AMERICAN FORESTS

A History of Resiliency and Recovery

United States Department of Agriculture
Forest Service
FS-540

in cooperation with
Forest History Society
Durham, North Carolina

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American Forests: A History of Resiliency and Recovery (FS-540) was published in December 1992 in cooperation with the Forest History Society, a nonprofit educational institution established in 1946 and dedicated to the advancement of historical understanding of human interactions with the North American forest environment.

The USDA–Forest Service has joined with the Forest History Society in preparing this book, the first in a series on contemporary issues with significant historical dimensions. The author, Douglas W. MacCleery, is assistant director of the Timber Management Staff in the Forest Service's Washington Office. The American Forest Foundation also contributed financially toward this publication.

The Forest History Society (701 Vickers Avenue, Durham, NC 27701) will publish other books in this Issues Series.The aim of the Issues Series is to present a balanced rendition of often contentious issues. All views are aired but the focus is on consensus. The pages that follow document the resilience of American forests and establish a baseline for discussion. Many of today's debates hinge not just on how much there *is* but also on how much there *was*.

Figures

American Forests

Overview

Forests are resilient. It is a tribute to this inherent quality of American forests and to the success of the policies that were put in place in response to public concerns that forest conditions over much of the United States have improved dramatically since 1900. The following snapshot compares the forest situation as it was in 1900 with the way it is today:

- Following 2 centuries of decline, the area of forest land has stabilized (see figure 2). Today, the United States has about the same forest area as in 1920.
- The area consumed by wildfire each year has fallen 90 percent; it was between 20 and 50 million acres in the early 1900s and is between 2 and 5 million acres today (see figure 5).
- Nationally, the average volume of standing timber per acre in U.S. forests is 30 percent greater today than in 1952.
- Populations of whitetail deer, wild turkey, elk, pronghorns, and many other wildlife species have increased dramatically (see figures 6, 7, 8, and 9).
- Tree planting on all forest land rose dramatically after World War II, reaching record levels in the 1980s. Many private forest lands are now actively managed for tree growing: 70,000 certified tree farms encompass 95 million acres of privately owned land (see figure 10).
- The tens of millions of acres of cutovers or "stumplands" that existed in 1900 have long since been reforested. Many of these areas today are mature forests. Others have been harvested a second time, and the cycle of regeneration to young forests has started again.
- Eastern forests have staged a major comeback (see figure 12).
- Forest growth nationally has exceeded harvest since the 1940s, with each subsequent decade generally showing increasing margins of growth over harvest. By 1986 the volume of forest growth was 350 percent greater than it had been in 1920; and forest growth exceeded harvest by 37 percent (see figure 15).
- Recreational use on national forests and other public and private forest lands has increased manyfold (see figure 16).

- The efficiency of wood utilization has improved substantially since 1900. Much less material is left in the woods, many sawmills produce more than double the usable lumber and other products per log input they did in 1900, engineering standards and designs have reduced the volume of wood used per square foot of building space, and preservative treatments have substantially extended the service life of wood. These efficiencies have reduced by millions of acres the area of annual harvest that otherwise would have occurred.
- American society in the 20th century changed from rural and agrarian to urban and industrialized. Although this change has been accompanied by a corresponding physical and psychological separation of people from the land and resources, today's urbanized nation is no less dependent on the products of its forests and fields than were the subsistence farmers of America's past (see figure 18).

Introduction

Forests are a key element in the broad sweep of United States history. The forest landscape has changed greatly over time, as has public concern for trees, water, and wildlife. The conservation movement of the early 20th century and the policy changes that resulted from that movement have been leading factors affecting the forests of today.

The single most important event in the evolution of the modern American landscape was the clearing of forests for agriculture, fuelwood, and building material.

People depended heavily on the products of the forest both in their personal lives and in the general economy. Wood was virtually the only fuel used in this country for most of its history. Wood warmed people, cooked their food, produced iron, and drove locomotives, steamboats, and stationary engines. People used lumber, timbers, and other structural products as the primary material for building houses, barns, fences, bridges, and even dams and locks. These wood products were essential to rural economies across the nation, as well as to industry, transportation, and the development of towns and cities.

Forests were also habitat for the wildlife that supplemented the diet of millions of Americans for centuries. However, even more important to the American diet was food produced on land cleared of its forests and employed for agricultural use. This was by far the primary cause of forest loss.

In the spiritual dimension, the forest, and the wildness it represented, also played an important role in the identity of the nation. This was expressed in the writings of Henry David Thoreau, Ralph Waldo Emerson, George Perkins Marsh, and others, and was first evidenced politically during the late 1800s by efforts to address concerns over the decline of wildlife populations and the loss of forests. There is no question that without its forests, the United States of America would have had a decidedly different history, and would be a decidedly different place than it is today.

Nature, Extent, and Ecology of U.S. Forests Prior to European Settlement

The original forest covered 1 billion acres, or about half of the U.S. land area (including Alaska). About three-quarters of that forest covered the eastern third of the country. Today there are 737 million acres of forest, about 70

percent of the original forest. About 310 million acres have been converted to other uses since 1600, primarily to agricultural lands (see figure 1).

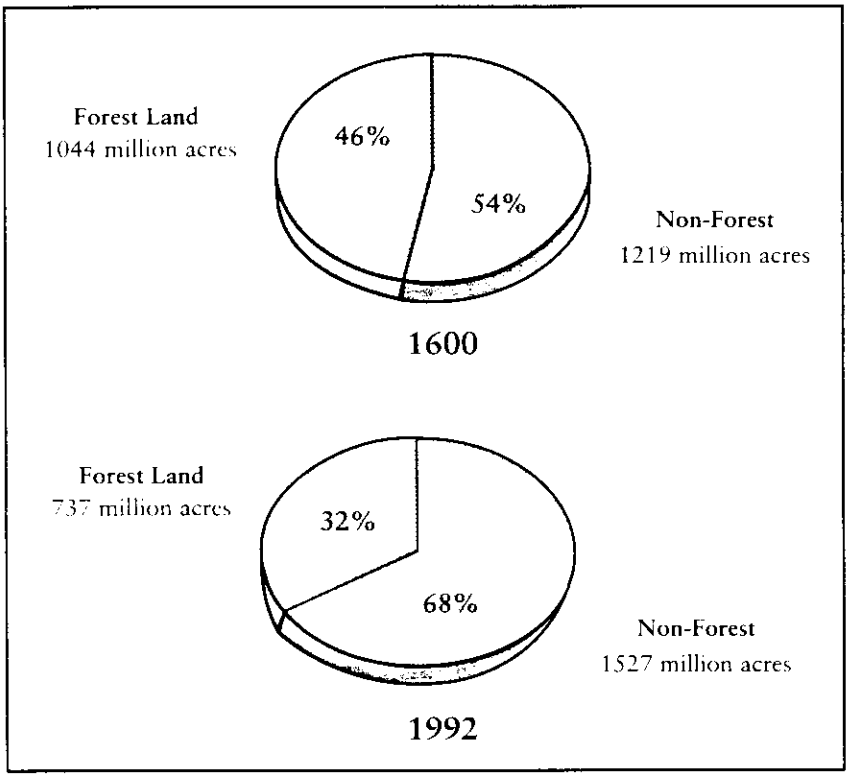
Forests remained the dominant feature of the landscape in eastern North America for centuries after initial settlement. In 1796, almost 2 centuries after the first European settlements, a French naturalist visiting the new American nation wrote that, "The most striking feature [of the country] is an almost universal forest, starting at the Atlantic and thickening and enlarging to the heart of the country." He said that in his travels to America's interior he "scarcely passed, for three miles together through a tract of unwooded or cleared land."

This country's forest was and is magnificent and diverse. East of the Mississippi River, deciduous and coniferous forests blanket New England; open and sunlit pineries cover the southern coastal plain and Piedmont; remarkably varied and productive central hardwood forests extend from the central and southern Appalachians through the Ohio Valley and central Midwest; extensive pine and oak woodlands of the prairie fringe grow in Texas, Missouri, Indiana, Illinois, and Ohio; and the cool hardwood and coniferous boreal forests shade the northern Lake States.

West of the Mississippi River, rainfall diminishes, and forests and woodlands give way to treeless prairies and deserts. But in mountainous areas of the West where rainfall is sufficient, and along the Pacific Coast, extensive forests flourish. Fire-maintained lodgepole pine, ponderosa pine, and mixed-conifer forests cover the slopes of the Rocky Mountains and areas east of the Cascade and Sierra ranges in Washington, Oregon, and California. The most magnificent western forests grow along the rain-drenched and fog-shrouded coasts of the Far West, where coast redwood and Douglas-fir, Sitka spruce, and hemlock form vast, cathedral-like stands.

Besides being impressed by North America's seemingly boundless forests, early explorers were astounded by the abundance and variety of its wildlife. They reported prolific numbers of large mammals in the eastern forests, such as whitetail deer, elk, moose, and bison. They also spoke of incalculable numbers and remarkable variety of bird-life: game birds such as ruffed grouse, wild turkey, and heath hens, and waterfowl including ducks, geese, herons, egrets, and ibises. The most abundant bird on the North American continent was the passenger pigeon, which darkened the sky in numbers that seem incredible today.

Figure 1. U.S. Forest Area
Forests as Percent of U.S. Land Area, 1600–1992



Source: Data from the 1992 RPA Assessment Update, USDA–Forest Service, 1993.

Forests covered about 1 billion acres, slightly less than half of the nation's land area, in 1600. Some of this land gave way to agriculture, reducing the acreage of the U.S. forest land base. About 310 million acres of forest have been converted to other uses since 1600—primarily to agriculture. Today about a third of the nation is forested, approximately 70 percent of the area that was forested in 1600.

Native Peoples' Effect on American Forests

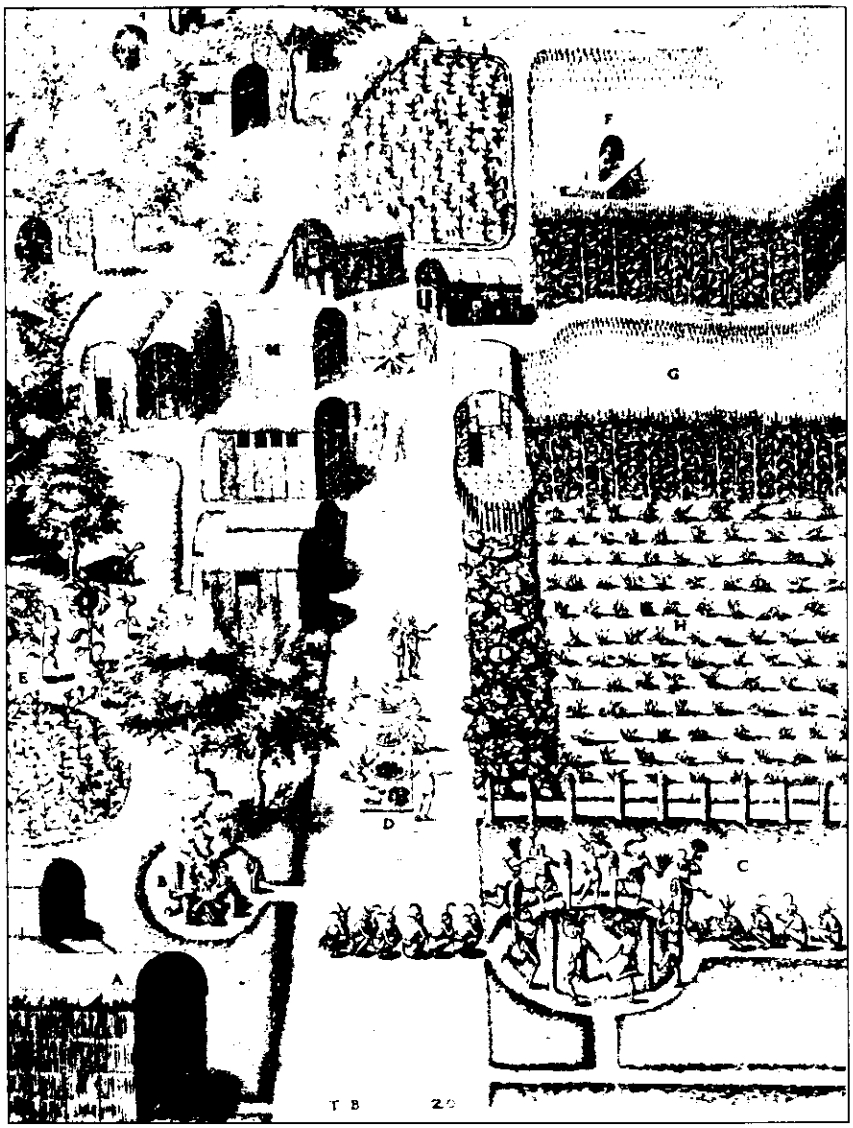
One popular myth is that, prior to European contact, America was dominated by impenetrable, relatively uniform ancient forests that cloaked the landscape in a long-term, static balance with the environment. The reality was far different. Presettlement forests were exceedingly dynamic, shaped by myriad natural and human influences, disturbances, and catastrophic events that had a profound effect on the age and species mix both for plants and animals. The diversity of forest conditions that resulted from these influences was a major factor in creating the wildlife variety and abundance that so impressed early European settlers.

Forests both in the country's East and West were not pristine. They were often strongly influenced by native peoples. In the eastern forests, humans lived in fixed villages and practiced a maize-based agriculture. Domesticated crops commonly accounted for half or more of their diet, with the remainder provided by wild berries, nuts, fruits, and wild game gathered from the adjacent forest.

Although presettlement population figures are constantly debated and revised, what is truly significant is the impact of these peoples on the land. In addition to areas largely cleared of trees for crops, thousands of additional acres around each village were burned periodically to improve game habitat, facilitate travel, reduce insect pests, remove cover for potential enemies, enhance conditions for berries, and drive game. For example, in New England it was reported that the native peoples underburned the woods twice a year, in the spring and in the fall. Roger Williams wrote that "this burning of the Wood to them they count a Benefit, both for destroying of vermin, and keeping downe the Weeds and thickets."

Early observers reported prolific numbers of animals along forest edges and openings, indicating a forest in which natural or human-induced disturbance was common. Even elk and bison, normally associated with the western prairies, were common in the eastern forest. In the early 1600s, bison were found grazing along the Potomac River in what is now Virginia and Maryland. Bison were reported in Massachusetts. The presence of these grazing animals indicates abundant grass and forbs that could only have been created by fire.

