Forests

Forest Area and Ownership

The Data

Data Collection Methodology: The USDA Forest Service's Forest Inventory and Analysis (FIA) program authority is mandated under the Forest and Rangeland Renewable Resources Research Act of 1978 (PL 95–307). Since the late 1940s, FIA has used a two-phase sample (generally, double sampling for stratification) to collect information on the nation's forests. Phase one establishes a large number of samples (more than 4 million, roughly every 0.6 miles). These are selected using aerial photographs or other remote-sensing images, which are then interpreted for various forest attributes. Phase two establishes a subset of approximately 450,000 phase-one points (roughly every 3 miles) for ground sampling. About 125,000 of these samples are permanently established on forest land. The forest characteristics measured include ownership, protection status, species composition, stand age and structure, tree growth, occurrences of mortality and removals, tree biomass, incidences of pathogens, natural and human-caused disturbances, and soil descriptors.

Forest land is any land that is at least 10% stocked by forest trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. The minimum area for classification of forest land is 1 acre. For the forest area and ownership indicator, public forests include those owned by federal, state, and local governments, as well as other public entities such as the Tennessee Valley Authority. Private lands include those owned by individuals, corporations, nongovernmental organizations, and tribes. The Forest Service's FIA program derived estimates of historic forest area from a wide variety of sources. For example, the sources included forest-clearing data collected during the 1870 and later decennial censuses, limited state and regional surveys, and the expert opinion of resource professionals.

Data Manipulation: Raw data from the 125,000 field samples are processed and merged with information from the remote-sensing phase of the sampling procedure to provide statistically reliable estimates of area and ownership.

Data Quality/Caveats: FIA surveys provide forest area data with a reliability of ±3–10% per 1 million acres (67% confidence limit). This standard applies to all data reported for 1953 and later. Regional totals generally have errors of less than ±2%. No error estimate is provided for data from before 1953. Note also that data collected before 1953 come from a wide variety of sources (see above).

Data Access: All data are available free of charge except for products that require special processing or shipping fees. Electronic databases are unavailable at the national level prior to 1987, and most regional data from before 1977 are not available electronically. Forest statistics, online databases, and a map of U.S. forest distributions are on the Web at http://fia.fs.fed.us. The data provided here also are available in Smith et al. (2001).

References

Smith, W.B., J. Vissage,D. Darr, and R. Sheffield. 2001. Forest statistics of the United States, 1997. Gen. Tech. Rep. NC-219. St. Paul, MN: U.S. Department of Agriculture, Forest Service. 191p.

Forest Types

Please see the technical note for Forest Area and Ownership (see p. 239), which also serves as the technical note for the Forest Types indicator.

Forest Management Categories

The Data

The data for this indicator were collected by the Forest Service's Forest Inventory and Analysis (FIA) program, which is described in the technical note for Forest Area and Ownership (p. 239). These data do not include information on private lands that are legally reserved from harvest, such as lands held by private groups like The Nature Conservancy. In addition, many "natural" and "semi-natural" lands are at times reserved from harvest because of administrative or other restrictions.

We hope that, in future reports, it will be possible to report on the existence of protected or reserved areas on a broader range of land ownerships. One dataset being developed for this purpose will report the acreage of lands according to a system of categorizing management intensity developed by the U.S. Geological Survey Gap Analysis Program (see http://www.gap.uidaho.edu/handbook/Stewardship/default.htm). This database is currently under development by the Conservation Biology Institute in conjunction with the USDA Forest Service; see http://www.consbio.org/cbi/what/pad.htm.

Note that "interior Alaska" includes all forests except the Southeast Coast area up to and including the Kenai Peninsula. Thus, "interior" includes areas that may not be thought of as part of Alaska's interior, yet they are included because of their remoteness. The acreage shown here for interior Alaska (about 113 million acres) does not include the Tongas National Forest (about 12 million acres). Note also that there is an apparent drop in interior Alaska acres in 1997; however, the 2-million-acre decrease came about from a reclassification, not a true loss of forest.

Forest Pattern and Fragmentation

The Indicator

As a means of illustrating the amount of forest providing different degrees of distance from non-forest cover, this indicator provides information on the percentage of forest surrounded by small, medium, and larger "neighborhoods" (defined below) containing at least 90% forest.

