

Chapter 7: Indicators of the Condition and Use of Forests

What makes a forest a forest is, obviously, the presence of trees: the giant redwoods of the West Coast; the maples, oaks, and hickories that give New England its flaming fall foliage; the trackless wilderness of interior Alaska; even the Pine Barrens of New Jersey—all these fit into the picture conjured up by the word “forest.” But forests also include the coastal live oak woodlands of California, the cypress swamps and savannahs of the South, and the pinyon–juniper woodlands of the arid Southwest. Highly managed timberlands are also forests. Many of these “forest” types overlap with, or even occupy the same space as, other ecosystem types (wetlands, grasslands and shrublands, farmlands, urban and suburban areas). These varied forest lands provide Americans with timber and other wood products, but they also offer the opportunity for solitude, hunting, hiking, birdwatching, and camping.

What can we say about the conditions and use of U.S. forests?

Fifteen indicators describe the condition and use of forests in the United States. Partial or complete data are available for eleven of these fifteen indicators; data are available for a higher percentage of forest indicators than for any other ecosystem. Seven indicators have a data record that is long enough to judge trends, and for one there is a regulatory standard for comparison. For four indicators, data are not adequate for national reporting. Nine of the eleven indicators for which data are available are presented by region, allowing comparison of conditions in different regions.

After the following brief summaries of the findings and data availability for each indicator, the remainder of this chapter consists of the indicators themselves. Each indicator page offers a graphic representation of the available data, defines the indicator and explains why it is important, and describes either the available data or the gaps in those data.

System Dimensions

Three of the four indicators of forest system dimensions track forest acreage, each in a different way. These are total forest acreage, including the split between public and private ownership; the acreage of about 20 major forest types, each of which provides habitat for a different mix of plants and animals; and the percentage of forest under various management regimes, from planted timberland to national parks and wilderness areas, where timber harvesting is prohibited. Both the type of forest and the degree to which the forest is broken into smaller patches and intermingled with nonforest areas are important for many forest species, so the fourth indicator reports the percentage of forest surrounded by small, medium, and large expanses of more-or-less complete forest cover.

- **How much forest land is there in the United States? How much is privately owned, and how much is publicly owned?** Forests cover 747 million acres, or about a third of the land area of the United States, down from about 1 billion acres at the time of European settlement. The area of forest is divided about evenly between East and West, but most historic conversion of forest to other uses has taken place in the East. In recent decades, the overall acreage of forest has been relatively stable. In the East, more than 80% of forest lands are privately owned; in the West, about two-thirds are publicly owned.
- **How is the area occupied by major forest types changing?** Over the past several decades, the major forest types with the largest increases in acreage were oak–hickory and maple–beech–birch in the East, and fir–spruce in the West. Forest types declining in area included elm–ash–cottonwood and oak–gum–cypress in the East and hemlock–sitka spruce, ponderosa pine, and lodgepole pine in the

West. Over this period, overall forest area changed very little, so reductions in area occupied by one forest type were generally balanced by increases in area by other types.

- **How intensively managed are U.S. forest lands?** In 1997, 11% of western forests and 3% of eastern forests were in federal wilderness areas and national parks (reserved forest), while 10% of eastern forests and 4% of western forests resulted from replanting with seedlings in anticipation of future timber harvest. Nationwide, reserved forest land has doubled since 1953, to 14 million acres; during the same period, planted timberland increased tenfold, also to 14 million acres. Most forest lands in the United States—including those used for timber production—are neither national parks or wilderness areas nor planted forests.
- **How fragmented are U.S. forests?** One way to report on forest fragmentation pattern is to describe the degree to which any forested point is surrounded by land that is mostly forested (at least 90% forest cover). About two-thirds of all points in both eastern and western forests are surrounded by mostly forest cover within a radius of about 250 feet. About a quarter of all forest points have mostly forest cover within about a 2½-mile radius. Tracking this indicator over time will make it possible to distinguish between natural forest patterns and changes caused by human activity. In addition, methods available in the future may allow identification of smaller features (for example, forest roads and small clearings with houses) than can readily be mapped using the current satellite data that this indicator relies upon.