The South was dominated by fire-created forests, such as longleaf pine savannas on the Coastal Plain and Piedmont. The hardwood forests of the Appalachian Mountains were also burned frequently by native peoples.



During the late 1580s the Indians of the village of Secoton, near Sir Walter Raleigh's colony of Roanoke in present-day North Carolina, raised abundant corn crops as well as some sunflowers and squash. This engraving by Theodore DeBry is after a watercolor by John White, the original leader of the colony. Library of Congress.

Virginia's Shenandoah Valley—the area between the Blue Ridge Mountains and the Alleghenies—was one vast grass prairie. Native peoples burned the area annually.

On the western fringe of the eastern forest, fire-dominated forests, such as oak and pine savannas, covered tens of millions of acres. These forests were heavily influenced by fires sweeping off the prairies. Fire-created prairies extended well into Ohio. Evidence of the dominant role fire played in these forests is demonstrated by the fact that, when farms finally began to move out onto the prairies reducing wild fires, millions of acres of open oak savannas and even treeless areas to the east of these farms became dense forests and woodlands within two decades.

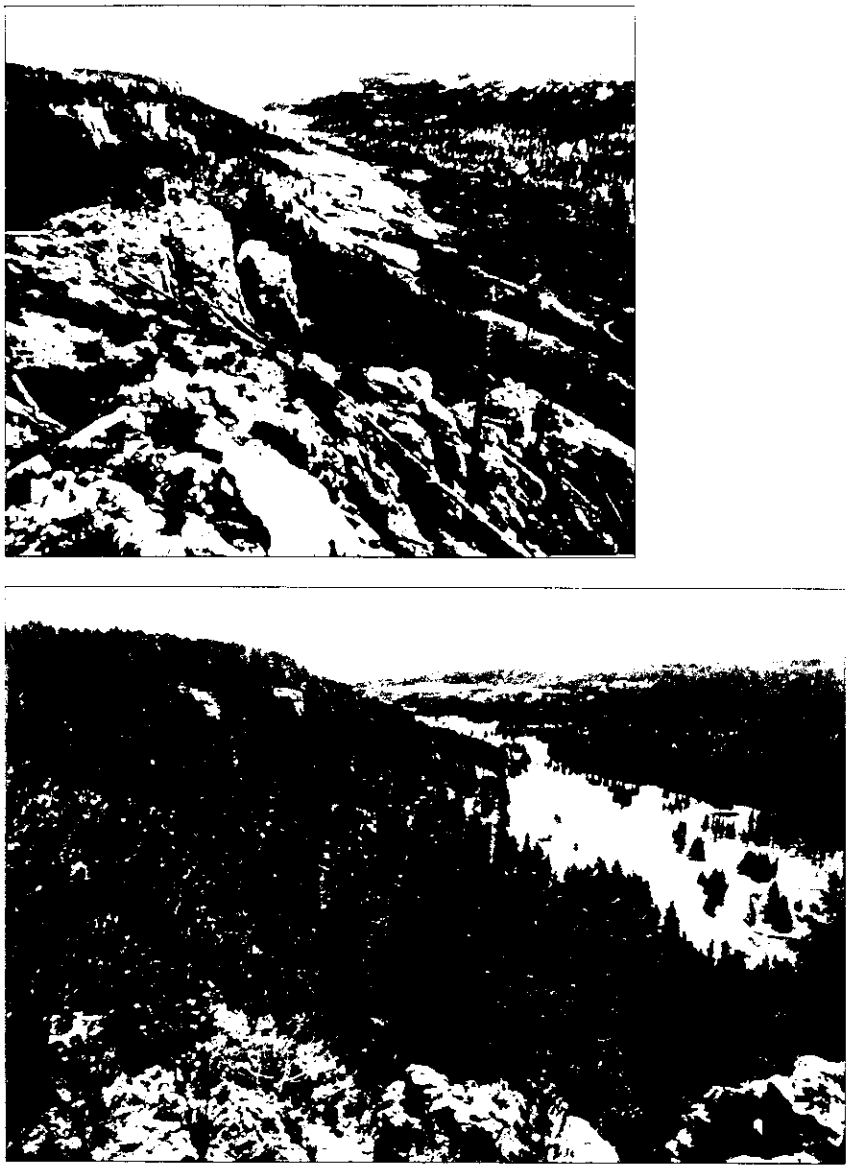
Today, with rising interest in protecting more forests in their "natural" condition, the complex presettlement history raises technical and policy questions over whether and how to allow wildfire to assume its natural role in these areas, and whether to seek to replicate presettlement human influences. It is difficult or impossible to distinguish natural from human-caused influences in presettlement forests: North American forests have been both occupied and influenced by humans from the time these forests advanced north behind the retreating continental glaciers 8,000 years ago.

Changes Brought to the New World, 1500–1785

European settlement ushered in a vast increase in the impact of humans on the forest. The abundance of land and resources and the scarcity of labor was a defining difference between America and Europe, where the situation was reversed. This difference was profound, affecting everything from the way resources were utilized to the type of stewardship applied to the land, as well as the adoption of slavery.

Both fishing and fur trading thrived before permanent settlements were established in what is now the United States. Fur trading based on beaver, otter, lynx, and many other forest-dwelling animals was one of North America's first industries, and its success depended on the active involvement of native peoples as hunters and trappers. The astoundingly productive Atlantic fishery formed the foundation of a lucrative industry that began along the Atlantic coast in the 1500s.

Lumber was also one of the first exports from the New World. In 1621, only a year after the Mayflower arrived, the Pilgrims sent the ship *Fortune* back to England "laden with good clapboard as full as she could stow." Soon



Castle Creek in the Black Hills during the 1870s (top) *and following a century of fire exclusion* (bottom) *that allowed more mature forests to develop.* South Dakota Agricultural Experiment Station photo.

the colonies became the source of white pine ship masts, oak planking, and cedar timbers, upon which the English navy depended. The forests of England had long since been depleted of ship-grade material; supplies from the Baltic States, where England was then obtaining its masts and timbers, were of lower quality, expensive, and subject to political disruption. By the middle of the 1600s, the colonists had established a booming business in ship masts and timber.

Early European colonists viewed the seemingly endless forest as a mixed blessing. On one hand it provided an abundant and available source of fuel and building materials. It yielded game that for decades after settlement remained an important food source. But the forest was also habitat for wolves, eastern panthers, and other predators that found colonial livestock easy prey and against which the colonists waged unrelenting war. It provided cover for sometimes hostile Indians. But most importantly, it occupied potential cropland that could be liberated only after intensive and back-breaking labor using hand tools.

For the first 3 centuries of United States history, most Americans were farmers. Ninety-five percent of the people lived on the land in 1800. Except for a relatively few people engaged in plantation agriculture in the South, most were subsistence farmers. From this perspective, the predominant view that emerged in the early 1600s, and that continued for almost 300 years, was that the forest was both inexhaustible and an obstacle to the preferred agricultural use of the land.

The colonists cleared the forests using techniques learned from the native inhabitants, but with the substantial advantage of iron tools and draft animals. Initially, white settlers sought abandoned Indian fields, which required less labor to clear than did a mature forest. Clearing forests was extremely laborious and time consuming. About 1 man-month of effort was required for each acre of mature forest cleared (assuming the axman was strong and healthy). Trees were either felled with an ax and removed before planting, or they were killed in place and left standing by girdling (removing the bark in a band around the tree). In both cases, fire helped clear the undergrowth.

The settlers planted crops borrowed from the Indians—corn, squash, tobacco, beans, and pumpkins. Other crops first domesticated by native peoples include: both white and sweet potatoes, tomatoes, blue grapes, peanuts, sunflowers, both sweet and chili peppers, strawberries, cocoa beans (chocolate), vanilla, avocados, pineapple, cassava, tobacco, cotton, and

gourds. American agriculture still relies heavily on native crops. Today almost 60 percent of the value of U.S. crop production consists of plants first domesticated by native peoples.

The most significant difference between European and native agriculture was that the Europeans possessed livestock and draft animals. Within a few years after settlements were established in an area, the numbers of livestock increased dramatically. In 1634 the Massachusetts Bay Colony had a population of 4,000 people, 1,500 cattle, 4,000 goats, and "swine innumerable."

Because labor was scarce, the common European practice of herding livestock was generally not practiced. Instead, hogs, cattle, and other livestock were turned untended into the woods, which meant that fences were needed to keep them out of crops and gardens.

Next to clearing the forest, the most labor-intensive activity in creating a farm was the building of fences. One observer wrote that "it is inconceivable the cost and care which a single large farm requires in that single item." A square 40-acre field enclosed by a wooden zigzag fence required about 8,000 fence rails. An average farmer could split 50 to 100 rails in a day.

Until woven wire and barbed wire were introduced in the latter half of the 19th century, farm fences were made of wood or stone. The volume of wood used in farm fencing substantially exceeded that of lumber until the 1840s. By 1850 there were about 3.2 million miles of wooden fence in the United States, enough to encircle the earth 120 times.

The abundant forests also provided European settlers a level of physical comfort in winter unknown in the forest-depleted Old World. In 1650 an English visitor, Francis Higgins, wrote that a "poor servant here...may afford to give more wood for Timber and Fire...then many Noble men in England can afford to do."

Such comfort came at a price. In the late 1700s, about two-thirds of the volume of wood removed from the forest was used for energy. Wood provided virtually all of the energy consumed in the United States. Heating and cooking was done in inefficient fireplaces. It was not uncommon for a single household to consume 20 to 40 cords of wood annually. Thus in a single year more wood went up the chimney in smoke than had been used to build the house that was being heated. The average per capita consumption of fuelwood was about 4.5 cords per year throughout the colonial period.

Wood for fuel went far beyond meeting domestic needs for heating and cooking. It was also used to produce iron and other metals critical to the country's economy. Virtually all iron produced in America throughout the 18th century was smelted using wood charcoal. The reason was clear: wood was abundant, the technology was simple, and it could be done in a small operation. Blacksmiths found charcoal iron malleable and easy to shape into a variety of tools and other iron products.

Fencing. Hand-split rails are stacked in zigzag fashion. Although these rail fences have a firm place in American pioneer folklore because of Abraham Lincoln's well-known youthful chores, they consumed large quantities of wood and were impractical when the westward-moving frontier reached the prairie region. FHS Lantern Slide Collection.

Charcoal-making in 1900 using methods unchanged for centuries. The wood is stacked in the shape of a cone, covered with earth, and then ignited. FHS photo.

Virtually every American colony had a number of iron-making furnaces. By the late 1700s many individual ironworks were producing 1,000 tons or more of iron per year. Thus the impact on the forest locally was significant. A 1,000-ton ironworks required between 20,000 and 30,000 acres of forest to sustain itself.

As settlers continued to clear forests for farms, firewood, and energy production, the many wildlife populations dropped dramatically. Even before the middle of the 1700s, many game animals and furbearers, such as deer, eastern elk, wild turkey, and beaver, were becoming scarce in many areas. Trappers practically eliminated beaver east of the Appalachians by 1700. These areas would not see the beaver's return for almost two and a half centuries. Wild turkeys were considered rare in many locations by 1670, and the bison was gone from the East before the Revolution of 1776.

This decline in game species was not primarily the result of habitat loss. On the contrary, habitat conditions in many parts of the colonies would have been ideal for deer, wild turkey, and beaver. The problem was in the social and property arrangements designed for the taking of desired species. Because wildlife crosses property lines at will, and ownership to it does not pass until it is killed, normal property arrangements do not work. Individuals therefore have little incentive to conserve game if their neighbors do not because, in economic terms, they suffer a known loss with little perceived benefit. Today, this difficulty in conserving common property assets is called the "tragedy of the commons."

In Europe, the "commons" problem was effectively, if undemocratically, dealt with by the nobility, who decreed that all wild game was the property of the crown and any commoner caught taking it would be severely punished. But this institutional arrangement did not cross the Atlantic. Initially it was not perceived as a problem because of the small human population and abundant wildlife. It soon became apparent that some form of regulation was needed, but it would be well into the 20th century before the country could muster the social will to institute and enforce effective game regulations.

Westward Expansion and Eastern Industrial Growth

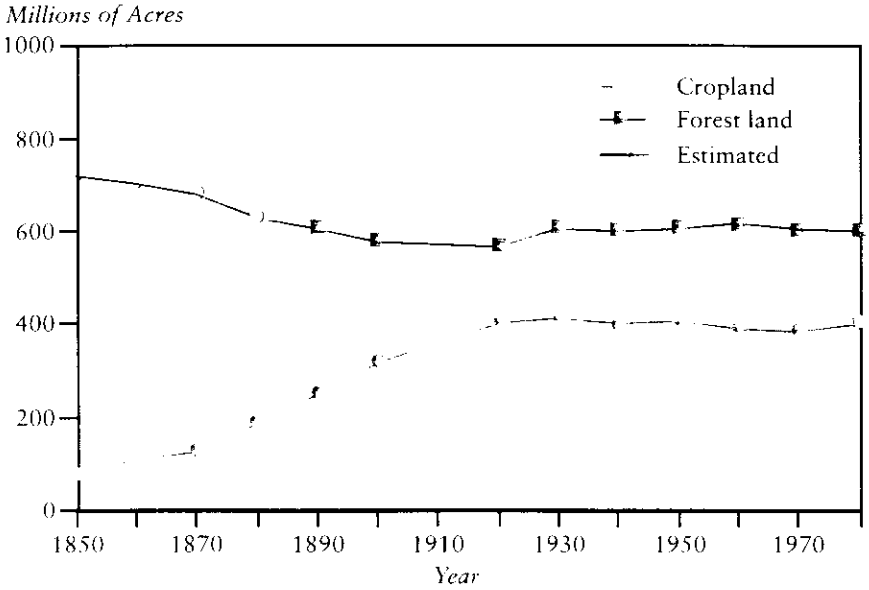
The massive Louisiana Purchase of 1803 doubled the nation's land area, and by 1850 the land base for the 48 contiguous states was in place. Acquired land was added to the public domain. Throughout most of the 19th century, the government viewed it as in the national interest to transfer rapidly public domain lands to private ownership. The work became the largest and longest-lasting privatization effort in the history of the world. The increase in land transfers reflected a parallel increase in population.

