Chapter Objectives
This chapter will help you:

Summarize the ecological and economic contributions of forests
Outline the history and current scale of deforestation
Assess aspects of forest management, and describe methods of harvesting timber
Identify federal land management agencies and the lands they manage
Recognize types of protected areas, and evaluate issues involved in their design

Lecture Outline
I. Central Case: Certified Sustainable Paper in Your Textbook
   A. As you turn the pages of this book, you are handling paper made from trees that were grown, managed, harvested, and processed using certified sustainable practices.
   B. The trees cut to make this book’s paper were selected for harvest based on a sustainable management plan designed to avoid depleting the forest of its mature trees or degrading the ecological functions the forest performs.
   C. At every stage in the paper-making process, independent third-party inspectors from the Forest Stewardship Council (FSC) examine the practices being used to ensure that they meet the FSC’s strict criteria for sustainable forest management and paper production.
   D. The Forest Stewardship Council is the most demanding of a number of organizations that officially certify forests, companies, and products that meet sustainability standards.
   E. FSC certification is the best way for consumers of forest products to know that they are supporting sustainable practices that protect the welfare of the world’s forests.
   F. The paper in this book is FSC-certified from sources that strive to follow sustainable practices.
II. Forest Ecosystems and Forest Resources
   A. Many kinds of forests exist.
      1. A forest is any ecosystem with a high density of trees.
      2. Ecologists and forest managers find it useful to classify forests into
         forest types, categories defined by their predominant tree species.
   B. Forests are ecologically complex.
      1. Forests have different subhabitats including the canopy, subcanopy, and
         understory.
   C. Forests provide ecosystem services.
   D. Carbon storage helps to limit climate change.
   E. Forests provide us with valuable resources.
      1. Nations maintain and use forests for economic and ecological reasons.

III. Forest Loss
   A. Agriculture and demand for wood has led to deforestation.
      1. Deforestation is the clearing and loss of forests.
         a. Deforestation has negative impacts. It causes major loss
            of biodiversity, desertification, and adds carbon dioxide
            to the atmosphere.
      2. In 2010, the U.N. Food and Agriculture Organization (FAO) released
         its latest Global Forest Resources Assessment, for which researchers
         combined remote sensing data from satellites, analysis from forest
         experts, questionnaire responses, and statistical modeling to form a
         comprehensive picture of the world's forests.
      3. Forests are being felled most quickly in the tropical rainforests of Latin
         America and Africa. Developing nations in these regions are striving to
         expand settlement areas for their burgeoning populations and to boost
         their economies by extracting natural resources and selling them
         abroad.
   B. Deforestation fed the growth of the United States.
      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 primary forest was left in the
         lower 48 U.S. states. The largest trees found in eastern North America,
         and even most redwoods in California, are secondary forest—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.
C. Forests are being lost rapidly in 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, Indonesia,
      and West Africa.
   2. Developing nations are often desperate for economic development, and
      so they impose few or no restrictions on logging.
   3. Often their timber is extracted by foreign multinational corporations,
      which pay fees to the developing nation’s government for a concession,
      or right to extract the resource. Once a concession is granted, the
      corporation has little or no incentive to manage forest resources
      sustainably.

D. Solutions to deforestation are emerging.
   1. Conservation concessions, POTICO, and carbon offsets are some of
      these solutions.

IV. Forest Management
   1. Foresters are professionals who manage forests through the practice
      of forestry (also called silviculture), and they must balance our
      society’s demand for forest products against the central importance
      of forests as ecosystems.

A. Forest management is a type of resource management.
   1. Sustainable resource management is the practice of harvesting
      resources in ways that do not deplete them.

B. Resource managers follow several strategies.
   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. Today many managers pursue ecosystem-based management,
      which attempts to manage the harvesting of resources in ways that
      minimize
      impacts on the ecosystems and ecological processes that provide
      the resource.
   3. 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.

C. Fear of a —timber famine—drove us to establish 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.

D. 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 the diversity, function, and structure of the original forests.

E. 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.

F. We harvest timber by several methods.

1. **Clear-cutting** is the easiest and most cost-efficient method in the short term, but it has the greatest impact 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 allow uneven-aged stand management, and 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.

G. 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.

6. Forest management is subject to political influence.

H. Fire policy also stirs 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. At the same time, increased residential development along the edges of forested land—in the so-called wildland-urban interface—is placing more homes in fire-prone situations.

5. 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.

6. In the wake of the California fires in 2003, 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.

7. Dead trees have enormous value to the forest, providing homes and food for many organisms. Timber removal operations on recently burned land can cause severe erosion and soil damage.

