   3. The fortunes of loggers have risen and fallen with the availability of big trees.

E. Deforestation is proceeding rapidly in many developing nations.
   1. Today's advanced technology allows developing countries to exploit their resources even faster than had occurred in North America. Deforestation is occurring rapidly in places such as Brazil and Indonesia.
   2. Developing nations are often desperate for economic development, and so impose few or no restrictions on logging.
   3. Many of the short-term economic benefits are being reaped by international corporations that log the timber, export it, and move on.

F. Fear of a "timber famine" spurred establishment of national forests.
   1. The depletion of the eastern forests spurred the formation of a system of forest reserves—the U.S. **national forest** system, managed by the U.S. Forest Service—that covers over 8% of the nation's land area.

G. Timber is extracted from public and private lands.
   1. Timber is extracted from publicly held forests in the U.S. and Canada by private timber companies and not by the governments of these nations. Government employees plan and manage timber sales, and build roads to provide access for the loggers who sell the timber for profit.
   2. Most timber harvesting in the United States today is on private land.
   3. Despite the slower pace of harvest from public and private forests, second-growth forests returning postharvest lack many of the characteristics of the original forests in terms of diversity, function, and structure.

H. Plantation forestry has grown.
   1. Tree plantations with **even-aged** monocultures are planted and cut all at once, and then the land is replanted.
   2. Because there are few species and little age variation, plantations have little biodiversity in the organisms that live there.
   3. It is important that some harvesting methods maintain **uneven-aged** stands, with a mix of ages and species, to more closely resemble a natural forest.

I. Timber is harvested by several methods.

1. Clear-cutting is the easiest and most cost-efficient method in the short term, but it has the greatest impacts on ecosystems.
2. The *seed-tree* approach leaves small numbers of mature and vigorous seed-producing trees to reseed the logged area.
3. The *shelterwood* approach leaves small numbers of mature trees to provide shelter for new seedlings.
4. All of these methods still lead to even-aged stands.
5. Selection systems cut only some trees at any one time, with the stand remaining mostly intact between harvests. Either individual trees or small patches of trees are cut at any one time.

J. Public forests may be managed for recreation and ecosystems.
1. Many people debate whether the Forest Service has in fact managed the forests sustainably. They want forests managed as ecological entities, not as croplands for trees.
2. The Forest Service has nominally been guided by a policy of **multiple use,** meaning that the national forests are to be managed for recreation, wildlife habitat, mineral extraction, and other uses.
3. In 1976 Congress passed the **National Forest Management Act,** mandating that renewable resource management plans be made for every national forest, based explicitly on the concepts of multiple use and sustained yield.
4. The Forest Service has developed new programs to manage wildlife and endangered species, including nongame species.
5. The **new forestry** approaches call for timber cuts that explicitly mimic natural disturbances.

K. Fire policy has also stirred controversy.
1. For over a century, the Forest Service and other land management agencies have suppressed fire whenever and wherever it has broken out.
2. Research now shows that many ecosystems depend on fire—for seed germination, to keep the understory clear, and to maintain both plant and animal biodiversity.
3. Fire suppression increases the likelihood of catastrophic fires that damage forests, destroy human property, and threaten human lives.
4. To reduce fuel load and improve the health and safety of forests, the Forest Service and other agencies have in recent years sponsored **prescribed burns,** or **controlled burns**—burning areas of forest under carefully controlled conditions.
5. In the wake of the 2003 California fires, the U.S. Congress passed the Healthy Forests Restoration Act, which encourages prescribed burns and **salvage logging,** the physical removal of small trees, underbrush, and dead trees by timber companies.
6. Dead trees have enormous value to the forest, providing homes and food for many organisms, and timber removal operations on recently burned land can cause severe erosion and soil damage. Therefore, many critics of the Healthy Forests Restoration Act say it increases commercial logging in national forests and does little to reduce catastrophic fires near populated areas. Recent studies also show that the salvage logging also impairs the

regeneration of healthy forests. It also decreases oversight and public participation.

L. Sustainable forestry is gaining ground.
    1. Several organizations examine timber company practices and offer **sustainable forestry certification** to products produced using sustainable methods.

IV. Agricultural Land Use

1. Agriculture now covers more of the planet's surface than does forest.
2. In theory, the marketplace should discourage farming with intensive methods that degrade land if such practices are not profitable, but agriculture in many countries is supported by massive subsidies.