The "percentage of forest" that meets a certain set of criteria is calculated by determining what fraction of "pixels" (squares of forest 30 meters, or about 100 feet, on a side) is in the center of a "window" that meets the criteria. Thus, the percentage of forest that has 90% or more forest cover within a radius of about 250 feet (the "immediate neighborhood," about 5 acres) is determined by counting the number of pixels that are in the center of a 5-acre window that contains at least 90% forest.

The Data

Data Source/Collection Methodology: Data for this indicator were prepared by Kurt Riitters, USDA Forest Service (see http://www.srs.fs.fed.us/4803/landscapes/). The data are based on the National Land Cover Dataset, which is described in more detail in the technical note for the national extent indicator, p. 207). This is a 30-meter resolution remote-sensing-based dataset that provides, among other things, forest/non-forest cover information for the lower 48 states. The unit of data is the pixel, which is a square approximately 30 meters on a side.

Data Manipulation: The data presented here are from a "moving window" analysis. In this approach, the algorithm describes many successive, overlapping "windows" of a certain size, making it possible to characterize the area surrounding each individual forest pixel, in addition to knowing its forest/non-forest status. As the window "moves" across the dataset, each pixel is used as the center of a window; thus, it is possible to determine how many forest pixels are surrounded by different amounts of forest.

Five window sizes were used for this analysis but only three are reported here. The three reported sizes are 2.25 hectares, referred to here as the "immediate neighborhood," 5 acres, or "within a radius of about 250 feet"; 65.61 hectares, referred to here as the "local neighborhood," 160 acres, or "with a radius of about one-quarter mile"; and 5314. 41 hectares, referred to here as the "larger neighborhood," 13,000 acres, or "within a radius of about one and a half miles." These sizes correspond to 25 pixels (a square of 5 x 5 pixels); 729 pixels (a square of 27 x 27 pixels) and 59,049 pixels (a square of 243 x 243 pixels). The other two window sizes were 7.29 hectares and 590.5 hectares. (Note: This analysis uses a square window, since each remote sensing pixel is square. Thus, the page text description of the "radius" of the "neighborhood" is an approximation to make the presentation clearer to a non-technical audience, and is written as if the window were round.)

The analysis on which the data presented here was based determines, for each pixel and window size, whether it is surrounded by at least 60% forest, at least 90% forest, or exactly 100% forest. For this report, the 90% criterion was chosen. The 90% criteri-

Table 3. Degrees of Forest Cover for Different "Window" Sizes

Window area (hectares)	West			East			East & West		
	% core	% interior	% connected	% core	% interior	% connected	% core	% interior	% connected
2.3	51.0	*64.1	85.4	59.0	*70.7	88.6	56.5	68.7	87.6
7.3	32.7	55.7	83.3	40.7	62.4	86.3	38.2	60.4	85.4
66	7.1	*44.0	78.5	11.1	*48.2	80.0	9.9	46.9	79.6
590	0.2	33.1	75.0	0.9	34.8	75.2	0.7	34.3	75.1
5310	0.0	*22.4	70.5	0.0	*25.1	72.6	0.0	24.2	71.9

on was selected based on considerations of data quality and previous experience with this analytical approach. The alternate interpretations, along with a detailed description of the methodology, are described in detail in K.H. Riitters et al. (submitted).

Table 3 presents the results of the full analysis, including all window sizes and all three degrees of forest cover. As in the original publication, the table uses the term “core” to refer to areas surrounded by 100% forest cover for the indicated window size, “interior” to refer to areas surrounded by at least 90% forest cover for the indicated window size, and “connected” for areas surrounded by at least 60% forest cover for the indicated window size. Data presented in the body of the report are indicated with an asterisk.

The satellite remote-sensing data presented here can, in theory, distinguish non-forest areas as small as 100 feet on a side (10,000 square feet) from adjacent forest pixels. In practice, the accuracy of doing this depends on the contrast between forest and non-forest land cover, which is, in general, quite good. In addition, geometry plays an important role in distinguishing non-forest land cover. For example, a clearing that fills several 100-foot by 100-foot pixels would probably be more easily detected than a winding road that may fill some pixels and only partially fill others.

For further reading on habitat fragmentation, see other related indicators in this document and also Noss and Csuti (1997) and Wilcove et al. (1986).