I. Climate change is altering forests.

1. This is occurring by bringing warmer weather, and driving the dynamics of certain pests.

J. Sustainable forestry is gaining ground.

1. Several organizations examine timber company practices and offer sustainable forest certification to products made using sustainable methods.

V. Parks and Protected Areas

A. Why create parks and reserves?

1. Enormous or unusual scenic features such as the Grand Canyon,
Mount Rainier, or Yosemite Valley inspire people to preserve them.

2. Protected areas offer recreational value for hiking, fishing, hunting, kayaking, and other pursuits.

3. Parks generate revenue from ecotourism.

4. Undeveloped land offers us peace of mind, health, exploration, wonder, and spiritual solace. Children especially benefit from healthy exposure to the outdoors.

5. Protected areas offer utilitarian benefits through ecosystem services. For example, undeveloped watersheds provide cities with clean drinking water and a buffer against floods.

6. Reserves protect biodiversity. A park or reserve is a kind of Noah’s Ark, an island of habitat that can maintain species (and communities and ecosystems) that human impact might otherwise cause to 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 392 sites totaling 34 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 are established on federal lands.

1. In response to the public’s desire for undeveloped areas of land, in 1964 Congress passed the Wilderness Act, which allowed some areas of existing federal lands to be designated as wilderness areas. These areas are off-limits to development, but open to hiking, nature study, and other low-impact public recreation.

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 recreation is epitomized by the wise-use movement.

3. Groups of indigenous people also frequently oppose government actions to set aside land, but protected areas sometimes serve the interests of indigenous people.
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. Biosphere reserves are tracts of land with exceptional biodiversity that couple preservation with sustainable development to benefit the local people. Local stakeholders apply to UNESCO for biosphere designations.
   4. 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.
      a. Some transboundary reserves function as peace parks, helping to ease tensions by acting as buffers between nations that quarrel over boundary disputes.

G. Habitat fragmentation makes preserves still more vital.
   1. When forests are fragmented, many species suffer.
   2. The problem may lie with edge effects, impacts that result because the conditions along a fragment’s edge are different than conditions in the interior.

H. Insights from islands warn us of habitat fragmentation.
   1. The island biogeography theory explains how species come to be distributed among oceanic islands.
      a. The farther an island lies from a continent, the fewer species tend to find and colonize it. Thus, remote islands host few species because of low immigration rates--this is the distance effect.
      b. Larger islands have higher immigration rates because they present bigger targets for dispersing organisms to encounter.
      c. Larger islands have lower extinction rates because more space allows for larger populations, which are less likely to drop to zero by chance.
      d. Together, the latter two trends give large islands more species
than small islands—a phenomenon called the \textit{area effect}.

e. Large islands also contain more species because they tend to possess more habitats than smaller islands, providing suitable environments for a wider variety of species.

\textit{f}. Very roughly, the number of species on an island is expected to double as island size increases tenfold. This is illustrated by \textit{species-area curves}.

2. These patterns hold up for terrestrial habitat islands as well, such as forests fragmented by logging and road-building.

I. Reserve design has consequences for biodiversity.

1. Conservation biologists debate the \textbf{SLOSS dilemma} (single large or several small).

2. A related issue is whether \textbf{corridors} of protected land are important for allowing animals to travel between islands of habitat.

J. Climate change threatens our investment in protected areas.

1. As temperatures become warmer, species ranges shift toward naturally cooler climes: toward the poles and upward in elevation.

2. In a landscape of fragmented habitat, it may sometimes be impossible for individuals of a species to move if they cannot fly or disperse over long distances.

3. Species we had hoped to protect in parks may, in a warming world, become trapped in them.

VI. Conclusion


B. Public forests today are managed not only for timber production, but also for recreation, wildlife habitat, and ecosystem integrity.

C. Public support for preserving natural lands has resulted in national parks, wilderness areas, and other forms of reserves, both in North America and abroad.

D. As development spreads across the landscape, fragmenting habitats and subdividing populations, scientists trying to conserve species, communities, and ecosystems are thinking and working at the landscape level to design protected areas.
**Key Terms for Chapter 12**

- adaptive management
- biosphere reserves
- clear-cutting
- concession
- controlled burns
- corridors
- deforestation
- ecosystem-based management
- edge effects
- even-aged
- forest
- forestry
- island biogeography theory
- land trusts
- maximum sustainable yield
- multiple use
- national forest
- National Forest Management Act
- national parks
- national wildlife refuge
- new forestry
- prescribed burns
- primary forest
- resource management
- salvage logging
- secondary forest
- silviculture
- SLOSS dilemma
- sustainable forest certification
- uneven-aged
- wilderness areas
- wildland-urban interface