It had taken the colonies a century and a half to reach a population of 3 million people. However, in the 65-year period between 1785 and 1850, the U.S. population multiplied more than 7 times, to 23.3 million people.

Since it required an average of about 3 acres of cropland to support each person, the area of cropland grew at about the same rate as the population. By 1850 the total cropland area, which had been about 20 million acres in 1800, had grown to 76 million acres. Clearing for pasture and hay land was perhaps twice that figure. Farmers and settlers carved much of this agricultural land out of the forest (see figure 2).

Expansion of population and industry put increasing pressure on U.S. forests, both east and west of the Appalachians. Water-powered mills operated next to New England rivers and streams. Farms in New England, which had previously functioned at subsistence levels, prospered as they provided for the communities growing up next to these mills. Farmers cleared large areas to pasture sheep that would provide wool for the textile industry; beef cattle provided meat and hides to growing areas in the East, both for domestic use and for export. In the South, forests were cleared for cotton, tobacco, and other crops.

Figure 2. U.S. Crop and Forest Land Area, 1850–1980



Source: RPA Technical Report, RM-175, USDA–Forest Service, 1989.

The nation's forest land area is about the same size today as it was in 1920, when the acreage devoted to cropland stabilized. Two factors contributed to this stabilization. First, as horses, mules, and other draft animals were replaced by farm tractors and motor vehicles, cropland formerly used to feed draft animals was freed for use in human food production. Second, after 1930 agricultural productivity began to improve due to genetically-improved crops, irrigation, and increasing use of fertilizers. Today U.S. farmers produce crop yields per acre 5 times greater than those produced in 1920.

Note: figure 2, in contrast to figure 1, does not include Alaska and Hawaii.

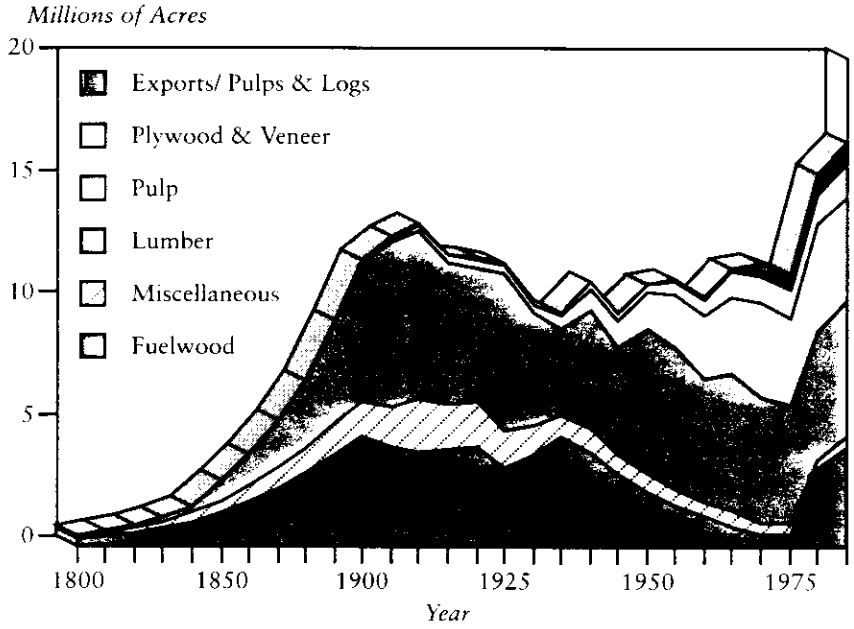
Use of the Forest for Fuel

The volume of wood used in 1850 was almost 6 times the volume of 50 years earlier. By mid-century, wood still supplied more than 90 percent of the nation's heat energy needs; domestic heating and cooking accounted for the largest use of wood fuel (see figure 3).

The increasing scarcity and expense of fuelwood spurred innovations in the form of cast-iron wood stoves, which were 4 to 6 times more efficient in the use of wood than fireplaces. In the 55 years between 1790 and 1845, the U.S. Patent Office issued more patents for stoves (over 800) than for any other object. But in spite of their obvious advantages, adoption of wood stoves was gradual, occurring first in towns, where wood was expensive as well as difficult to store because of its bulk. Fireplaces continued to predominate for cooking and heating in rural areas well into the mid-1800s.

Southern Appalachian farm eked out of the forest. USDA–Forest Service photo.

Figure 3. Domestic Production of Forest Products, 1800–1985



Source: R. A. Sedjo, "The Nation's Forest Resources," RFF Paper ENR90-07, 1/90.

During the first half of the 19th century, domestic output of forest products rose at the rate of population growth. Heating and cooking was the largest use of wood during this period, averaging from one-half to two-thirds of total wood use. In 1850 wood provided over 90 percent of the nation's energy. After 1900, fossil fuels largely replaced wood fuels, and wood substitutes, such as steel and concrete, replaced wood in some structural applications. In addition, there were significant gains in efficiency in the utilization of wood in logging operations, at the mill, and in end product uses. The rising real price of wood encouraged such changes. The price of timber, adjusted for inflation, had risen steadily since 1800, increasing about 5 times during the century. The real prices of most materials that competed with wood were steady or declining during this period.

While increased use of wood stoves began to reduce the per capita consumption of fuelwood for domestic purposes, increases in industrial uses of fuelwood (including ironmaking and fuel for growing numbers of steamboats and railroad locomotives) offset these gains. Consequently, the per capita consumption of fuelwood for all purposes remained at more than 4 cords per year until the late 1800s. Because the population expanded more than 14 times between 1800 and 1900, and per capita consumption of fuelwood remained constant, there was increasing pressure on many forest areas. This led to forest depletion in some areas and local shortages. A traveler reported that on the 240-mile journey between New York and Boston in the early 1800s he passed through less than 20 miles of woodland, scattered in 4 or 5 dozen separate parcels.

Fuelwood remained the primary product of the forest until the 1880s, when the volume of lumber finally exceeded it. Although the volume of wood used for energy continued to increase until 1900, it supplied a progressively lower proportion of U.S. energy needs. As the country began to turn to coal, and later to oil for its energy needs, wood dropped from supplying more than 90 percent of the nation's energy in 1850 to 75 percent in 1870 to about 10 percent in 1920 (most of which was consumed by farm families). Yet even the move to coal increased the demand for wood in the form of millions of mine props to support deep mining operations in the mountains. Today, wood energy supplies about 3 percent of U.S. energy needs, two-thirds of which is produced in industrial processes.

Ironmaking

Production of charcoal iron continued to increase after 1800. In 1810 England had not one charcoal iron furnace; all were coal- or coke-fired. In the United States at that time, there were no coke-fired furnaces; America's abundant forests encouraged charcoal ironmaking long after the technology for coke-fired iron smelting had been fully adopted in Europe.

Ironmaking provided a material critical to the economic development of the nation, and abundant wood was key. While ironworks were often responsible for severely depleting the forests in the area surrounding them, nationally, the impact of ironmaking did not rival other uses, such as farm clearing or domestic heating. It is estimated that only about 5 to 6 million acres of forest went into iron furnaces during the 19th century, less than 2 percent of the area cleared for agriculture during that period.

In the 1850s the tonnage of coke iron produced finally exceeded that of charcoal iron. Even so, charcoal iron production continued to rise until 1900. Charcoal iron continued to be used after 1900 for specialty products. Because of its special properties, some early car makers specified it for engine blocks. The last charcoal-iron furnace finally shut down in 1945.

Transportation

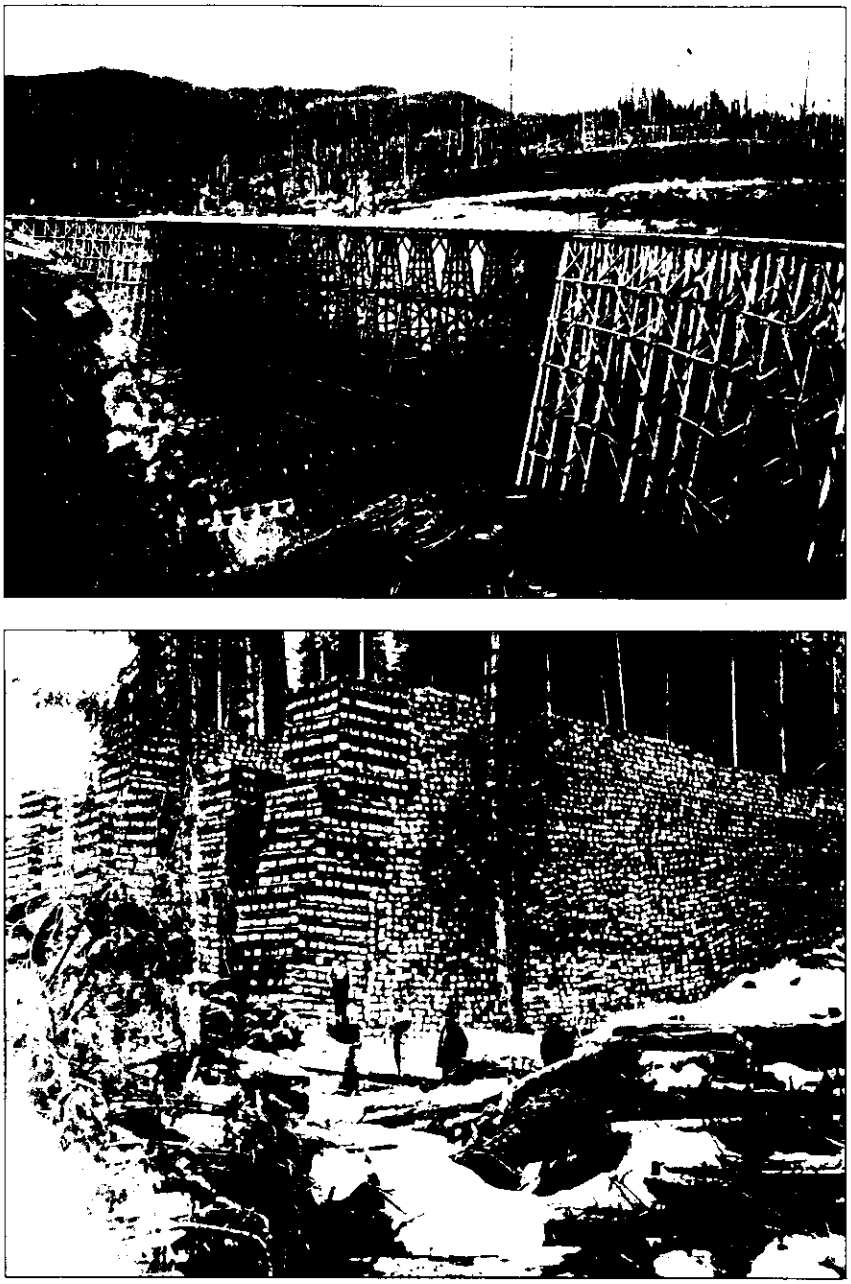
By the early 1800s, the United States was one of the largest nations in the world. The transportation system more than anything else tied the large, disparate, and often quarreling states together. America's forests figured heavily in building this system.

The nation's first highways were its rivers, where wooden keelboats and, after 1830, steamboats transported goods. Steamboats were made of wood and, until the Civil War, used wood for fuel. In 1840, almost 900,000 cords of wood were sold for steamboat fuel, representing one-fifth of all fuelwood sold.

Following steamboats came railroads. After 1850, railroads began expanding rapidly, linking growing cities and providing access to market for agricultural and forest products. Although called the "iron road," railroads used far more wood than iron. Except for the engine and rails, railroads were made of wood: cars were wood, ties were wood, the fuel was wood, the bridges and trestles were wood, and station houses, fences, and telegraph poles were wood.

The number of miles of U.S. railroads increased from less than 10,000 miles to more than 350,000 miles between 1850 and 1910. By the late 1800s, railroads accounted for 20 to 25 percent of the country's total consumption of timber.

By far the most significant railroad use of wood was for crossties. Each mile of track required over 2,500 ties. Crossties were not treated with preservatives until after 1900, so because of their rapid deterioration in contact with the ground, they had to be replaced every 5 to 7 years. Given the miles of track in 1910, that would be equivalent to replacing the ties on over 50,000 miles of track annually. Just replacing railroad ties on a sustained basis required between 15 and 20 million acres of forest land in 1900.



Railroads consumed vast quantities of wood. Bridges and trestles were constructed of pilings and large timbers (top). FHS photo. *Crossties were hewed or sawn* (bottom). B. C. Forest Service photo.

Population and Agricultural Growth

The 5 decades from 1850 to 1900 witnessed an unprecedented demand for and impact on the nation's natural resources; its forests, croplands, grasslands, and wildlife populations and habitats felt increasing pressure. Rising population and increasing urbanization drove this demand.

Between 1850 and 1900, the population tripled, from 23 million to 76 million. Even the bloody decade of the Civil War showed a 27-percent increase. Immigration added to this population growth, amounting to 32 percent of the nation's growth during the last half of the 19th century.

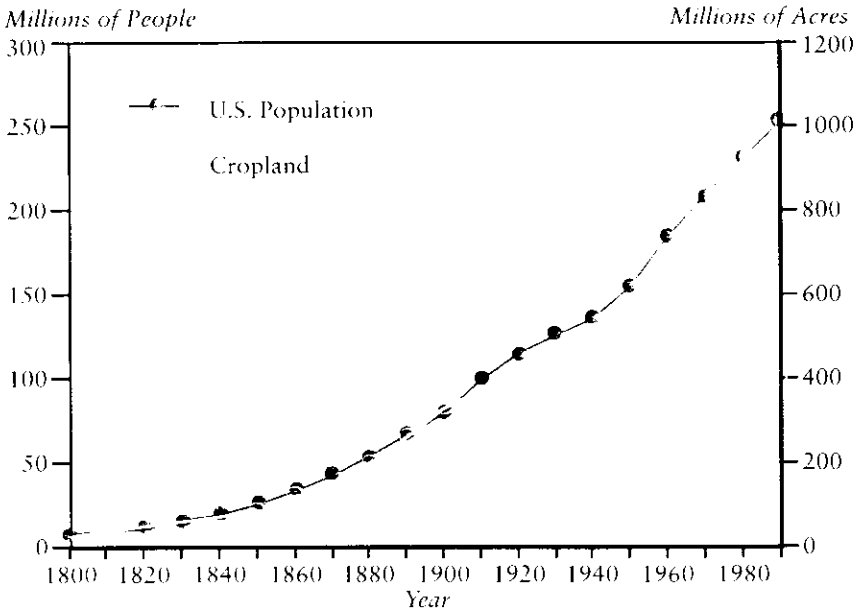
Increased industrialization might logically reduce a nation's demands on its forests. Coal replaced wood fuels and objects formerly made of wood, such as buildings, fences, bridges, nails, and machinery, were increasingly made of brick, iron, steel, and other materials. In fact, industrialization in Europe was partly a response to diminishing wood supplies. In America, however, other factors were the driving force, including improving transportation systems and adoption of European industrial technologies.