References

Noss, R.F., and B. Csuti. 1997. Habitat fragmentation, pp. 269–304. In G.K. Meffe and R.C. Carroll (eds.), Principles of conservation biology. Second edition. Sunderland, MA: Sinauer Associates.

Riitters, K.H., et al. Fragmentation of continental United States forests. Submitted to Ecosystems.

Wilcove, D.S., C.H. McLellan, and A.P. Dobson. 1986. Habitat fragmentation in the temperate zone, pp. 237–256. In M.E. Soulé (ed.), Conservation biology: The science of scarcity and diversity. Sunderland, MA: Sinauer Associates.

Nitrate in Forest Streams

See the technical note for Nitrate in Farmland Streams, p. 232.

Carbon Storage

The Indicator

Metric tons of carbon are measured for the following components: biomass (total live tree material above ground plus coarse roots—“trees” in the figure), soil (soil organic matter), and dead plant material and coarse woody debris on the forest floor (forest floor litter). The weight of organic materials in plants is approximately 50% carbon.

Determining the amount of carbon stored in a forest can change dramatically within a few days, such as following a fire or timber harvest. Such fluctuations are natural in most forests and do not provide a useful indication of forest condition. Carbon lost during long-term agricultural use of soils can be restored by reforestation. In fact, the steady increase of carbon stored in eastern forests is a reflection of the re-establishment of forests on abandoned agricultural lands.

Carbon storage does not necessarily end when harvest occurs. Some wood products are used in long-term applications such as housing. Other products (e.g., newspapers) may end up in landfills, thus storing carbon for long periods of time. Landfills also generate methane (a carbon-rich greenhouse gas), so they both store and release carbon.

The Data

Data Sources: The information presented here is from the USDA Forest Service Forest Inventory and Analysis (FIA) program (see p. 239) and is based on field estimates of the size of trees of various species, along with statistical models of the relationships between tree stem volume and the other components of carbon storage. Carbon contained in branches, leaves, the forest floor, and soil are estimated from, and are therefore less precise than, data for harvestable wood. Although extensive, the field measurements used as the basis for this indicator do not include national parks and wilderness areas or slower-growing forests. Expansion to these areas is currently planned.

Data Collection Methodology and Data Manipulation: Carbon storage is estimated by the FIA program using on-the-ground measurements of tree trunk size from many forest sites and statistical models that show the relationship between trunk size and the weight of branches, leaves, coarse roots (>0.1 inch in diameter), and forest floor litter. Such data are combined with estimates of forest land area obtained from aerial photographs and satellite imagery. Forest floor litter includes all dead organic matter above the mineral soil horizons, including litter, humus, small twigs, and coarse woody debris (branches and logs greater than 1.0 inches in diameter lying on the forest floor). Data for Alaska and Hawaii are not included in this data series. Note that there are 1.1 English tons per metric ton. In most international discussions, carbon storage is reported in metric tons.

Data Access: Data for 1950 through 1987 are from Birdsey (1996), and data for 1992 are from Birdsey and Heath (1995). Additional information about carbon storage in forests can be obtained at http://www.fs.fed.us/ne/global/research/carbon/forcarb.html.

The Data Gap

Data on soil carbon are scarce, and the influences of management activities on soil carbon are still poorly known. More intensive measurements of soil carbon are planned by both the Forest Service and the USDA Natural Resources Conservation Service (NRCS).

Some forests have not yet been fully inventoried, notably in parts of Alaska and for pinyon-juniper forests throughout the western United States. Where data were available, they were employed in the estimation process; where data were not available, assumptions were used. Data on these areas are now being collected and will be incorporated into future estimates.

Estimates of carbon storage in the soil and forest floor litter were developed using models based on data from specific forest ecosystem studies. There are no inventories specifically designed to estimate carbon storage over large regions in ecosystem components other than wood, although the Forest Service and the NRCS are currently testing protocols for measuring total carbon in a forest ecosystem. Measurement protocols for forest floor litter and soil carbon are being developed and are being implemented as funds become available.

The amount of product in landfills is based on studies conducted by the Forest Service Forest Products Laboratory and other sources. The Forest Service developed conversion factors to translate products in use and materials in landfills to carbon-equivalents. These conversion models account for all steps in the transformation of cut timber into products and through use to disposal. The models are run separately for each region of the United States and for different kinds of harvest (e.g., pulpwood, sawtimber). More information on these models can be found in Row and Phelps (1991).