A. Wetlands have been drained for farming.
    1. Many of today's crops grow on the sites of former wetlands that have been drained.
    2. Today, less than half the original wetlands in the lower 48 states and southern Canada remain.
    3. Today we have a Wetland Reserve Program offering subsidies to landowners who refrain from developing wetland areas.

B. Livestock graze one-fourth of the Earth's land surface.
    1. As severe as its ecological impacts have proven to be, cropland agriculture uses less than half the land taken up by livestock grazing.
    2. Human use of rangeland does not exclude its use by wildlife or its continued functioning as a grassland ecosystem.
    3. Most U.S. rangelands are federally owned and managed by the **Bureau of Land Management (BLM).**

C. Land use in the American West might have been better managed.
    1. Land uses such as grazing, farming, and timber harvesting need not have strongly adverse impacts.
    2. Most land to the west of the 100th meridian receives less than 50 cm of rain per year, making it too arid for nonirrigated agriculture.
    3. The ideas of John Wesley Powell were too revolutionary for the entrenched political interests and the prevailing misconception that the West was a utopia for frontier settlement.
    4. For agriculture and forestry, debates continue today over how to best utilize land and manage resources.

V. Parks and Reserves

A. Why have we created parks and reserves?
    1. Many people believe that enormous, beautiful, or unusual features should be protected.
    2. Protected areas offer recreational value to tourists, hikers, fishermen, hunters, and others.
    3. Protected areas offer utilitarian benefits such as clean drinking water and buffers against floods.
    4. Parks have been created as a way to make use of sites lacking economically valuable material resources.

5. A park or reserve is widely viewed as a kind of Noah's Ark—an island or habitat that can maintain species that might otherwise disappear.

B. Federal parks and reserves began in the United States.
   1. The striking scenery of the American West impelled the U.S. government to create the world's first **national parks,** publicly held lands protected from extraction and development but open to the public for nature appreciation and recreation.
   2. The National Park Service (NPS) was created in 1916 to administer the growing system of parks and monuments, which today comprises 388 sites totaling 32 million hectares.
   3. A **national wildlife refuge** is another type of protected area and is managed by the U.S. Fish and Wildlife Service.

C. **Wilderness areas** have been established on various federal lands.
   1. Areas of existing federal lands may be designated wilderness areas, meaning that they are off-limits to any kind of development but are open to hiking, nature study, and other activities with minimal impact on the land.

D. Not everyone supports land set-asides.
   1. The restriction of activities in wilderness areas has helped generate opposition to the land protection policies of the U.S. government.
   2. The drive to extract more resources, obtain greater local control of lands, and obtain greater access for motorized recreation is epitomized by the **wise-use** movement.
   3. Debate between environmental groups and wise-use spokespeople has been vitriolic, each claiming the other is repressive.

E. Nonfederal entities also protect land.
   1. Efforts to set aside land and the debates over such decisions at the federal level are paralleled at the state and local levels.
   2. Each U.S. state has agencies that manage land and resources on state lands, as do many counties and municipalities.
   3. Some land conservation is also accomplished by private nonprofit groups such as **land trusts,** local and regional organizations that preserve lands valued by their members.

F. Parks and reserves are increasing internationally.
   1. Many nations have established national park systems and are benefiting from ecotourism as a result.
   2. Many of the world's protected areas are so-called *paper parks*, protected on paper but not in reality.
   3. Some types of protected areas fall under national sovereignty but are designated or protected by the United Nations, such as the *world heritage sites* and *transboundary parks* that overlap national borders.
   4. **Biosphere reserves** are tracts of land with exceptional biodiversity that couple preservation with sustainable development to benefit the local people. They are designated by UNESCO following application by local stakeholders.

G. The design of parks and reserves has important consequences for biodiversity.

1. Often it is not the outright destruction of habitat that threatens species, but the fragmentation of habitat.
2. Because habitat fragmentation is an important issue for biodiversity conservation, conservation biologists debate the **SLOSS dilemma** (single large or several small).
3. A related issue is whether **corridors** of protected land are important for allowing animals to travel between islands of habitat.

VI. Conclusion

A. Managing natural resources is necessary for resources like timber, which can be either responsibly and sustainably managed or carelessly exploited and overharvested.
B. Public forests today are managed not only for timber production, but also for recreation, wildlife habitat, and ecosystem integrity.
C. Meanwhile, public support for preservation of natural lands has resulted in national parks, wilderness areas, and other forms of reserves, both in North America and abroad.
D. These trends are positive ones because the preservation and conservation of land and resources is essential if we wish our society to be sustainable and to thrive in the future.