In the second half of the 19th century, extensive land was cleared for farming. During this period, while the U.S. population tripled, the total area of cropland increased by over 4 times, from 76 million to 319 million acres.

For every person added to the U.S. population during the 19th century, farmers put another 3 to 4 acres under the plow. Except for the decade of the Civil War, the increase in the area cleared for cropland paralleled the increase in U.S. population (see figure 4). Between 1850 and 1910, farmers cleared about 190 million acres of forest for crops and pasture, an amount greater than the total over the previous 250 years of settlement. In fact, during the 60 years between 1850 and 1910, the nation's farmers cleared at an average rate of 13.5 square miles of forest per day.

All sections of the country contributed to forest clearing for agriculture between 1850 and 1910, with about 44 million acres (23 percent) occurring on the Pacific Coast and in the Southwest; and 146 million acres (76 percent) in the East and South. Ohio was typical of farm clearing in the Midwest. In 1800 about 96 percent of the state was covered with hardwood forests, with the remainder in grass prairies probably maintained by Indian-set fires. Fifty years later, forest still covered about 60 percent of the state; but by 1900 forests covered only 25 percent of the state. In the productive farm country of the western half of the state, forest cover in many areas was reduced to 4 percent of the land.

Figure 4. Cropland vs. U.S. Population, 1800-1990



Source: J. Fedkiw, GTR RM-175, USDA–Forest Service, 9/89

The U.S. population rose more than 14 times during the 19th century. Since farm productivity did not increase on a per acre basis during the century, farm clearing continued at about the rate of population growth.

Between 1850 and 1900, the U.S. population increased over 3 times, from 23 to 76 million people, while the area of cropland increased 4 times, from 76 to 319 million acres. For every person added to the U.S. population during the 19th century, farmers were putting another 3 to 4 acres of cropland under the plow. The area of pasture and hayland increased even more than that of cropland.

In the 1920s, the inexorable, 3-century-long conversion of U.S. forests to farmland largely halted. Today, the U.S. has about the same area of cropland as in 1920. This has occurred in spite of the fact that the U.S. population has more than doubled since 1920, from 106 to 250 million, and that U.S. farmers also feed, through exports, the equivalent of more than 100 million additional people in other lands.

The vast improvement in agricultural productivity, which made possible the stabilization of cropland area, is a truly remarkable accomplishment which has been a major benefit to American forests.

It was well into the 20th century before gains in per acre agricultural productivity were made. Such gains were essential to reduce the rate of cropland clearing to feed a growing population, and were a prerequisite to reducing pressures on the nation's remaining forests and wildlife habitats.

Expansion of Lumber Production

Throughout the first half of the 1800s, most sawmills were small-scale, two- to five-person operations. Census figures for 1840 indicate that the number of sawmills in the United States was 31,649, or an average 25 mills for every county. The numbers were much greater for eastern counties than for areas newly settled, with some counties along the Atlantic seaboard having more than 100 mills, and pioneer counties in the Midwest and South having fewer than 10 mills.

Until 1850, small country sawmills handled most of the nation's wood needs—either as a result of farm clearing or from farm woodlots. Often it was the farmers themselves that cut the timber and cordwood and operated the sawmills.

Although farmers cleared at record levels after 1850, the process generated too little wood to meet rapidly increasing demand. The location of the clearing was also a problem; rural communities could meet their wood needs with local production, but the large quantities of lumber and other wood products that cities demanded required new arrangements for manufacturing and transporting forest products. Also away from the city and away from the forests, prairie farmers west of the Mississippi began to demand large quantities of wood for houses, barns, fences, outbuildings, and fuel. Logging and sawmilling increasingly became large-scale, as the physical distance between consumers and forests grew.

Lumber production increased dramatically, rising more than 8 times between 1850 and 1910, from 5.4 billion board feet to 44.5 billion annually, a rate more than double the rate of population growth.

Farmers and loggers burned limbs, tops, and other logging debris, believing that the logged areas could be converted to cropland or improved pasture. These uncontrolled slash fires burned nearly continuously, and under some weather conditions they resulted in massive wildfires that destroyed property and lives.

The South escaped much of the destructive post-logging fires that occurred in the North, perhaps because many of the native southern pine stands were of a more open type that had been maintained by frequent natural or Indian-set fires. Southern farmers continued the native practice of burning the woods, which reduced undergrowth and fuel buildup necessary for large wildfires.

Wildlife

The buffalo was one of the most dramatic examples of a large number of wildlife populations that by the last half of the 19th century had been severely diminished. By 1890 people had eliminated the whitetail deer from much of its range east of the Mississippi, including all the New England states west of northern Maine, as well as Maryland, New Jersey, Ohio, Pennsylvania, and the Lake States except the extreme northern portions of Michigan, Minnesota, and Wisconsin.

No longer was wildlife abundant. Because of unrestricted market hunting of all kinds of wildlife for food, furs, and feathers as well as habitat modification caused by farm clearing, logging, and extensive wildfires, the population was decimated. Even many songbirds—such as robins and meadowlarks—were heavily hunted for food.

Emergence of a Call for Action

Before the turn of the century a growing number of people became concerned about what was happening to the nation's woodlands and wildlife. The combination of logging, massive wildfires, farm clearing, and wildlife depletion began to call into question the notion of the forest's inexhaustibility. Fears about future timber supplies combined with implications for increased flooding and watershed damage, declining wildlife populations, harm to the beauty of the American landscape, and even concerns about how forest clearing was affecting the climate itself. George Perkins Marsh raised concerns about the adverse effects farm clearing had on watersheds and other environmental values. His 1864 book, *Man and Nature*, became a catalyst for public concern. As early as 1865, Frederic Starr predicted an impending "national famine of wood"—a concern that would be raised frequently in the

next few decades. Use of the term "famine" was apt, for wood in its various forms was among the most widespread and essential materials both for domestic use and industry.

The rapidity of change led to public concern as people in some areas watched the landscape, in 40 or 50 years, lose 80 percent of its forested land. At first the conservation movement was not organized. Groups with common interests moved more or less independently, seeking to achieve similar results through their efforts. Some of these groups began to set aside land in protective areas: Yosemite in California (1864); Yellowstone in Wyoming (1872); and the Adirondack Preserve in New York (1885). In 1891 Congress authorized the president to designate forest reserves out of public domain lands but made no provision for their management. The forest reserves, unlike the park preserves, were generally not tied to the preservation of a nationally significant unique area. These reserve designations, which had grown to 40 million acres by 1897, generated considerable opposition, because no one knew how such set-asides would address society's need for water, forage, wood products, and other resources.

Scientists—including foresters like Bernhard E. Fernow and geologists like John Wesley Powell and Arnold Hague—prepared reports, wrote articles, and testified to Congress about the need to protect forested watersheds, water for irrigation, trees, forage, and wildlife. Citizen groups—the American Forestry Association and the Boone and Crockett Club—also advanced the cause. The result of these efforts was that Congress gave the forest reserves a management mandate (through the 1897 Organic Act) to "preserve and protect the forests," to "secure favorable conditions of water flows," and to "furnish a continuous supply of timber for the use and necessities of the citizens of the United States."

Congressional and presidential actions to reserve national forests from public domain lands signaled a shift away from 3 centuries of national policy that was designed to transfer public land to private ownership. By 1900 more than a billion acres of public domain lands, more than half the land area of the contiguous 48 states, had been transferred to private ownership.

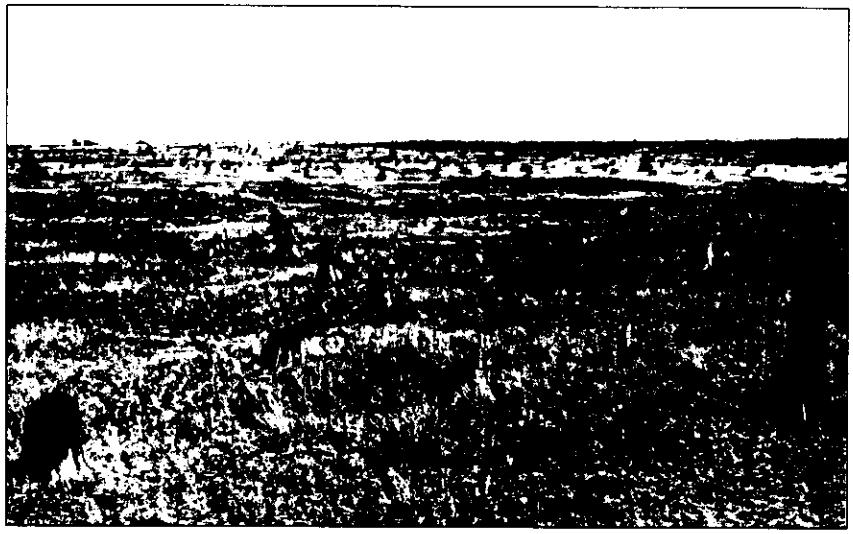
The turn of the century also signaled a general change in how people viewed natural resources. It was becoming clear that the myth of forest and wildlife inexhaustibility was untenable and that the existing rates of forest and wildlife consumption were not sustainable. While new approaches were called for, it was not clear what shape these approaches would take.

The idea of "conservation as wise use" emerged and received widespread public support under the dynamic advocacy of Gifford Pinchot and his friend and mentor, President Theodore Roosevelt. Pinchot and other conservation leaders were influenced strongly by "progressive era" thinking, which put great faith in science and the rational approach. Their view supported faith in efficiency but strong distrust of the "special interests" in politics. From this progressive era came the idea of conservation as the "wise use" of natural resources. Under this view, current use of resources should protect the basic productivity of the land and its ability to serve future generations.

Condition of Forests and Wildlife in 1900

The following snapshot of the condition of the nation's forest and wildlife in 1900 helps frame the natural resource situation that faced these early conservation leaders:

- Wildfire commonly consumed 20 to 50 million acres annually (an area the size of Virginia, West Virginia, Maryland, and Delaware combined).
- There were about 80 million acres of "cutovers" that continued to be either idle or lacking desirable trees.
- The volume of timber cut nationally greatly exceeded that of forest growth.
- There was no provision for reforestation. Aside from a few experimental programs, long-term forest management was not practiced.
- Wood was still relatively cheap; because of this, large quantities were left after logging, sawmills were inefficient, use of wood in buildings was based on custom rather than sound engineering, and huge volumes of wood simply rotted.
- Massive clearing of forest land for agriculture continued: in the last 50 years of the 19th century, forest cover in many areas east of the Mississippi had fallen from 70 percent to 20 percent or less. In the last decade of the century, America's farmers cleared forests at the average rate of 13.3 square miles per day. Much of this land included steep slopes that were highly erodible.



Cutover and abandoned forest land in northern Michigan at the beginning of the 20th century. FHS photo.

- Formerly abundant wildlife species were severely depleted or nearing extinction. Among them were whitetail deer, wild turkey, pronghorn, moose, black bear, bighorn sheep, and bison. Furbearers, especially beaver, had been eliminated from significant portions of their ranges. Waterfowl were severely affected, including wood ducks, Canada geese, and plumed wading birds (such as herons, egrets, ibises). The passenger pigeon, once the most abundant bird on the North American continent, was nearly extinct in 1900; the heath hen, an eastern relative of the western prairie chicken, was on the brink of extinction, and the great auk, a flightless bird along the northeast coast, was extinct.

U.S. forestry research and practical experience also increased, providing a sound foundation from which forestry professionals could work. By the 1950s, more and more wildlife biologists, soil scientists, hydrologists, forest engineers, and people in other natural resource disciplines were graduating from U.S. colleges.

Increased Research

Forestry research shifted as interest in the subject grew. Before 1900 forestry research focused on identification and description of trees, shrubs, and forest vegetation, timber use, consumption, and probable future timber supplies. That began to change after 1900.

In 1910 the Forest Service established the Forest Products Laboratory in Madison, Wisconsin. Its purpose was to seek ways to improve the utilization of wood products. Even before 1910, Forest Service researchers had been working with railroad companies seeking ways to extend the service life of wooden crossties through preservative treatments and other methods.

In 1915 the Forest Service created the Research Branch for scientific and technical investigations. Forestry research grew further with passage of the McSweeny-McNary Act in 1928. The act expanded forestry research and authorized regional forestry research stations and a nationwide forest inventory program. Research at forestry schools and state agricultural experiment stations also grew during the 1930s.

Following World War II, research improved and developed in the Forest Service, as well as at forestry schools and state agricultural research stations. The forest industry also stepped up its research efforts, making headway in silviculture, genetics, insect and disease control, and plantation and nursery practice.

Researchers discovered new efficient ways to use wood and at the same time developed new products. For example, plywood soon replaced lumber for sheathing on buildings.

Fire Protection

In the first 2 decades of the century, wildfire ran essentially unchecked through America's forests. Before 1930 from 20 to 50 million acres commonly burned each year; few forest areas were effectively protected. In the

1920s there were about 80 million acres of land that were unstocked, largely due to repeated wildfires. Few if any areas were replanted after logging, at least in part due to the risk of loss to fire.

It became clear that the fire problem had to be addressed. Europe, which had a negligible fire problem, left foresters without a model.

In 1902 a series of catastrophic fires near Yacolt, Washington, burned more than a million acres and took 38 lives. These fires encouraged the forest industry to set up private fire protection associations. In 1910 devastating fires in northern Idaho and northwestern Montana left considerable property damage and loss of life and helped galvanize federal efforts in fire control. William B. Greeley, who was in charge of the Idaho and Montana region of the Forest Service at the time of the 1910 fires and later became Forest Service chief, campaigned vigorously for stronger fire suppression programs. The fires prompted Congress in 1911 to pass the Weeks Act, which authorized federal matching funds for state fire-control agencies.

