UNITED STATES
2003 Report on Sustainable Forests

DATA REPORT

Criterion 1
Indicators 1, 2, 3, 4
CONSERVATION OF BIOLOGICAL DIVERSITY

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GENERAL OVERVIEW OF U.S. FORESTS

Forests in the United States have developed in response to climate, physiography, geology, soils, water, and human intervention. Human influences include presettlement impacts of Native Americans, agricultural clearing during the 19th century, timber harvest, reservoir construction, fire suppression, and encroachment of urban areas into forests. Prior to European settlement, forests covered the eastern one-third of the Nation giving way to prairies west of the Mississippi River and then deserts. Further west, in mountainous areas and along the Pacific Coast, forests were again abundant. The pre-European settlement forest covered more than 1 billion acres or about one-half the land area of what is now the United States. Native Americans and fire, both natural and human caused, as well as other sources of disturbance strongly influenced presettlement forests. The following provides a brief overview of U.S. forests and their climatic and ecological context for various geographic regions. These historic regions are based on a combination of common resource characteristics and political boundaries (figure 1-1). The following general descriptions of these regions and their ecosystems are based on Bailey (1996).

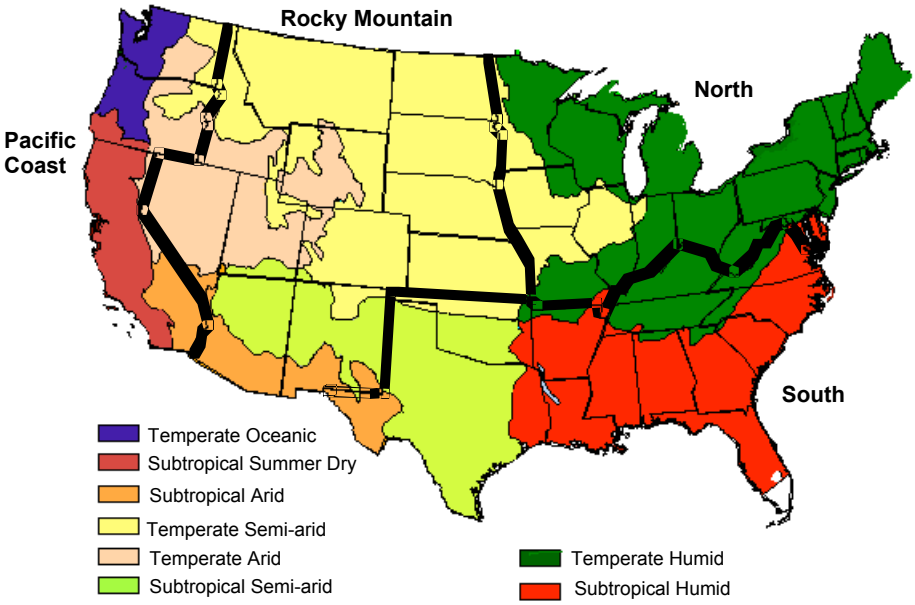

Figure 1-1. – Major geographic reporting and ecological regions of the United States

North Region—*Maine west to Minnesota, south to Maryland and west to Missouri*
The North is predominantly in a temperate humid climate zone with forests comprised of broadleaf and conifer tree species. Conifer and mixed broadleaf-conifer forest extends along the length of the northern parts of the region. The spruce-fir and white-red-jack pine forests are scattered throughout the northern latitudes of the region. Aspen-birch forests are found in the upper Midwest. The mid and southern latitudes of this region are dominated by oak-hickory and maple-beech-birch forests on the uplands and elm-ash-cottonwood forests in the bottomlands.

South Region–*Virginia west to Oklahoma and Texas, south to the Gulf of Mexico*
The South is predominantly in a subtropical humid climate zone with prevalent pine and oak-pine forests. Loblolly, longleaf, and slash pine forests are most common in the Piedmont and Coastal Plain areas while shortleaf pine ranges further into the interior South. Oak-pine forests are most common on drier upland sites at the northern and western fringes of the South. Oak-hickory forests are the most extensive forest cover in the region and occupy the upland areas of the interior South. Oak-gum-cypress forests are extensive in the low coastal areas of the South.