References

Birdsey, R.A. 1996. Carbon storage for major forest types and regions in the conterminous United States, pp. 1–25. In R.N. Sampson and D. Hair (eds.), Forests and Global Change, Vol. 2: Forest Management Opportunities for Mitigating Carbon Emissions. Washington, DC: American Forests.

Birdsey, R.A., and L.S. Heath. 1995. Carbon changes in U.S. forests. In Joyce, L. A. (ed.), Productivity of America's forests and climate change. U.S. Department of Agriculture, Forest Service, General Technical Report RM-271, Rocky Mountain Forest and Range Experiment Station, Ft. Collins, CO.

Row, C., and Phelps, R.B. 1991. Carbon cycle impacts of future forest products utilization and recycling trends. In Agriculture in a world of change, Proceedings of Outlook '91, U.S. Department of Agriculture, Washington, DC.

At-Risk Native Forest Species

See the technical note for the core national at-risk species indicator (p. 214).

Non-native Plants

The Indicator

The term "non-native" generally refers to species found in the United States whose native range is outside North America. More recently, this term has also been applied to species that are native to North America, but which are now found outside their historic range. Other terms for non-native species include "alien," "non-indigenous," or "introduced." The term "invasive" is also applied to many non-native species; invasive species spread aggressively into areas occupied by native species. Clearly, not all non-native species are invasive; nor are all invasive species from outside North America.

This indicator will report total area covered by non-native species. In some cases, the total area covered by any single species may be relatively low, but total area covered by all non-natives may be larger.

A useful introduction to the issue of non-native species can be found in the Office of Technology Assessment publication *Harmful Non-Indigenous Species in the United States* (1993; http://www.wws.princeton.edu/~ota/disk1/1993/9325_n.html).

A more recent, policy-oriented view of non-native species issues can be found in the Congressional Research Service report *Harmful Non-Native Species: Issues for Congress* (1999; http://cnie.org/NLE/CRSreports/Biodiversity/biodv-26.cfm).

Two state-based surveys of the kinds of non-native species and their impacts and controls can be found at http://www.ct.nrcs.usda.gov/landscp/invasive/problems.htm (Connecticut) and http://www.mdflora.org/publications/invasives.htm (Maryland).

Forest Age

The Indicator

It is important to note that the age of a tree does not necessarily convey information about the size of the tree. Fast-growing species attain sizes comparable to much older trees of another species, and trees of the same species and age growing in different locations may be very different in size. In addition, processes such as forest fires and hurricanes can act to limit the age of trees in a region (e.g., hurricanes are more prominent in the eastern United States).

The Data

This indicator presents data for a subset of all forests in the United States—those defined by the USDA Forest Service as "timberlands." Timberlands is a designation that covers lands on which harvesting is not prohibited by law and which grow an average of 20 cubic feet of wood per acre per year. Thus, the data presented here do not include national parks and wilderness areas and other natural and semi-natural forestland not classified as timberlands and thus not included in previous inventories. As a result, these data describe nearly all eastern forests, but only about 40% of western forests. Data on slow-growing forests and those in parks and wilderness areas are being collected, but they are not yet available.

Data Source: Data for this indicator were collected by the USDA Forest Service Forest Inventory and Analysis (FIA) program, which is described in the Forest Area and Ownership technical note (p. 239).

Data Collection Methodology: The age of a stand of trees is a classification based on the mean age of trees with dominant or codominant crown positions in the stand. Dominant/codominant crowns are those tree crowns dominating or sharing space in the upper layer of the tree canopy. The age of these trees is generally determined using tree cores from which annual growth increments were counted.

Forest Disturbance: Fire, Insects, and Disease

The Data

Data Source: Data reported here are from the USDA Forest Service Forest Health Monitoring (FHM) program. FHM, a component of the Forest Service's Forest Health Protection program, is a national program designed to determine the status, changes, and trends in indicators of forest condition on an annual basis. The program uses data from ground plots and surveys, aerial surveys, and other data sources and develops analytical approaches. See http://www.na.fs.fed.us/spfo/fhm/index.htm.

Data on forest fire acreage in national forests (referenced in text) was included in the 1999 Heinz Center prototype for this report (Heinz, 1999), and is from the General Accounting Office (GAO, 1999).