The Clarke-McNary Act in 1924 augmented cooperative federal and state fire suppression efforts as well as existing funding under the 1911 Weeks Act. This fire control system covered federal, state, and private lands in a cooperative effort.

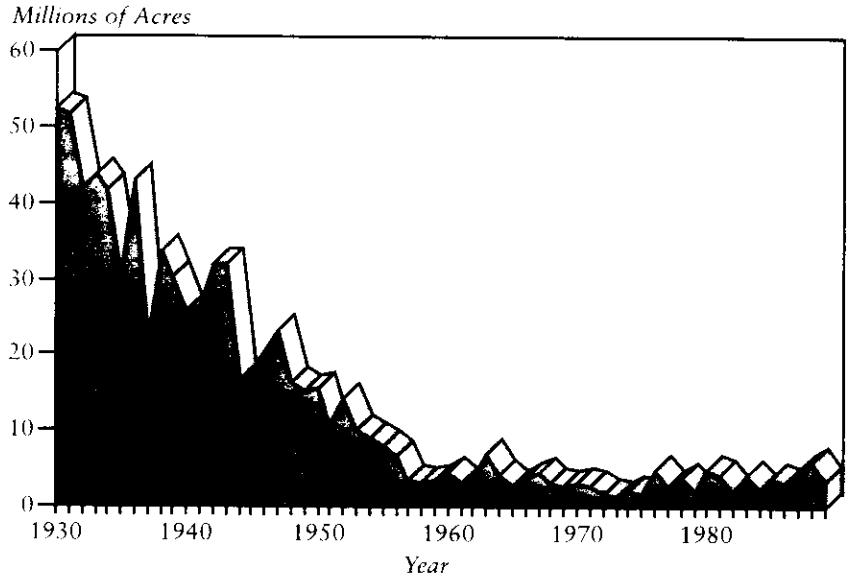
By the end of the 1930s these programs began to show results. However, it took 3 decades before wildfires were reduced to present levels. Of all the efforts to educate the public about fires, the introduction of Smokey Bear as a symbol of fire prevention was perhaps the most successful and widely recognized.

By the late 1950s, as a result of increasingly sophisticated fire protection, suppression, and public education, both the area burned and size of fires had been substantially reduced. Today, only 3 to 5 million acres burn in an average year (see figure 5).

Expansion of State Efforts in Forest Conservation

State forestry programs preceded federal action. In 1885 California and New York established forestry commissions, and the Empire State even set aside the Adirondack Preserve to protect water supplies for the Erie Canal. However, it was not until the 1911 Weeks Act provided federal matching funds to forest fire protection agencies that state programs grew. The 1924 Clarke-McNary Act further bolstered federal support of states through a major study of forest land taxation and assistance with tree nurseries.

Figure 5. U.S. Wildfire Trends, Area Burned, 1930-1990



Source: Wildfire Statistics, USDA–Forest Service; Forest Statistics of the U.S., USDA–Forest Service, 1989.

Wildfires scorched 40 to 50 million acres of land each year during the 1930s, a fact that ultimately made fire control a national priority. By 1960 the area burned had been reduced by 90 percent, to between 2 and 5 million acres annually. This remarkable accomplishment was due to cooperative federal, state, and local efforts in fire prevention, suppression, and public education. Reducing the risk of loss to wildfire was a prerequisite to effective forest management in the United States. It reduced the risk for long-term investments in timber growing. However, the nation still loses about 4.5 billion cubic feet of timber a year to insects, diseases, and wildfire. This adds up to about a quarter of the volume of wood the nation consumes annually.

During the 1920s and 1930s many states reexamined their constitutions to see if property tax changes could be made that would give special consideration to forest lands. The tax problem for forest managers was that although trees were taxed annually, they produced income only after long intervals. This situation, and the possibility that taxes might substantially increase during a managed forest's rotation, reduced incentives for reforestation following logging. Nationally, the property tax situation was modified piecemeal. Today forest land generally receives a more favorable tax treatment.

In the 1940s, with passage of various state forest practice laws, the Forest Service campaign for federal regulation was ended when states became the regulators of private forest practices. Early forest practice laws emphasized fire protection and reforestation. Recent revisions include requirements for successful reforestation and reflect broad concerns for the environment. Game also fell under state regulation, even game in national forests. In most states, fish and game agencies, funded largely by sport license fees, developed bag limits and hunting seasons in an effort to enhance the wild populations. Predator controls shifted from extermination to balanced maintenance as a way to ensure long-term wildlife health.

Stabilization of Timber Consumption After 1910

One significant development in the forest conservation picture after the turn of the century was the stabilization of timber consumption, followed by a modest but persistent decline in the timber volume used. Per capita consumption rates for wood, which in 1905 were over 500 board feet per year, dropped to less than 200 board feet by 1970. Even though population continued to increase, by the 1940s national wood production was about 15 percent lower than in the early 1900s.

There were various reasons for the leveling off and subsequent decline of timber consumption. One was technology. Fossil fuels replaced wood fuels, and wood substitutes, such as steel and concrete, replaced wood in structural applications. The rising real price of wood encouraged such shifts. The price of timber, adjusted for inflation, had risen steadily since 1800, increasing fivefold during the century. The real prices of competing materials were steady or declining during this period and throughout most of the 20th century as well.

After World War II, increasing real prices for wood created powerful incentives not just to use wood substitutes but also to improve the efficiency with which wood was used. Tree sizes and species formerly left behind were removed. Sawmills invested in wood-saving technologies. More efficient new products such as plywood and various panel products were developed.

Statistics reflect these changes in technology. In 1940 plywood accounted for less than 3 percent of U.S. production of solid wood products. By 1980 plywood's share had risen to 11 percent. Expanded use of preservative treatments also reduced the demand for wood. By 1920 virtually all crossties were being treated, and by 1960 railroad use of wood had dropped to one-fifth of what it had been in 1900.

Rise in Wildlife Conservation

Beginning in the late 1800s, organized sportsmen waged a protracted and ultimately successful war against market hunting. These groups vigorously supported enforcement of game laws, self-taxation to support state game management, and acquisition of habitat reserves and management areas. Sportsmen formed the National Audubon Society out of concern over commercial plume hunting. Such organized efforts saved scores of game and non-game species from extinction (see figures 6, 7, 8, and 9).

Before 1920 the primary focus was on eliminating market hunting and establishing a strong framework for the regulation of hunting. The regulatory framework that eventually emerged included the following:

- Halt market hunting of wildlife for meat and most other products, including feathers (regulated market hunting of furbearers continued)
- Eliminate spring shooting of waterfowl and other game birds
- Establish state regulation of resident game and non-game species
- Prohibit hunting song birds, plume birds, and other migratory non-game birds; prohibit interstate commerce in wildlife products taken in violation of state law
- Enact federal regulation of sport hunting of waterfowl and other migratory game birds

Figure 6. Trends in U.S. Whitetail Deer Populations, 1930–1990

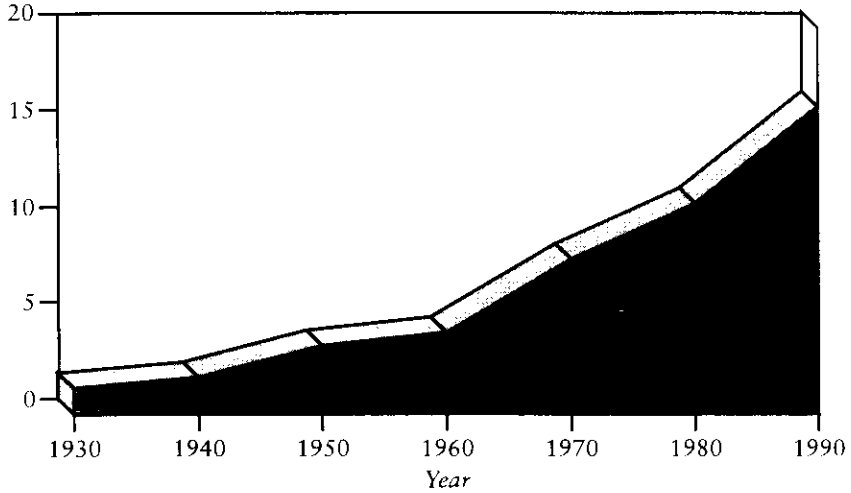
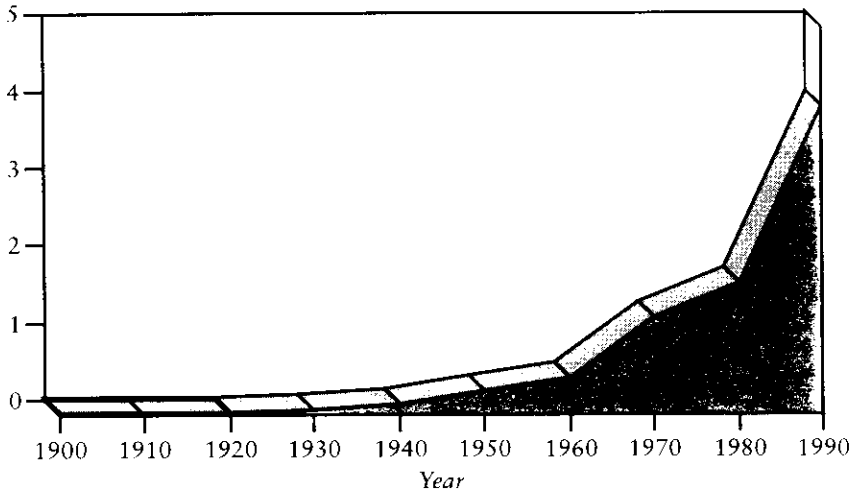


Figure 7. Trends in U.S. Wild Turkey Populations, 1900–1990



Whitetail deer, elk, pronghorn, wild turkey, and many other wildlife populations, both game and non-game, have increased dramatically since 1930. These increases are the result of effective hunting laws, increases in habitat acreage of managed forests, the adaption of species to a variety of forest conditions, and the dedicated work of federal and state wildlife agencies and private groups, such as the National Wild Turkey Federation. Recently there has been growing concern over some wildlife species needing specialized

Figure 8. Trends in U.S. Elk Populations, 1930–1990

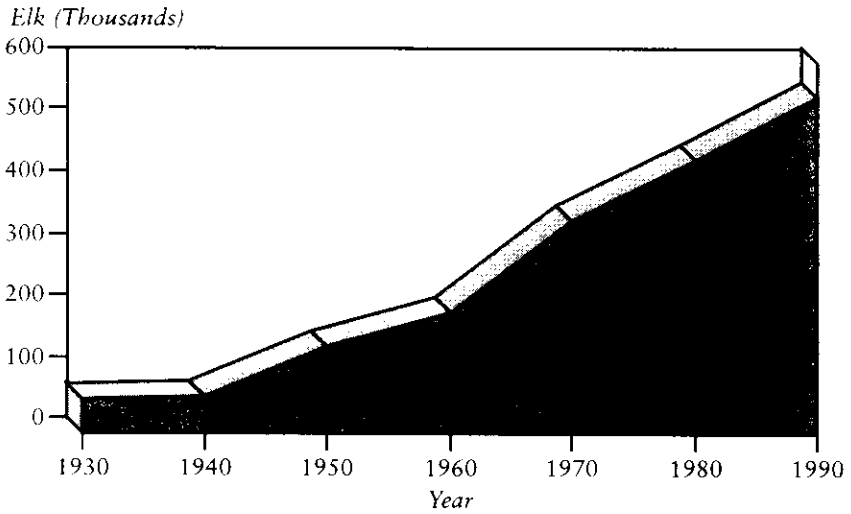
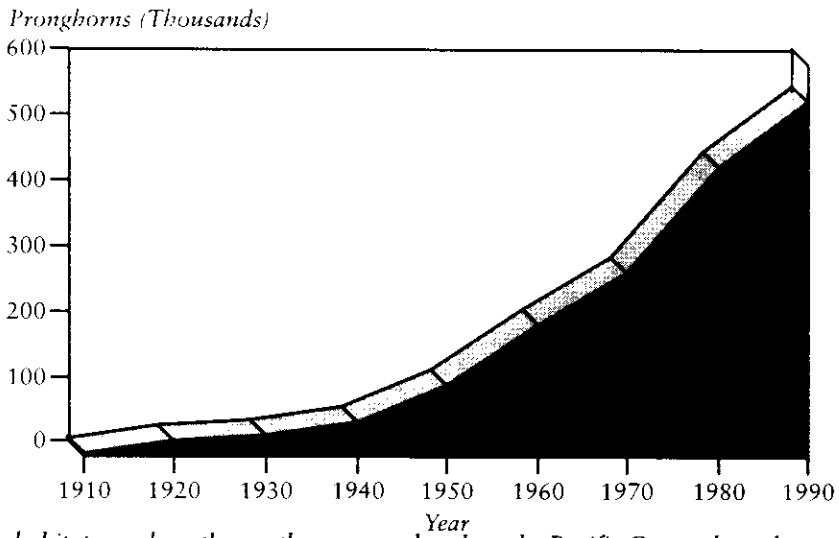


Figure 9. Trends in U.S. Pronghorn Populations, 1920–1990



habitats, such as the northern spotted owl on the Pacific Coast, the red-cockaded woodpecker in the South, and some neo-tropical birds. (Sources: Figures 6 and 9: Graphs reflect trends, not absolute numbers; based on Chapter 8, "Wildlife," by Jack Ward Thomas, in "Natural Resources for the 21st Century," American Forestry Association. Figure 7: National Wild Turkey Federation. Figure 8: A. Christensen, USDA–Forest Service, based on data from Elk of America.

After 1920 the emphasis on game conservation expanded from regulating to improving the art and science of wildlife management. Wildlife management became part of the curriculum at many colleges and universities, and state fish and game departments devoted to scientific wildlife management and game law enforcement were established. Before 1930, most state game departments were staffed by political appointees whose competence and tenure depended on the governor.

Increased wildlife professionalism, coupled with improving habitat conditions, especially on millions of acres of abandoned farm lands in the East and South, provided the foundation to reintroduce wildlife species into formerly occupied ranges.