Rocky Mountain Region—*Great Plains west to Cascade and Sierra Nevada mountains, ranging from the countries of Canada to the north and Mexico to the south*
This region's climate ranges from temperate to subtropical with moisture ranging from semiarid to arid. The landscape flows from prairies in the east to mountains and plateaus separated by wide valleys in the west and deserts in the Southwest. Trees are scarce in the eastern prairies giving way to pinyon-juniper forests and woodlands in the mid and south central portions of the region. Conifer forests dominate this region. Ponderosa pine is generally the first type to be found above valley floors with Douglas-fir at elevations directly above. At higher elevations, fir-spruce and lodgepole pine appear. Broadleaf forests, rare in this region, are generally found along streams or rivers with aspen and cottonwood as the dominant species. Bur oak is a common broadleaf species found in the eastern plains region.

Pacific Coast Region—*Cascade and Sierra Nevada mountains west to the Pacific Ocean, ranging from the countries of Canada to the north and Mexico to the south (see Hawaii below)*
The climate of this region is a mix of temperate oceanic along the north coast to Mediterranean in central and western California. The North Pacific coast is dominated by mountainous topography bordered by coastal plains. Altitude is critical to forest composition ranging from mild, humid coastal rain forests, predominantly conifers, containing Douglas-fir, hemlock-Sitka spruce, and redwood forests to cool boreal fir-spruce forests at higher elevations. To the south, the Mediterranean region of central and western California is characterized by evergreen shrubs, chaparral, patchy oak woodlands, ponderosa pine forests on the upper slopes, and Douglas fir and fir-spruce forests occur at higher elevations.

Alaska—Alaska's climate ranges from polar in the north to boreal in the central and western regions to temperate oceanic along the southeast coast. The polar climate is dominated by tundra giving way southward to extensive boreal forests consisting of close stands of spruce and fir interspersed with white birch and aspen. The temperate oceanic climatic region along the southeast coast zone receives abundant rainfall, has mountainous topography and forests are mainly hemlock-Sitka spruce with fir-spruce and lodgepole pine at higher elevations. Broadleaves, mainly aspen and birch, are found along streams and intermixed in the predominant conifer forests.

Hawaii and Puerto Rico—The small area of tropical humid climate in the United States is at low latitudes and is influenced largely by equatorial and tropical air masses. Hawaii, and Puerto Rico and extreme southern Florida support this regime. While southern Florida is dominated by wet savanna, Hawaii and Puerto Rico have evergreen and semideciduous forests of great diversity. For this report, Hawaii is included in the Pacific Coast region and Puerto Rico is generally excluded.

Indicator 1. Extent of area by forest type relative to total area

What is the indicator and why is it important?

Forest type is a coarse representation of land cover based on major trees species associations. As individual trees respond to change, which may be natural or human induced, forest composition and structure changes. Monitoring changes in the location and distribution of forest types is useful for resource managers and analysts interested in forest resources to track the sustainability and diversity of the forest cover of the Nation and their desired future condition.

Ecological processes and viable populations of species that are characteristic of forest ecosystems are dependent on a contiguous ecosystem or ecosystems of a certain minimum size. Each forest type is considered to represent a separate ecosystem and is itself composed of a variety of ecosystem structures and components. If sufficient area of each forest type is not maintained, these ecosystems become vulnerable to loss from fires, hurricanes or typhoons, disease, and other catastrophic disturbances. This indicator reports the current status and trends in forest area for the North, South, Rocky Mountain, Pacific Coast, and Alaska geographic regions.

What does the data show?

Since the early 1600's when European settlers arrived in what is now the United States, about 300 million acres of forest have been converted to other uses (figure 1-1). Most of the forest conversion, predominantly broadleaf forest cleared for agriculture, occurred in the North and South regions of the country between 1850 and 1900 (figure 2). For the last 100 years, total forest area in the United States has been relatively stable. Perhaps the most remarkable aspect of this stability is that during the last 100 years the population of the United States has more than doubled. In contrast, forest loss of nearly 200 million acres between 1850 and 1900 was in direct correlation to the increases in population primarily as a result of immigration of agrarian settlers.