Data on acreage affected by diseases/parasites were obtained from "Forest Insect and Disease Conditions in the United States" for the years 1999, 1998, and 1997 (available at http://www.fs.fed.us/foresthealth/annual_i_d_conditions/index.html). These reports provide data on recent (i.e., past 5 years) acreage affected by the five major insects reported here. Data on historical acreage affected by these insects were provided by the Forest Inventory and Analysis program.

Insect data are collected using aerial surveys, implemented using a nationally standardized program, addressing both public and private forests. Disease data are collected using ground surveys and are considered to be less reliable.

Forest fire data were provided by the USDA Forest Service National Forest System, but are not limited to national forests. These data do not presently distinguish between forest fires and fires on other land cover types.

References:

GAO. 1999. Western National Forests: Nearby communities are increasing threatened by catastrophic wildfires. United States General Accounting Office. GAO/T-RCED-99-79.

The Heinz Center. 1999. Designing a Report on the State of the Nation's Ecosystems: Selected Measurements for Croplands, Forests, and Coasts & Oceans. The H. John Heinz III Center for Science, Economics and the Environment. Washington, D.C. http://www.heinzctr.org/publications.htm.

Fire Frequency

Note: This serves as the technical note for the Grassland/Shrubland fire frequency indicator.

The Data

The USDA Forest Service has an active program of research into fire and fuels management, including development of tools for assessing fire risk due to changes in fire frequency. In particular, the Fire Regimes for Fuels Management and Fire Use project, which began in 1997, involves mapping and characterization of presettlement natural fire regimes and current vegetation conditions and development of an index of departure for use in national-level fire management planning.

As part of this program, the Forest Service has developed estimates of presettlement fire frequency, using biophysical information, preexisting remote-sensing products, and expert knowledge about disturbance and successional processes and developed stylized successional pathways for unique combinations of presettlement fire regime and potential natural vegetation. These estimates can be found at http://www.fs.fed.us/fire/fuelman/firereg.htm.

Additional information on this procedure may be found in Schmidt et al. (in press).

However, current fire return intervals, based on tree ring scars and similar site measurements, have not been determined for the majority of the United States. The research project described above has developed estimates of fire return intervals by inference from existing vegetation. Essentially this involves assumptions about the fire return interval required to permit a certain vegetation type to develop. While these are valuable estimates, they are based on a significant amount of expert knowledge and modeling, rather than being relatively direct measurements of fire return frequency, and thus were not appropriate for inclusion in this report.

References

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Swanson, F.J., J.A. Jones, D.O. Wallin, and J.H. Cissel. 1993. Natural variability—implications for ecosystem management. In M.E. Jensen and P.S. Bourgeron (eds.), Eastside Forest Ecosystem Health Assessment. Vol. II: Ecosystem management: Principles and applications. Portland OR: U.S. Forest Service.

Wallin, D.O., F.J. Swanson, and B. Marks. 1994. Landscape pattern response to changes in pattern generalization rules: Land use legacies in forestry. Ecological Applications 4:569–580.

Forest Community Types with Significantly Reduced Area

The Indicator

Rarity of species and ecosystems is a common conservation criterion, but in measuring risk, rarity may be less relevant than extent of historical decline or potential for further decline. Many rare species and communities have apparently always been rare and may not be highly vulnerable to extinction. On the other hand, a major decline in a once-dominant or widespread species or ecosystem type may have ecological consequences far more severe than the loss of the last few individuals of a chronically rare species or the loss of a plant community that never covered more than a small area.

This indicator will be based on an identification of forest community types that occupy at least 70% fewer acres than at presettlement. Note that the "forest community types" described in this indicator are more specific than the groupings described in Forest Types, p. 118. The "forest types" reported in that indicator are broad classifications, each of which would include many "forest community types."

The indicator will report the number of these community types and the present acreage of the suite of significantly reduced community types. It will also report the change in area of these community types from one reporting period to the next, allowing readers to understand whether reductions in the area of these already-reduced types is continuing or has been stopped or reversed.

Note that use of a presettlement baseline is not intended to imply that forest community types were "pristine" or completely unaffected by human activity. It is clear that Indians exerted influence over the presettlement landscape, although the extent of that influence is currently under debate and is likely to have differed by region. The use of a presettlement baseline is also not intended to serve as a goal for action or policy. It is rather intended as a relatively long-term reference point, against which to compare current conditions.