Rise of Industrial Forestry

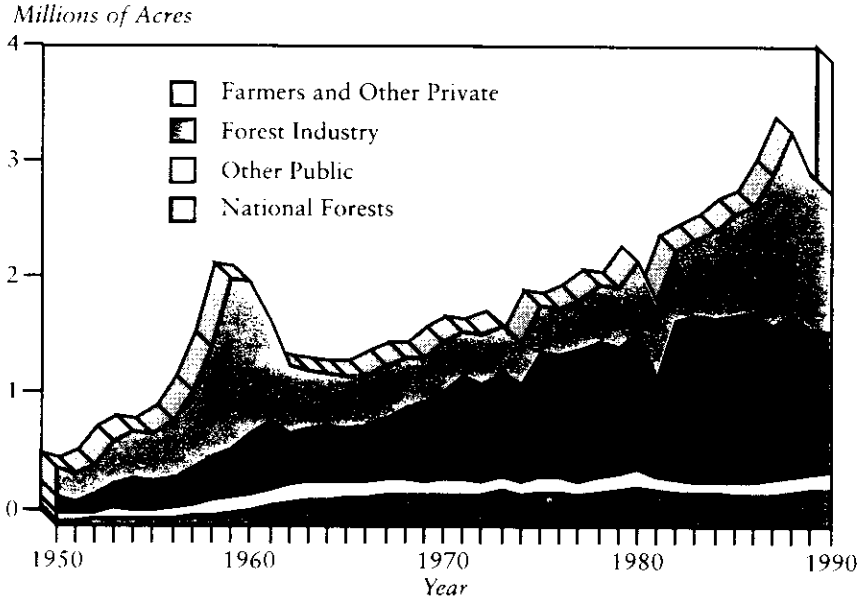
Until the 1920s, the forest products industry showed little interest in forest management. In fact, timber companies often sold cutover tracts for farmland or even let it revert to the counties for nonpayment of taxes. Tax codes had an effect on land use; because property taxes were based on the combined value of land and timber, landowners were implicitly encouraged to cut timber and thereby reduce their tax burden. There was little incentive for long-term investment.

By 1960 many states had changed their tax codes to base timberland taxes on bare land values, taxing the timber only upon harvest. A 1944 federal tax revision treated timber harvest income as a capital gain rather than straight income.

Modified tax codes, state laws encouraging—even regulating—fire protection and reforestation, and the rising real price of wood products prompted increased management of industrial forest lands for long-term timber growing, especially following World War II. Industrial tree planting rates increased dramatically after 1950, rising from an average of about 7,000 acres a year just prior to 1945 to 1.2 million acres during the 1980s (see figure 10). Much of this tree planting was in the South.

The forest industry also began to increase forest land holdings after World War II. Between 1952 and 1987, industrial land increased by 11.6 million acres, half of which was in the South. Today about 73 percent of U.S. productive forest land is privately held. These lands provide 80 percent of the nation's timber harvest volume. Forest industry lands comprise 15 percent of

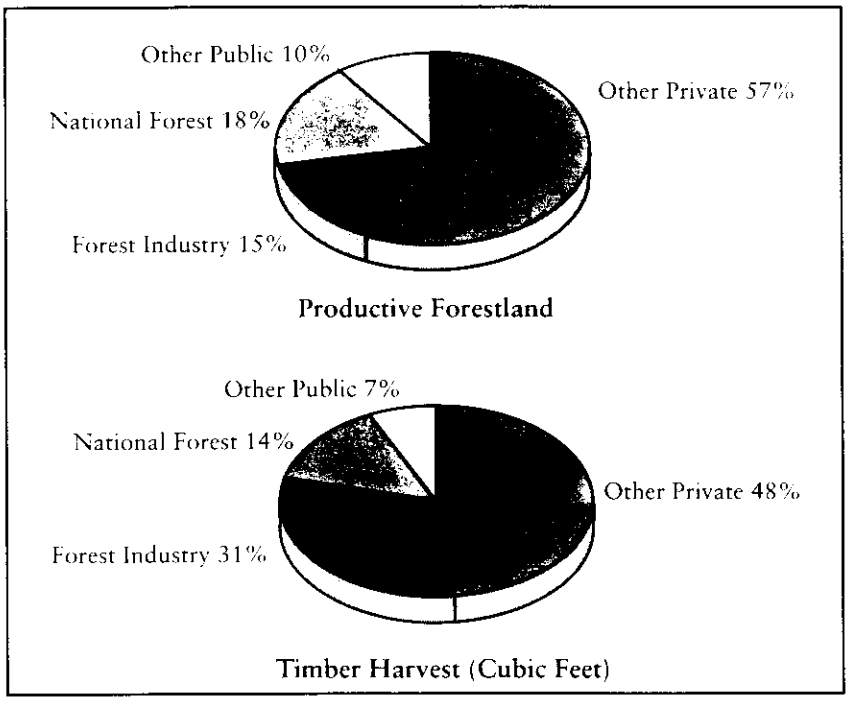
Figure 10. Tree Planting in the United States



Source: Annual planting reports, USDA–Forest Service

Tree planting has been increasing steadily since World War II, and has been at record levels for most of the last decade. In the 1980s more than 26 million acres were planted, including a record 2.3 billion seedlings planted on 3.4 million acres in 1988. In 1990, more than 400 trees were planted for every child born in the United States.

Figure 11. U.S. Forest Ownership and Timber Harvest



Source: Forest Statistics of the U.S., USDA–Forest Service, September 1989.

Just as they had encouraged improved wood utilization, increasing wood prices spurred private sector investments in timber growing, although investments other than for fire protection were not significant until after World War II, when industrial forest lands began to be managed in earnest for tree growing. Today, private forests comprise 73 percent of U.S. productive forest land, yet supply 80 percent of the wood volume harvested. The forest industry holds about 15 percent of the nation's productive forest land, yet provides about 31 percent of the timber harvested.

the U.S. productive forest land base, yet they provide 31 percent of the nation's timber harvest volume, and 37 percent of the nation's softwood timber harvest volume (see figure 11).

Stabilization of Forest Area

By the 1920s, the 300-year loss of forest land in the United States had nearly halted. Today the country actually has about the same area of forest as it did in 1920. The primary reason for forest land stabilization was the stabilization of the nation's cropland area.

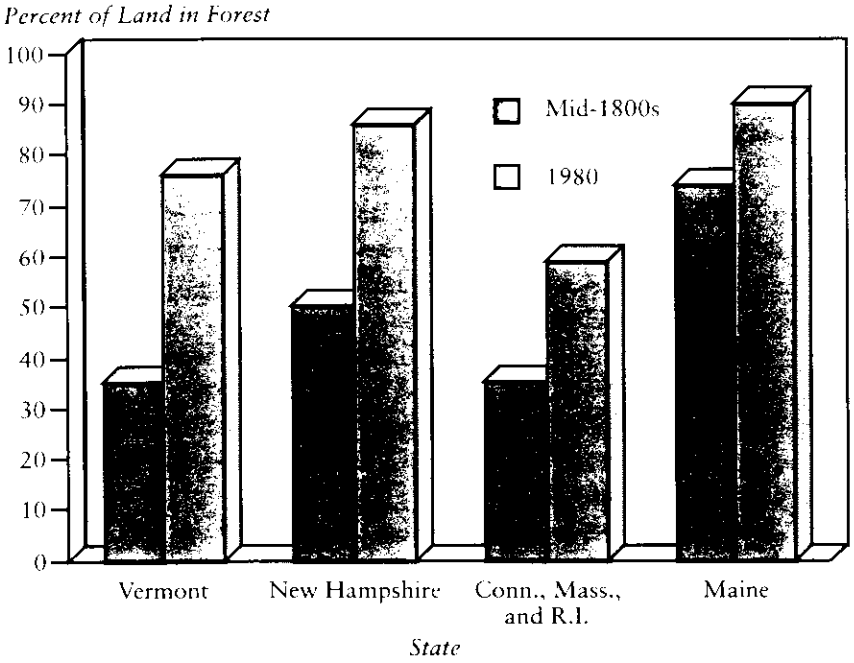
Around 1920, for the first time in American history, increases in the area of cleared farmland abruptly stopped, rather than rising at the rate of population growth. Farm clearing of forests continued after 1920 in some areas, but it was offset by farmland abandonment and reversion back to forest in other areas (see figure 2).

Cropland stabilized primarily for two reasons. First, rapidly increasing numbers of motor vehicles and farm tractors made it unnecessary to continue raising large numbers of draft animals. Twenty-seven percent of all cropland was devoted to growing food for draft animals in 1910. By 1950 the number of draft animals had dropped so dramatically that the equivalent of 70 million acres had been released to grow crops for human consumption. The second reason for the stabilization of cropland was that after 1935, spurred by the development of genetically improved hybrid crops and expanded use of chemical fertilizers and liming, agricultural productivity improved. Today, American farmers commonly produce 5 or more times the crop yield per acre they did in 1920.

The Eastern Forest Comes Back

Although the United States has about the same aggregate area of forest as it did in 1920, some areas have considerably more and some have less. Beginning in the mid-1800s, marginal agricultural land in the East and South was gradually abandoned as more productive farmlands in the Midwest were developed, the abandoned farmland often reverting to forest (see figure 12). This reversion to forest has not been generally recognized by the public.

Figure 12. The New England Forest Comes Back: Trends in Eastern Forest Land, 1850 and 1980



Source: Barrett, Regional Silviculture of the U.S., 1980

The amount of forest land in many parts of the East and South has actually increased by tens of millions of acres since 1900. Virtually every state east of the Mississippi has seen an increase in forest land since 1900; although the specific amounts and timing vary by state. The reasons for reversion back to forest are complex. The growth of the cities accelerated the transition of U.S. agriculture from subsistence to commercial. At the same time, the nation's progressively improving transportation system opened up more productive western lands to provide for the growing cities. The steep lands, small fields, and less productive lands of the East and southern Appalachians were unable to compete commercially with the lands of the Ohio Valley and much of the rest of the Midwest. The process of farmland reversion back to forest was greatly accelerated by the Great Depression.

The reasons for reversion to forest include two related factors working in concert. The first was the growth of cities, which accelerated the transition of U.S. agriculture from subsistence to commercial. The second was the nation's progressively improving transportation system, which opened up more productive western lands that could supply the growing cities. Steep slopes, small fields, and less productive lands of the East and southern Appalachians could not compete with lands of the Ohio Valley and the rest of the Midwest. The opening of the Erie Canal in 1835 was the first major step in this reversion to forest that occurred in the Northeast. Vermont is typical of the abandonment: in the 1850s, only about 35 percent of Vermont was forest, with the remainder primarily crops and pasture. Seventy-five percent of the state had become forest by 1980.

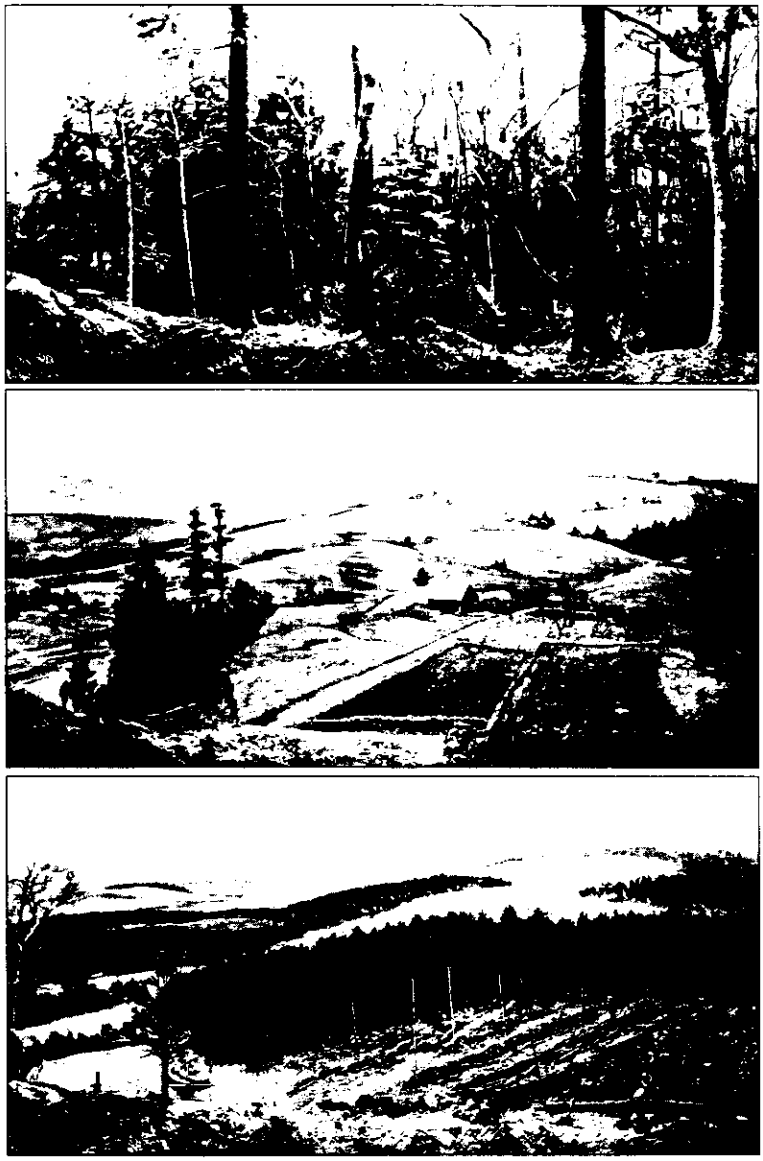
As surely as the Erie Canal and the railroads created a prosperous Midwest, they signaled the demise of agriculture in New England. The agricultural land abandonment that started in the Northeast in the 1850s gradually spread during the next century to other parts of the East, to the South, and eventually even to less productive farmlands of the Midwest. It culminated in massive farm abandonments during the Great Depression of the 1930s.

In many ways, the forest and farmland landscape of the Appalachians, as well as many other parts of the East and South, has come full circle. By the 1960s and 1970s, the pattern of forest, fields, and pastures was similar to that prior to 1800, its appearance much like it must have been prior to the American Revolution.

The Eastern National Forests

By 1915 national forests of the West had been established in the form they retain today. These national forests, which included 162 million acres in 1915, were essentially carved out of the public domain. At that time there were no federal forests in the East because the public domain had been transferred to private ownership before the conservation movement began.

The impetus for eastern national forests had two sources: some groups advocated federal acquisition to provide general protection for cutover lands, and other groups focused on the need for flood prevention. These parallel interests converged to influence passage of the 1911 Weeks Act, authorizing the acquisition of federal lands to protect the watersheds of navigable streams.