Current forest area in the United States is 749 million acres or about one-third of the Nation's land area, compared to about 1 billion acres at the time of European settlement. Most of the forest loss (nearly 200 million acres) occurred in the East (North and South Regions) between 1850 and 1900, predominantly broadleaf forest cleared for agriculture. For the last 100 years total forest area has been relatively stable while the population of the United States has more than doubled. Today, conifer forests cover 412 million acres in the United States and are found predominantly in the West (315 million acres) and South (67 million acres). Broadleaf forests cover 273 million acres, predominantly in the North and South (223 million acres).

The overall stability of forest area in the United States makes interpretation of many indicators less complex. Changes or trends in indicators show the ebb and flow of natural successional shifts in the forest landscape as well as those caused by human intervention. These patterns, which differ regionally, combine to paint a rather stable picture in terms of total forest land area.

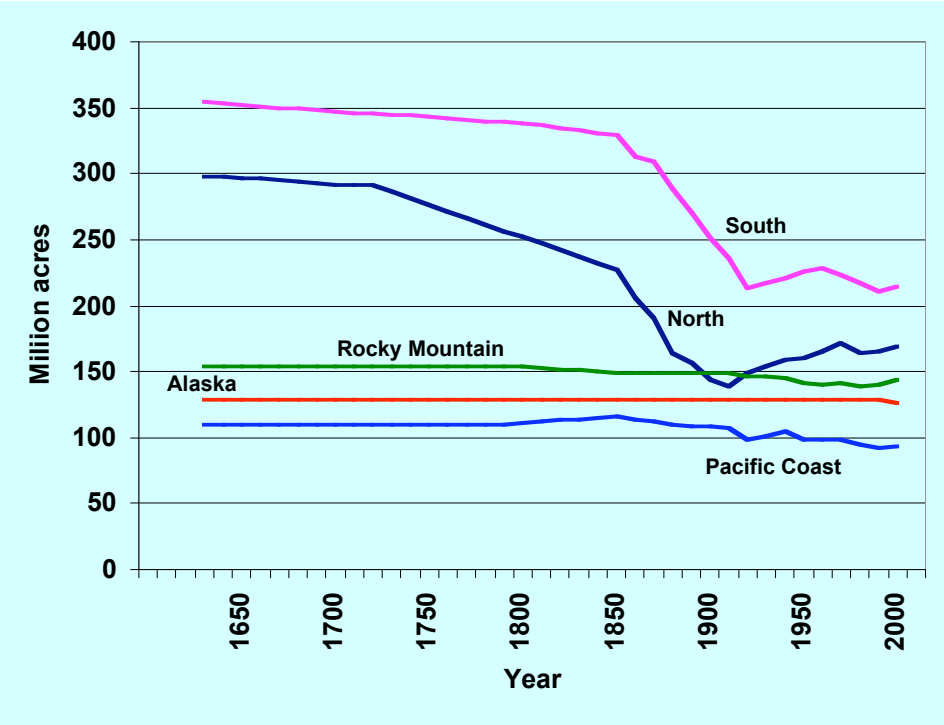

Figure 1-2. Historic forest area in the United States by geographic region, 1630–2002

Today, regional forest cover ranges from a low of 19 percent of the land area in the Rocky Mountain region (figure 1-3) to 45 percent in the Pacific Coast region, 41 percent in the North, 40 percent in the South, and 34 percent in Alaska.