A recent review of threats to imperiled species in the United States found that 85% of all imperiled species were threatened by habitat degradation or loss (including 92% of vertebrates, 87% of invertebrates, and 81% of plants) (Wilcove et al. 1998). A separate study tallied species that were listed or were candidates for listing under the Endangered Species Act (ESA) for three major endangered ecosystems. As an example, in 1993 the longleaf pine–wiregrass ecosystem, which has declined by nearly 99% since presettlement times, contained 27 ESA-listed species and 99 species that were candidates or proposed for listing under ESA (Noss et al. 1995).

Forest community types for this indicator are defined at the “alliance” level of the National Vegetation Classification System (Grossman et al. 1998). An alliance is a group of plant associations that share a similar architecture and one or more diagnostic species, which are generally the dominants in the primary canopy. In some cases, aggregations of ecologically related alliances may be tracked. The alliance level of classification is roughly equivalent to “covertype” as defined by the Society of American Foresters.

Ecosystems can decline in area through outright conversion to another land cover or through gradual changes, like those that accompany fire suppression, which allows other species to take over a forest. For this indicator, as long as an area has the characteristics of a specific forest community type, it would be counted as part of that type. If, for example, significant vegetation changes occurred as a result of fire suppression, the forest may eventually be classified as a different type.

The Data Gap

The Association for Biodiversity Information and the USDA Forest Service Forest Inventory and Analysis (FIA) program are collaborating on development of methods that would allow estimation of the area of alliances (or in certain cases, aggregations of alliances) from existing FIA data. This would provide a recent historical perspective on changes in alliance area, and would allow the area of these community types to be tracked in the future.

Many scientists recognize the value of developing a national map of presettlement vegetation at the alliance or comparable level to provide a more quantitative basis for the assessment of forest cover change. A preliminary approach to this analysis could be done by crosswalking alliances to the Kuchler Potential Natural Vegetation types (Kuchler 1964). The Association for Biodiversity Information is seeking funding to complete this work.

Specific data in the indicator writeup are from sources as follows. Data on redwood acreage and Great Lakes pine forest are from Klopatek et al. 1979 and Powell et al. 1993. It is important to note that other estimates exist for the reduction in acreage of redwood (see Noss 1995) and Great Lakes pine forest (see Frelich 1995). Data on oak savanna are from Nuzzo 1986.

References

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Timber Harvest

The Indicator

Sawlogs are logs that are at least 8 feet long, with minimum defects or bends, and that are at least 6 inches in diameter (measured inside the bark) for softwoods and 8 inches for hardwoods. *Pulpwood* includes trees, chips, or logging residues used to produce wood pulp, from which products such as paper are made. *Fuelwood* is cut as a source of energy and is used primarily for residential firewood. *Veneer* logs are trees from which veneer is sliced for plywood and other veneer products. *Logging residues/other* describes parts of trees that are cut or otherwise killed in the harvesting process (e.g., for road building), but that are not removed to make products. *Other products* is a miscellaneous category of products from trees, including pilings, poles, shingles, and charcoal.

The Data

The data presented in this indicator are not directly comparable with the data presented in the growth and harvest indicator, because that indicator reports only the volume of “growing stock,” an inventory category that excludes certain trees and parts of trees.

Data Source: Data on forest products and their source were collected by the USDA Forest Service Forest Inventory and Analysis (FIA) program and the Forest Service Forest Products Laboratory, which also supplements these data with information from U.S. Department of Commerce published reports and industry trade association sources.

Data Collection Methodology: The FIA collects data through a large-scale field sampling program, described in the technical note on forest area and ownership (p. 239). Also included here are data from periodic Forest Service wood facility surveys, residential fuelwood surveys, studies of active logging operations, and field inventories of harvested trees.

Data Manipulation: FIA field data are used to estimate harvest distributions by ownership based on trees harvested for products. The Forest Service Forest Products Laboratory also conducts utilization studies on active logging operations to estimate wood usage for products and residues left in the woods. These data are merged with log receipt data from wood-using facilities to produce estimates of timber and other material cut to deliver those logs to the facility. Ancillary data from the Department of Commerce on wood use and industry association data are used to validate information on the volume of trees cut annually to produce primary wood products such as sawlogs, pulpwood, veneer logs, fuelwood, and other wood products.