Harvard Forest diorama showing a hardwood-conifer forest in 18th century New England (top). *A century later, the forest had been largely cleared for farms. Within a few decades competition from agriculture farther west will have caused this farm to be abandoned* (middle). *Yet another century later the farm had reverted to forest* (bottom). Harvard Forest Diorama, Fisher Museum, Petersham, Massachusetts. M. H. Zimmerman photo.

The first acquisitions under the Weeks Act were in the southern Appalachians and in the White Mountains of New Hampshire. By 1925 land had been purchased to establish the national forests today known as the Monongahela in West Virginia; the Pisgah in North Carolina; the George Washington and Jefferson in Virginia; the White Mountain in New Hampshire; the Nantahala in North Carolina, South Carolina, and Georgia; the William B. Bankhead in Alabama; the Cherokee in Tennessee; and the Allegheny in Pennsylvania.

The major acquisition of eastern national forests was during the Great Depression. At that time 26 national forests were established, ranging from the Ocala in Florida to the Nicolet in Wisconsin; from the Green Mountain in Vermont to the Mark Twain in Missouri.

By 1945, when acquisition of national forest land in the East substantially slowed, about 24 million acres of depleted farmsteads and cutover and burned woodlands had been incorporated into the eastern national forest system and placed under long-term management.

Increased Demands on the National Forests after World War II

The period after World War II ushered in a substantial increase in demand for a variety of forest products as well as non-timber uses and values. Prior to the late 1940s, management of national forests was generally custodial or focused on meeting demands for resources in the surrounding area. After the war, as millions of GIs returned home and started families, demand for timber to use in housing increased dramatically, and the nation looked to the national forests to meet that demand. The roads into national forests had improved by the late 1940s and many of the more accessible private lands had been logged to provide timber for the war effort.

National forest timber sales increased from about 3 billion board feet in the late 1940s to about 12 billion board feet after the 1950s. By the 1960s, national forests met about one-sixth of the nation's total consumption of wood volume, and over a quarter of its softwood sawtimber needs, a primary source of lumber and plywood for housing.

This increase not only met the critical need for timber, it also took pressure off private forest lands, many of which had been heavily used to meet the needs of the war effort. Standing inventory was affected by this demand, as

was regrowth (see figures 13 and 14). Balancing harvest with growth in a system of multiple owners, and the transition from old growth to second growth, proved challenging (see figure 15).

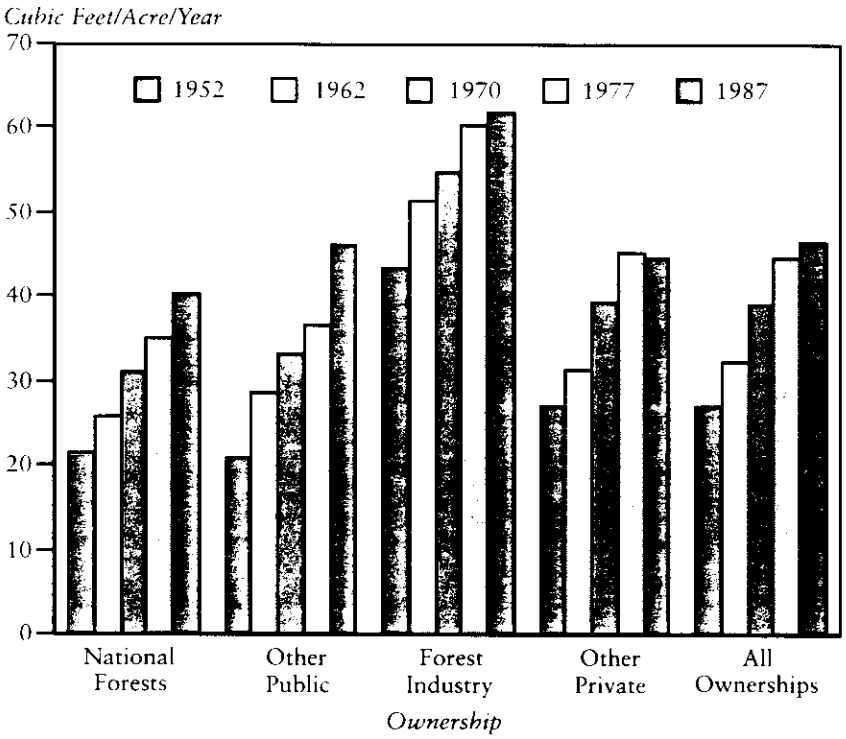
The 1950s also witnessed a substantial increase in demand for other national forest uses and values. An increasingly mobile and affluent population began to look to these lands for outdoor recreation. National forest recreational visits increased from 18 million in 1946 to 93 million in 1960 (see figure 16).

The increased demands on national forests led to new laws in the 1960s. The Multiple Use-Sustained Yield Act of 1960 required that national forests be managed for a variety of uses and values, including outdoor recreation, wildlife, timber, grazing, and watershed protection. In effect, this law reflected the uses and management already occurring on these lands.

The Wilderness Act, passed in 1964 after much debate, provided for the preservation of significant areas of national forest land in their natural and untrammeled condition. Timber sales and most other commodity uses were prohibited in these areas. By 1990 over 33 million national forest acres had been designated as wilderness. Approximately half of this land is forested.

In 1974 the Renewable Natural Resources Planning Act (RPA) required the Forest Service to carry out periodic assessments of the national long-term demand and supply situation for all renewable resources and to lay out a policy and programmatic framework for addressing projected resource demands and needs. In 1976 the National Forest Management Act provided detailed guidelines for national forest land management and for public participation in national forest decision-making. This last statute clearly reflected a change in congressional thinking; instead of broad mandates, the agency would operate under more detailed guidelines.

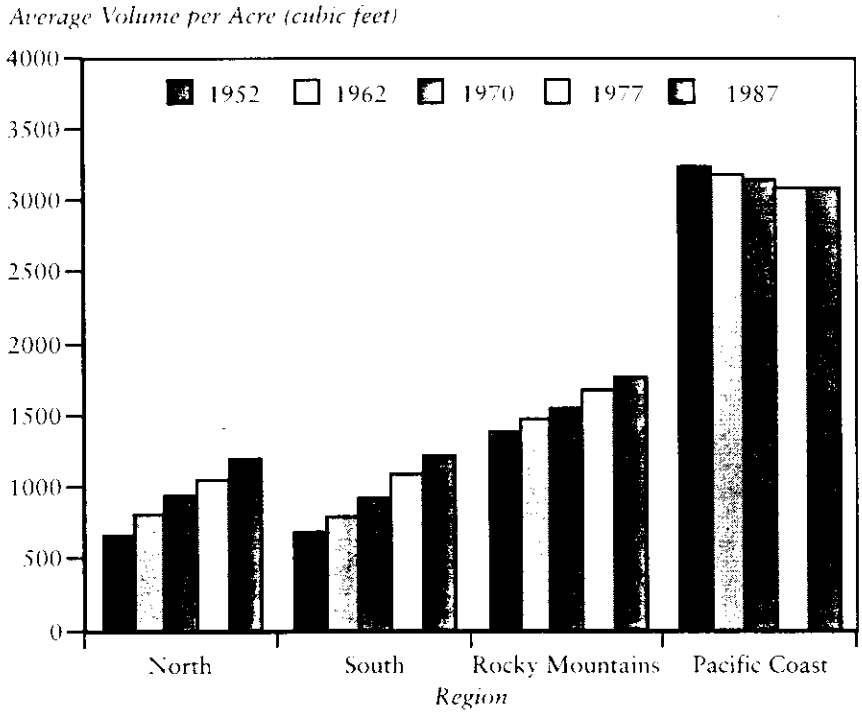
Figure 13. Trends in Growth Per Acre by Major Owner Average Net Growth Per Acre, 1952–1987



Source: Forest Statistics of the U.S., 1989

Forest growth has increased dramatically on all types of ownership over the last several decades. Net annual growth for all U.S. forests has increased 62 percent; net annual growth per acre has increased by 71 percent.

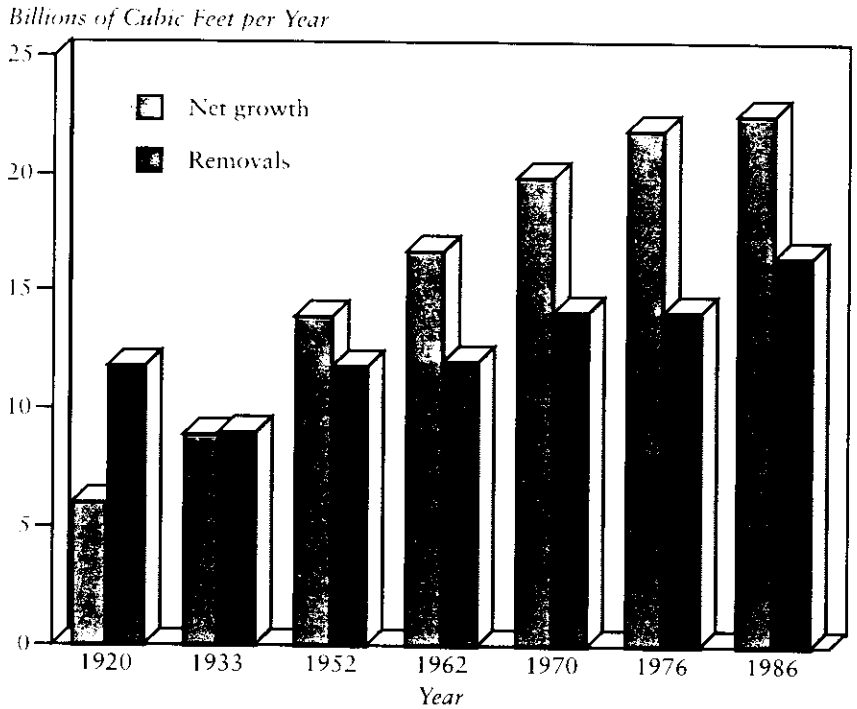
Figure 14. Trends in U.S. Standing Timber Volume Per Acre, All Owners, by Region, 1952–1986



Source: Forest Statistics of the U.S., 1987, PNW-RB-168, USDA–Forest Service, 9/89

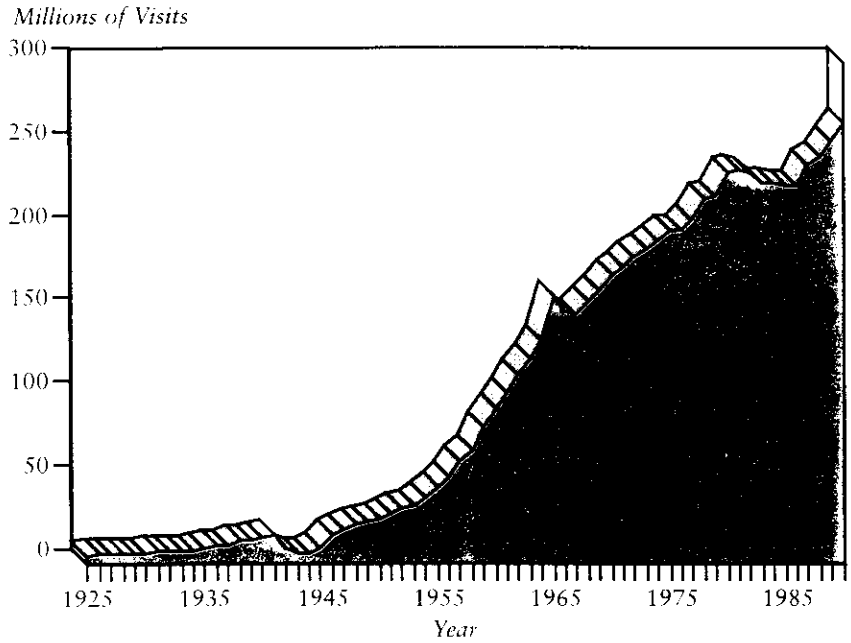
Since 1952, the amount of timber standing in U.S. forest land has increased dramatically in all regions except the Pacific Coast, where per acre volume has declined 5 percent because of the harvest of old-growth timber. Timber volume per acre has increased by 30 percent nationally since 1952.

Figure 15. U.S. Timber Growth and Removals, 1920–1986



In 1920 timber harvest rates nationally were double the rate of forest growth; but by 1952, net annual growth had exceeded annual harvest from all U.S. forest land. By 1986 net annual growth was 3.5 times what it was in 1920. In 1986 net growth exceeded harvest by 37 percent, or 6 billion cubic feet (20 billion board feet).

Figure 16. National Forest Recreational Use, 1925–1990



Source: USDA–Forest Service

After World War II, steadily increasing national economic growth provided the basis for increasing personal income and leisure time. That, along with the proliferation of automobiles, revolutionized the recreational habits of the American people. Increasing recreational visits to the national forests reflect a pattern common to other public lands as well.

Increased recreational demands came at the same time that the nation's public forests were also experiencing increased demands for other uses. Such pressures have been felt especially in the last 3 decades as conflicts over the use and management of public lands have intensified.

U.S. Forests Today

It is a measure both of the inherent resilience of our forests, and of the success of the policies put in place in response to public concerns in the early decades of this century, that forest conditions over much of the United States have improved dramatically since 1900:

- Forest land area has stabilized
- Acreage of uncontrolled forest fires is down 90 percent
- Forest growth now exceeds harvest
- Average timber volume per acre is up over 30 percent since 1952
- Reforestation is at record levels
- Eastern forests have staged a comeback
- Recreational use is at an all-time high
- Wood is used with greater efficiency.

Forest Wildlife Today

Several species of American wildlife became extinct as a result of forest changes and human uses during the 20th century, including the passenger pigeon, heath hen, and Carolina parakeet. An even larger number of subspecies and wildlife populations were substantially diminished.

Many of those species that were threatened with extinction in 1900, however, have come back in abundance. Due to actions that were set in motion in the early decades of this century, today most forest-wildlife species are both more abundant and more widespread than they were at the turn of the century. Many species which would have been on an endangered species list, had one existed in 1900, are now abundant. Examples include: wild turkey; beaver; egrets, herons, and many other wading birds; many species of shorebirds; wood ducks, and several other species of ducks; whistling swans; Rocky Mountain elk, pronghorn, bighorn sheep, black bear; even white-tailed deer throughout most of its range. Many other species, although not actually on the brink of extinction in 1900, are today both more abundant and

more widespread than they were in 1900. Since the 1930s, forest wildlife that can tolerate a relatively broad range of conditions (so-called "habitat generalists") has increased most quickly, and most American forest-wildlife species are habitat generalists. This may be due to the natural dynamics of North American forests causing frequent disturbances in the natural regime (see figures 6, 7, 8, and 9).