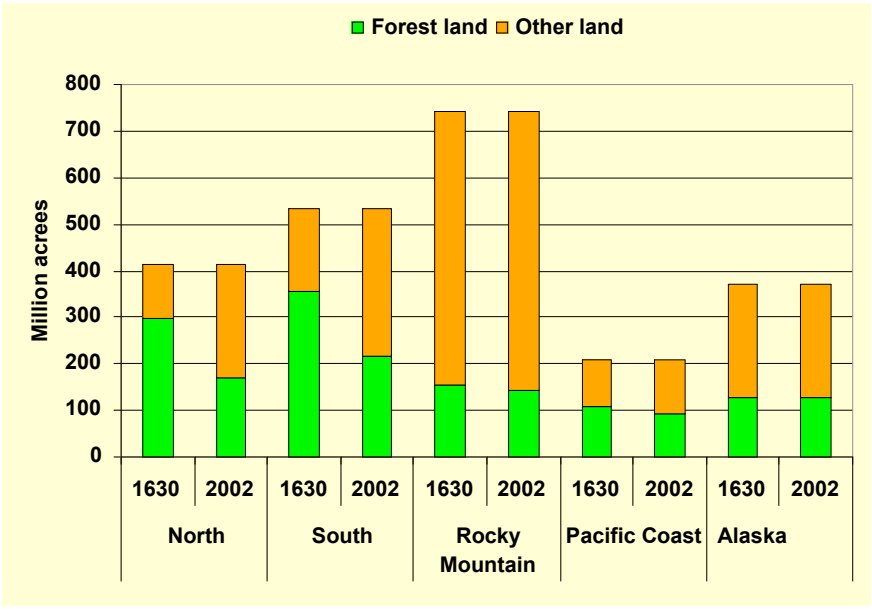

Figure 1-3. Area of forest and other land by geographic region, 1630 and 2002

The most significant changes are in the north and south, which were 72 and 66 percent forested at the time of European settlement around 1630.

The first broad association of forest type, generally used for global analysis is coniferous (also called evergreen or softwood), broadleaved (also called deciduous or hardwood), and mixed (figure 1-4).

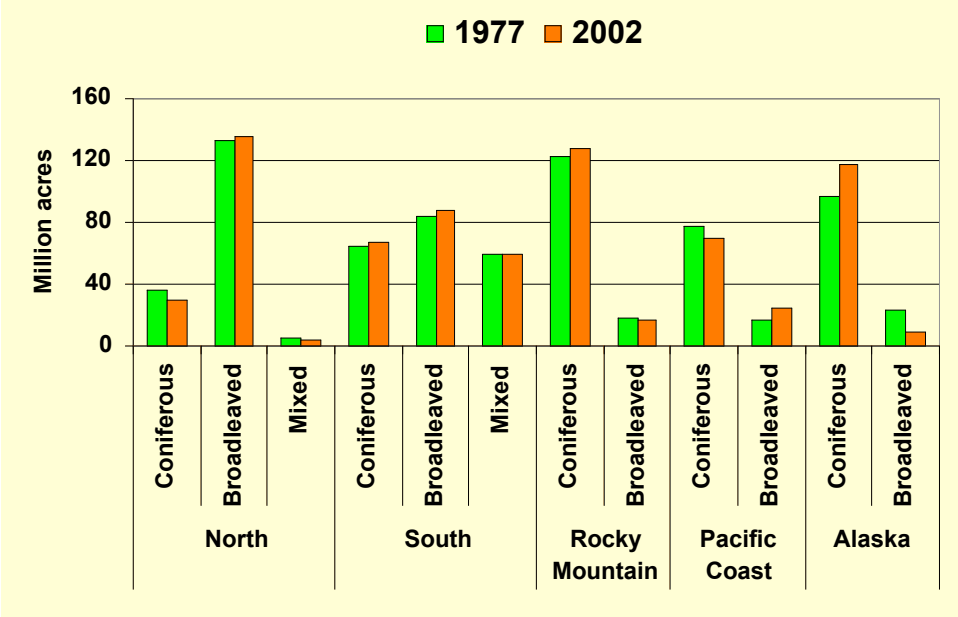

Figure 1-4. Area of forest land in the United States by major cover group, 1977 and 2002

There has been little shift in the area of forest by broad cover groups in the past 25 years. A notable shift does appear in Alaska. However, this is primarily the result of much of the historic and current data being based predominantly on remote sensing and has been subject to continued reclassification based on improved estimation procedures. Currently, field verification data are only available for the southeast and southwest coastal areas of Alaska that contain only about 20 percent of the State's forest land. Field inventories are now scheduled to begin in the interior in 2004, and they will greatly improve estimates of forest conditions and trends for this remote region.