Chemical and Physical Conditions

Two indicators describe the chemical and physical condition of forests. We track nitrate in forest streams because elevated concentrations of this nutrient can be a sign of plants under stress or of increased inputs from sources such as atmospheric deposition and conversion of forest to other land use. We track carbon storage because carbon is the major building block of forest systems and because increased carbon storage in forests can offset emissions of carbon dioxide from burning fossil fuels.

- **How much nitrate is there in forest streams?** Almost all forest streams had nitrate concentrations below 1 part per million; more than half had concentrations below 0.1 part per million. The federal drinking water standard is 10 parts per million. No trend data are available, but streams in forested regions have the lowest nitrogen concentrations, farmland streams the highest.
- **How much carbon is stored in U.S. forests?** Increased carbon storage by forests and other ecosystems can offset emissions of carbon dioxide from the burning of fossil fuels, of concern because of climate change. The amount of carbon stored in trees on timberlands (a USDA Forest Service designation for areas with trees that grow fast enough to support timber harvests and on which harvest is not prohibited by law) has gone up steadily in the East and remained stable in the West. Data are not adequate for national reporting on carbon stored in roots, forest floor litter, and soil.

Biological Components

Six indicators describe the biological condition of the forests. One tracks the fraction of native forest species according to their relative risk of extinction. A related measure tracks changes in forest plant communities—specific plant groupings—whose area has declined by at least 70% since presettlement times. Because forests of different age structures provide different goods, services, and values, a third measure tallies the age distribution of forest trees. The remaining three indicators focus on several key forest disturbances. The first focuses on non-native plants, which can be ecologically disruptive; the second tracks acres of forest affected by fire, insects, and disease; and the third indicator will focus on fire frequency, a key determinant of forest composition, once adequate data become available.

- **What are the percentages of forest-dwelling species that are at different levels of risk of extinction?** About 9% of 1,700 native animal species that depend on forests are considered critically imperiled or imperiled, and about 1.5% of forest species may already be extinct. When “vulnerable” species are

counted, a total of 20% of forest species are considered to be at risk. Interpretation of these data will be greatly enhanced when it is possible to present information on population trends for these species.

- **What percentage of the plant cover in forests is not native to the region?** Non-native plants can crowd out native plants and may provide poorer quality habitat for wildlife. Data are not adequate for national reporting on the amount of non-native cover in forests.
- **How much of the nation's forests is young, middle-aged, or old?** Data are currently available only for timberlands, a USDA Forest Service designation for areas with trees that grow fast enough to support timber harvests and on which harvest is not prohibited by law. Sixty-five percent of eastern timberlands are less than 60 years old, and 90% are less than 100 years old. About 35% of western timberlands are more than 100 years old. No trend data are available. Forest age is affected by historical and management factors, as well as by the difference in life spans of different species.
- **How many acres are affected each year by fires, insects, and tree disease?** Since 1980, between 2 million and 7 million acres were burned by wildfire per year, down from a high of 52 million acres in 1930 (note that these figures include some grassland and shrubland fire acreage). Insect damage decreased overall from 1979 to 1999, but there are dramatic year-to-year variations (over these two decades, damage ranged from 8 million acres to 46 million acres).
- **Are forest fires burning much more or less frequently than in presettlement times?** The frequency with which forests burn is an important factor in shaping the composition of the forest. Data are not adequate for national reporting on this indicator.
- **How much area is occupied by forest types that have declined in area significantly since presettlement times?** Are these forest types increasing or decreasing in area now? Many forest community types now occupy a small fraction of their former area. Data are not adequate for national reporting on this indicator.

Human Use

Two of the indicators of human use of forests focus on timber: the first tracks timber harvest and the products into which it is made (for example, sawlogs or pulpwood). The second reports whether each year's harvest is greater or less than that year's growth. A third measure focuses on recreational use of forests.

- **How much timber is harvested each year, and what is it used for?** Nationally, timber harvest grew by 40% from 1952 to 1996. There was slow, steady growth through 1976, followed by a sharp increase from 1976 to 1986, and a subsequent decline. Pulpwood and sawlogs account for more than half of all harvest; other uses include fuelwood and veneer logs.
- **How much timber grows each year, compared to the amount that is cut?** Growth exceeds harvest on both public and private timberlands in the East and West; this has been true for most of the past 50 years. In 1997, growth was higher than it was in the 1950s on all categories of land, although growth on eastern forest lands (both public and private) was lower than it was at its peak in the 1970s. Nationally, almost 90% of harvest occurs on private lands.
- **How much recreational activity takes place in the nation's forests?** People use forest lands for hunting, fishing, hiking, skiing, and many other recreational activities. Data are not adequate for national reporting on this indicator.