Data Quality /Caveats: Non-fuelwood product totals shown would generally have errors of less than ±10 percent. Data are from FIA wood facility surveys, which are full industry canvasses and are thus assumed to have negligible sampling error. Periodic residential fuelwood studies generally have errors of ±15%.

These data are not directly comparable with the data presented in the "Growth and Harvest" indicator, because that indicator reports only the volume of "growing stock," an inventory category that excludes "trees of poor form or quality and the upper central stem" (U.S. Department of Agriculture definition).

Data Access: All data are available free of charge, except for products that require special processing or shipping fees. Electronic databases are unavailable at the national level before 1987, and most regional data from before 1977 are not available electronically. Forest statistics, online databases, and a map of U.S. forest distributions are on the Web at http://fia.fs.fed.us. Forest Products Laboratory data synthesizing Department of Commerce and industry trade association data are available at http://www.fpl.fs.fed.us. Additional data on wood products use may be found at http://www.fpl.fs.fed.us/.

Timber Growth and Harvest

The Indicator

Definitions for the terms "growth," "harvest," and "timberlands," as used in this indicator, are those used by the USDA Forest Service. Growth is the net annual increase in the volume of living tree stems between inventories after accounting for effects of mortality but before accounting for the effects of harvest. Harvest is a measure of the average annual volume of living trees harvested between inventories. Timberland is the subset of forest land on which harvesting is not prohibited by law and potential wood growth rates are greater than 20 cubic feet per acre per year. Growth is a rough measure of the rate at which forests are converting solar energy into tree biomass. Comparing growth with harvest is a frequently used method of assessing whether wood harvesting is reducing the volume of tree biomass in a forest.

The Data

The data presented in this indicator are not directly comparable with the data presented in the timber harvest indicator, because the data presented here report only the volume of "growing stock," an inventory category that excludes certain trees and parts of trees (these data—defined below—are used for both the growth and harvest categories presented here). The harvest data presented in Timber Harvest (p. 130) encompass a broader suite of timber products, including "growing stock" and other harvested materials.

Data Source: Data for this indicator were collected under the USDA Forest Service Forest Inventory and Analysis (FIA) program, which is described on page 239. FIA data are from national compilations of periodic statewide survey data.

Data Quality/Caveats: The data for this indicator are limited to "growing stock" trees. Growing stock is a Forest Service inventory category that includes live trees of commercial species meeting specified standards of quality or vigor. When used in calculating volume, this category includes only trees 5.0 inches d.b.h. ("diameter at breast height" a common measurement of tree size) and larger, and which have no obvious characteristics that would make them unusable for industrial use (e.g., rot, unusual shape). In addition, volume is computed for the central stem from a 1-foot stump to a minimum 4-inch top diameter outside bark, or to the point where the central stem breaks into limbs. Noncommercial species are species that normally do not develop into trees suitable for industrial wood products. Since many forest products are made from trees and parts of trees that are not counted as "growing stock" for this indicator, the amounts and trends shown here may differ from those shown in the harvest and use indicator.

This indicator does not provide data on the species, age, quality, or other attributes of the trees being harvested or of trees whose growth is measured. General trends in growth and harvest in the East and West do not reflect some important trends that are occurring at smaller scales. Factors influencing trends in growth and removals vary substantially among and within regions. Subregions where growth/harvest ratios are similar today may have very different growth/harvest ratios in the future. In the West, growth/harvest ratio on timberland may be a poor indicator of change in forest biomass because timberland accounts for only 40% of total forest area in the region. These data exclude forest areas in parks and wilderness, where timber harvesting is prohibited, as well as slow-growing forests.

Current inventory practices limit the data shown here to the main trunk of trees of a certain size, shape, and species. Therefore, the data presented are not directly comparable with the figures presented for Timber Harvest and Use, which account for products made from all parts of all species of trees.

Because this indicator does not include information on growth in slow-growing forests and those in parks and wilderness, which make up 60% of western forests, it may not reflect significant changes in forest growth in that region.

Data Access: see the technical note for Forest Area and Ownership (p. 239); additional data for this indicator were taken from the publications listed in the references.

References

USDA Forest Service. 1958. Timber resource for America's future. Forest Resource Report No. 14. Washington, DC.

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Recreation in Forests

There is no technical note for this indicator.