For further analysis it is useful to break these broad forest types into more specific associations. The following discussion will break these three broad groups into 23 subgroups called SAF forest type groups (Eyre, 1980) by broad geographic region. A further break into 105 more detailed SAF covertypes is provided in the tables at the end of this indicator report. This expanded list of covertypes represents the current tree species associations identified during field data collection in the United States.

Caveats on forest covertype classification

The analysis of forest covertypes in this report use the Society of American Foresters (SAF) classification system, which is based on dominant tree species. In the long term, a more ecologically based system is being sought. The U.S. Department of Agriculture (USDA) Forest Service and NatureServe are currently involved in pilot projects to refine the National Vegetation Classification System (NVCS), which includes a more holistic suite of information including all vegetation and physiognomic factors to classify forest and other land covers. A preliminary NVCS system was adopted by the Federal Geographic Data Committee in October of 1997 (TNC, 1998) but it thus far lacks the necessary national consistency and measurement protocols to be effectively used in field inventories. The work underway to refine this system to an operational level is at least 2 years from completion. In the interim, the SAF system, which has been in common use for several decades in the forestry community, will be used for analysis. In general, at the major forest alliance level of conifer, broadleaf, and mixed forest types the two systems would likely yield similar classifications.

Forests of the North Region

Overall, the forests of the North (figure 1-5) have been relatively stable showing only a 3 percent decline (4.4 million acres) since 1977.

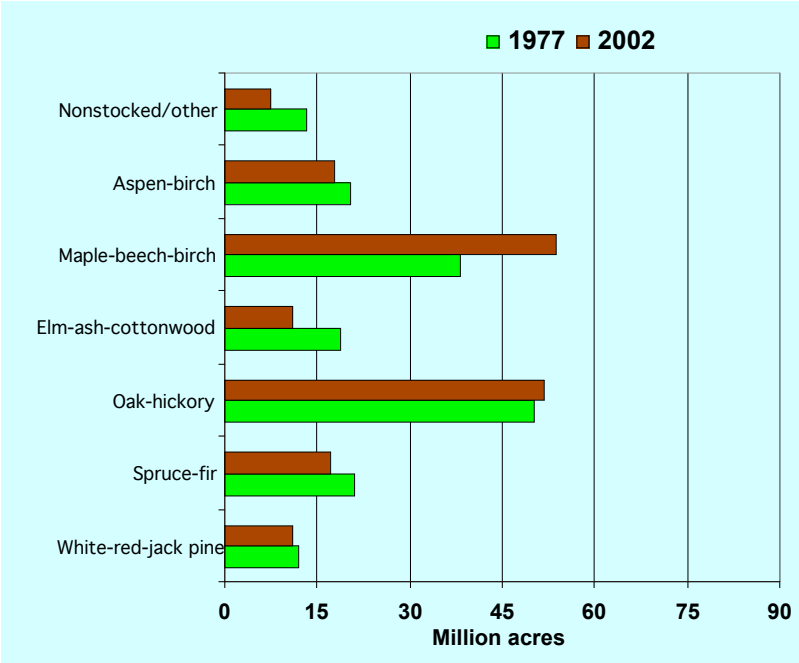

Figure 1-5. Trends in major forest covertypes in the North, 1977–2002

In the North, maple-beech-birch (*Acer/Fagus/Betula spp*.) at 53.8 million acres has increased 40 percent above its 1977 level of 38.3 million acres, surpassing Oak-hickory as the most dominant type in the region. Oak-hickory (*Quercus/Carya* spp.*)* forests encompass 51.9 million acres, an increase of 3 percent since 1977. Together these two mid-successional types account for nearly half of all northern forests. These gains have been accompanied by losses in early successional types, such as spruce-fir *(Abies* spp.*/Picea* spp.*)* down 19 percent (4 million acres) and aspen-birch *(Populus* spp.*/Betula* spp.*)* down 12 percent (2.5 million acres). Perhaps the most dramatic change in the region is the 40 percent loss (9 million acres) of elm-ash-cottonwood *(Ulmus* spp.*/Fraxinus* spp.*/Populus* spp.*)*. The reason for this loss is primarily agricultural conversion and flooding of lowlands for reservoirs. As a result of flood control projects, some of the drier sites have probably transitioned to maple-beech-birch.