Some species abundant in forests prior to European settlement, particularly large predators and herbivores such as wolves, elk, and bison that need large home ranges, have not returned to large areas where they formerly were common. Yet, even many of these species have come back in areas large enough to accommodate their needs for a home range. But, while there have been many successes, problems remain. Some species with specialized habitat requirements are of concern today. Examples include:

- The red-cockaded woodpecker and gopher tortoise, both natives of fire-created southern pine savannas and woodlands
- The Kirtland's warbler, which lives in young jack pine forests of Michigan
- The northern spotted owl, which occupies mature and old-growth forests in the West

Some forest-wildlife species require active management of young forests for their survival, for example Kirtland's warbler. Many other species need a mixture of forest and forest edge environments, including a wide variety of game and of non-game species. Some, like grizzly bears, wolves, elk, and forest-interior birds, need large, contiguous areas of habitat. Some require old and ecologically diverse forest. Others, like the red-cockaded woodpecker, need both mature forest and other specific habitat conditions, such as open savannas and woodlands created by frequent ground fires. Even the old-growth, Douglas-fir forests in which the northern spotted owl lives are subclimax forest types that will eventually move toward different forest conditions unless there are occasional, stand-replacing wildfires.

The Forest in a Broader Context

The American Forestry Association, formed in 1875, and the Sierra Club, formed in 1892, are both tangible examples of public concern for the forested environment. Other concerned groups included the Boone and Crockett Club (1888), National Audubon Society (1905), and the Izaak Walton League (1922). The 1935 creation of the Wilderness Society punctuated a deepening sense that some land should remain relatively undisturbed, but not until the 1960s did this segment of the public begin to exercise fully its clout in setting forestry priorities.

At that time of turmoil when many of society's institutions were severely challenged, the modern environmental movement took form, moving beyond merely advocating wilderness preserves. Environmental quality became a high priority; Earth Day, a public celebration, followed closely on the heels of the National Environmental Policy Act, a federal watershed in managing lands and resources. Litigation became a weapon as public organizations made full use of new statutes. The National Environmental Policy Act and other statutes mandated public involvement in land management, which included forest land.

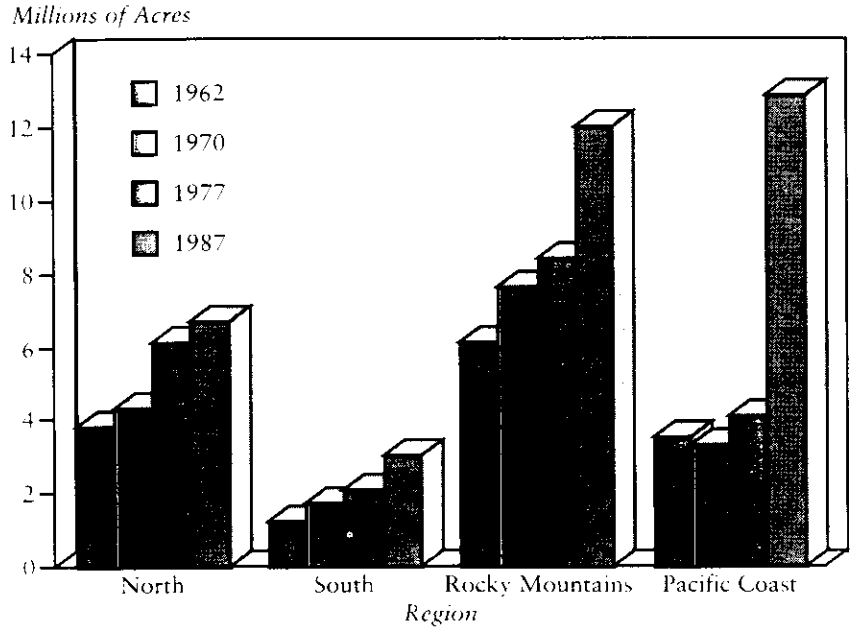
As forest conservation policies and practices set in place decades before began to work, and the nation demonstrated its ability to meet wood product needs from private and public lands, more forest lands have been set aside for parks, wilderness areas, and similar designations under which timber removal is prohibited. The area of such set-asides has increased significantly in recent years. Today, about 34.5 million acres of productive forest have been reserved. This area, the size of Florida, is about double the set-aside acreage of 1970 (see figure 17).

American Forests—A Transformed Heritage

Today our forests represent a substantially transformed legacy—certainly in comparison to 1600. But our forests have also been substantially transformed since 1900, a dimension not commonly understood.

Attitudes about the nation's forests have changed profoundly over the years. Native peoples viewed the forest in a spiritual context, but they also took a utilitarian approach and managed forests to serve their own ends. European Americans initially viewed forests both as an encumbrance to

Figure 17. Trends in Reserved Productive Forest Land, by Region, 1962-1987



Source: USDA–Forest Service Timber Assessment Report

As personal incomes increased and the nation's population became more urbanized and mobile, interest grew in setting aside land in parks, recreation areas, and reserves. In addition, the success of forest conservation practices began to demonstrate the nation's ability to meet increasing wood product needs from both private and public lands. Consequently, there has been a significant increase in the area of forest land set-asides for amenity values in parks, wilderness areas, and similar designations under which timber harvest is prohibited.

Currently, about 34.5 million acres of productive forest land have been so designated—about double what was set aside in 1970. This is an area the size of Florida. Withdrawals have centered in the Rocky Mountain and Pacific Coast regions, where the federal government is the largest forest landowner.

agriculture and as an inexhaustible resource. At first they used the forest—its wildlife, wood products, and land—to meet their subsistence needs for food and energy, much as the native population had done.

Later, the abundant wealth of the forests built the homes, cities, and transportation infrastructure of a growing nation. Lands previously occupied by forests were used to feed a rapidly increasing population.

Scarcely more than a century ago, it became increasingly clear that old approaches were not sustainable. Americans began to view forests and wildlife not as products to be mined or foraged, but as resources that could be managed scientifically over the long term, yielding products and services without unduly disrupting the basic resource.

As the nation's population has continued to urbanize, the principle of forest conservation for products and services has remained, but its role and scope have expanded. A few decades ago Americans started to view forests as attractive settings for outdoor recreation and as places for human spiritual renewal. Recently this view has evolved to a view of forests as ecosystems that support a complex web of life, of which humans are a part (see figure 18).

Although it is impossible to predict how the American view of forests may change in the future, the past provides information about how these forests came to be what they are today.

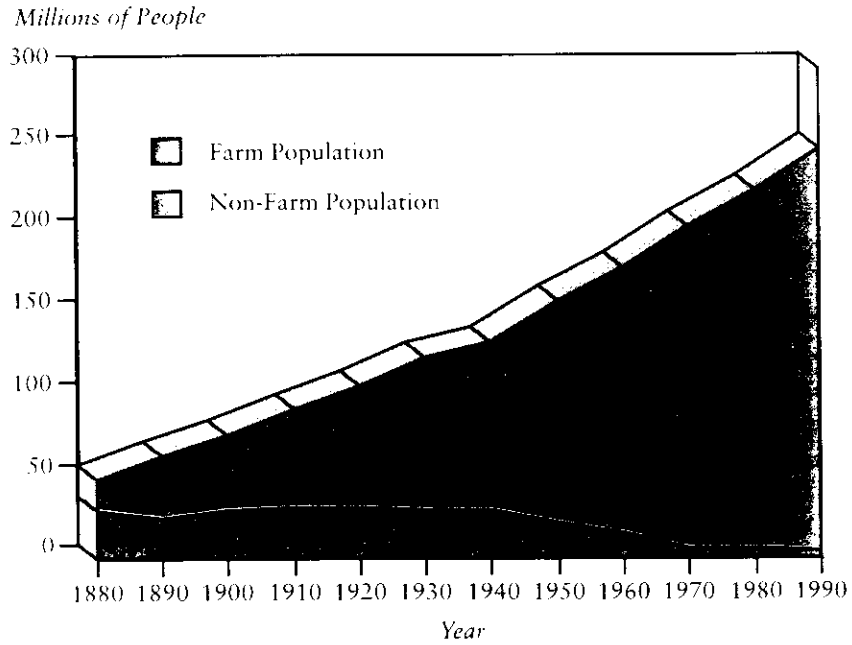
Lessons of the Past and Challenges for the Future

The U.S. population has more than tripled since 1900, and the standard of living is substantially higher as well. At the same time our forests and wildlife are, in most of their major dimensions, in significantly better condition today than they were a century ago.

American forests and wildlife have demonstrated a resilience and responsiveness to management undreamed of by conservationists at the turn of the century. These leaders were almost universally pessimistic about the future. Forest Service chief Gifford Pinchot and others predicted timber famine coupled with significantly increased wood product prices and consequent economic hardship. Wildlife leaders like William T. Hornaday predicted the imminent extinction of scores of species.

The timber famine never came; most species whose extinction was prophesied have since recovered and many are abundant today. Predictions by these early conservationists reflected what they felt was likely to occur if trends continued. Their words were a call-to-arms. Action was taken: new

Figure 18. Trends in U.S. Population Growth, by Farm/Non-Farm, 1880-1990



One of the most profound changes in American society in the 20th century has been its transition from a rural, agrarian society to an urban, industrialized nation. This change has been accompanied by a corresponding physical and psychological separation of its people from the land and resources that sustain them.

In a world of farms, forests, and small towns, the linkages between food and fields and between forests and home and hearth were clear and sustained by personal experience. In a world of cities and suburbs, of offices and air conditioning, these linkages have become more obscure, and for many people, virtually nonexistent. Yet today's urbanized society is no less dependent upon the products of its forests and fields than were the subsistence farmers of America's past.

policies were debated and implemented. History has demonstrated that these policies, coupled with the natural resilience of the resource, have caused forests and their wildlife to come back.

In addition to policy, certain actions and conditions unforeseen by early conservation leaders have also been important to the improved condition of forest and wildlife resources. One, of course, was resiliency; even Forest Service projections have consistently underestimated forest growth. Wildlife specialists have also been surprised at the recovery rates of many species, once placed under protection and management.

Another action was consumers' conversion from wood energy to fossil fuels, relieving American forests of that burden as population grew. Indirectly, use of fossil fuels in internal combustion engines substantially reduced pressure to clear forest land for agriculture because it released millions of acres of cropland to grow food for humans rather than for draft animals. Petroleum was also the base for fertilizers and pesticides that substantially increased agricultural productivity after 1930.

Too, American forests have been principal beneficiaries of the remarkable improvement in agricultural productivity over the last half century. The inexorable, 3-century-long conversion of U.S. forests to farmland largely halted in the 1920s. Today, about the same area is devoted to cropland as in 1920, despite a doubling of the nation's population. On top of this, U.S. farmers feed, through exports, the equivalent of more than 100 million people throughout the world.

Finally, a factor unrecognized by early conservation leaders was the effect that increasing prices for wood products would have in encouraging reduced consumption and increased supply. Real price increases for wood created incentives for efficient use, including less left behind after logging, better utilization by sawmills, and more efficient use in end-product applications through improved engineering, protection from rot through preservative treatment, and similar measures. Price increases also encouraged use of substitutes for wood, such as steel and concrete. These market responses were the primary reason that wood consumption did not rise after 1910 as it had in previous decades. Projections of impending shortages were based on assumptions that such past trends would continue.

But there are still significant issues and controversies surrounding management of U.S. forests. In recent years the growing urbanization, affluence, and mobility of Americans has caused a virtual revolution in the expectations and demands that the public places on forests. Some of these demands are in direct conflict with traditional forest values and uses.

Today, protection of remaining old-growth forests in the West, maintenance of biological diversity, protection of endangered species, loss of wetlands, use of herbicides in forestry, the impact of atmospheric pollution on forests, and other issues are hotly debated. While most wildlife are in better condition today than a century ago, there are clear exceptions. Some species with specialized habitat requirements remain the focus of concern.

In the last decade, the debate between people advocating the use and management of forests for commodity products and people wanting to minimize human influences and emphasize amenity values (particularly on public forests) has become increasingly shrill and divisive. On the positive side, it is a measure of the substantial success of its past conservation policies that the United States now has the option to consider such choices.

But as always, there are limits to such choices. Society remains dependent on forests for a wide variety of economic products. Indeed, on a wood volume basis utilization of the forest for products has never been higher.

Today, the United States consumes about as much wood on a tonnage basis as the total for most other raw materials, such as steel, plastics, aluminum, other metals, and cements, combined. Because of this, society's ability to continue to provide for the amenity side of the conservation spectrum will in no small part depend upon how much attention is paid to the commodity side as well.

As human population increases and demands on natural resources grow, the challenge for society and its land managers is to find ways to realize both commodity products and amenity values from the same area of forest. This increasingly must become the dual focus for the concept of land stewardship and forest sustainability.

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MacCleery worked in northern California for 7 years as a field forester for the USDA–Forest Service on the Tahoe and Shasta-Trinity National Forests. In this job he assisted in the multiple purpose management of the national forests for timber production, recreation, wildlife management, livestock grazing, and watershed production.

He then left the Forest Service for experience in the private sector, taking a position as a forest policy analyst for the National Forest Products Association in Washington, D.C.

Between 1981 and 1987, MacCleery was Deputy Assistant Secretary for Natural Resources and the Environment in the U.S. Department of Agriculture, a position in which he had oversight over the Forest Service and Soil Conservation Service.

In 1987 MacCleery returned to the Forest Service in Washington, D.C., most recently as the Timber Management Staff's Assistant Director for Forest Inventory and Planning.

For the past several years, MacCleery has been compiling a history of how U.S. forests have changed from pre-colonial times to the present. The focus is on how the relationship between humans and their forests has evolved over the years, on how the deteriorating forest and wildlife situation at the end of the 19th century led to the first national environmental movement, on the policies that emerged from that movement to address forest and wildlife depletion, and on how the forest and wildlife situation has changed since 1900 in response to those policies and to other factors.

The idea behind the history, which focuses on forests, agriculture, and wildlife, is that informed choices about the future of our forests and wildlife should be based in part on knowledge of how they came to be what they are today.

Contents