What do we mean by "forests"?

Many of the data reported here are based on the USDA Forest Service definition of forest: any lands at least 10% covered by trees of any size, at least one acre in extent. This includes both heavily treed areas and areas where trees are intermingled with other cover, such as the chaparral and pinyon-juniper areas of the Southwest. This definition includes both naturally regenerating forests and areas planted for future harvest (plantations or "tree farms")—that is, areas that may not have mature trees now, but that will in the future, are classified as forest.



This definition overlaps to some degree with the definition of “grasslands and shrublands” in this report, largely because some areas share characteristics of both forests and grasslands and shrublands. For example, the Forest Service classifies pinyon–juniper and chaparral as forest; in this report, these lands are considered “grasslands and shrublands” as well.

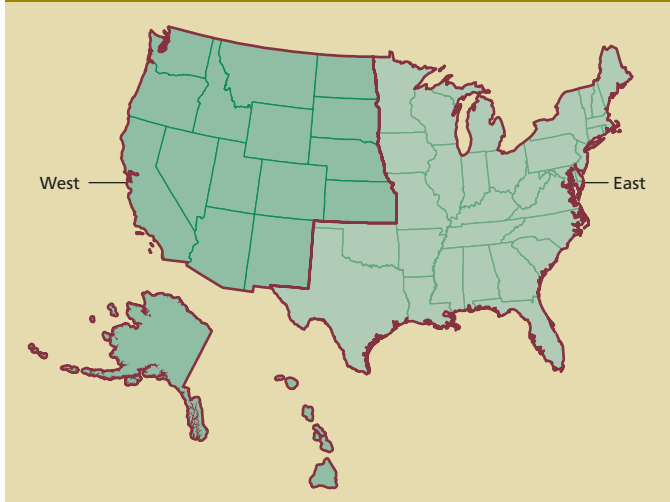
Other approaches to defining and delineating forests, which did not meet our needs, include restricting the definition to “closed canopy” areas—this would eliminate consideration of woodland areas with less complete tree cover, such as chaparral and pinyon–juniper—and excluding areas that are stocked with nursery seedlings for later harvest.

Forest Service estimates reported here are part of an extensive monitoring program that provides information on many aspects of forest extent, use, and condition, and the program’s breadth of coverage, historical trends, and internal consistency are quite useful. However, since this program does not produce comparable information about other ecosystem types (grasslands and shrublands, farmlands, etc.), the data cannot be used for reporting on ecosystem extent and change nationwide.

One method that does produce consistent nationwide estimates of ecosystem extent uses satellite remote sensing information (see Map 4.2, p. 40). For forests, the remote sensing method produces estimates that are about 55 million acres (9%) lower than the Forest Service estimates reported in this

chapter. Differences between the methods include the scale of measurement (the satellite data include areas as small as about 100 feet on a side, or just over one-fifth of an acre) and the fact that the Forest Service approach considers as forest any areas that *will* become or return to forest cover—including areas on which timber harvest has occurred and that are either replanted or are being reseeded naturally, even if they are currently covered with grass, shrubs, or other nonwoody vegetation.

Map 7.1. Eastern and Western Regions, Used for the Majority of Indicators in this Chapter



A Note about Regions

The eastern and western regions used to present data on eight of the indicators in this chapter (Map 7.1) are aggregates of the USDA Forest Service regional structure and mirror the distribution of forest lands in the United States, which is interrupted by the major expanse of farmland and grassland and shrubland that occupies the Midwest and the Great Plains. This approach was selected to enable the report to focus on very broad regional trends. Data from Alaska, when available, are included in the western region.

Map 7.2. Regional Boundaries for the At-Risk Species Indicator, p. 124



One indicator (At-Risk Species) is presented on the basis of seven regions (see Map 7.2), consistent with the data presented in other at-risk species indicators (pp. 52, 144, and 168).