Forests of the South Region

Overall, the forests of the South (figure 1-6) have been very resilient showing only a 3 percent increase (7.5 million acres) since 1977. In the South, oak-hickory (*Quercus/Carya* spp.*)* forests dominate the landscape at 80.3 million acres or 37 percent of all forest land. These forests have increased dramatically in the past 25 years, up 30 percent.

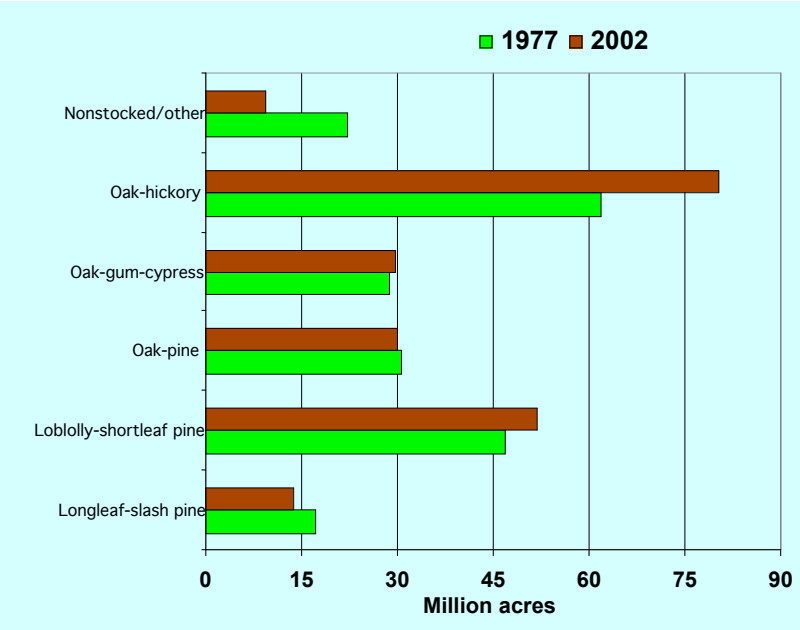

Figure 1-6. Trends in major forest covertypes in the South, 1977–2002

New technologies and increased demand for wood have placed new pressures on this once overlooked resource. The second most dominant type in the region is loblolly-shortleaf pine (*Pinus taeda* and *echinata*) 51.8 million acres (24 percent). The Conservation Reserve Program in the late 1980s and early 1990s increased pine acreage by nearly 3 million acres with loblolly pine being the largest benefactor. Reduced conifer harvesting in the West in the last decade has significantly increased demand for this resource for commercial products. Longleaf-slash pine forests (*Pinus palustris* and *elliotii*) at 13.6 million acres declined 3.5 million acres since 1977. These forests have declined steadily for nearly five decades as a result of fire suppression and conversion to the more commercially favored loblolly pine. Today, natural stands of longleaf pine occupy only 25 percent of the area present in 1953. Recent efforts have begun to reverse this trend as more emphasis has been placed on restoration of longleaf pine in the South. Plantation forestry is big in the South and plantations account for 47 percent of all pine forests in the region. Virtually all of the mixed forests of oak-pine (*Quercus/Pinus spp*.) and oak-gum-cypress (*Quercus/Nyssa/Taxodium spp*.) are found in the South with 59 of the 64 million acre total. While oak-gum-cypress is found in the wet lowlands of the South, oak-pine is usually found on drier uplands. The total area of both types has remained stable since 1977.

Forests of the Rocky Mountain Region

Overall, the forests of the Rocky Mountain Region (figure 1-7) have been stable, increasing by 3.2 million acres (2 percent) since 1977.

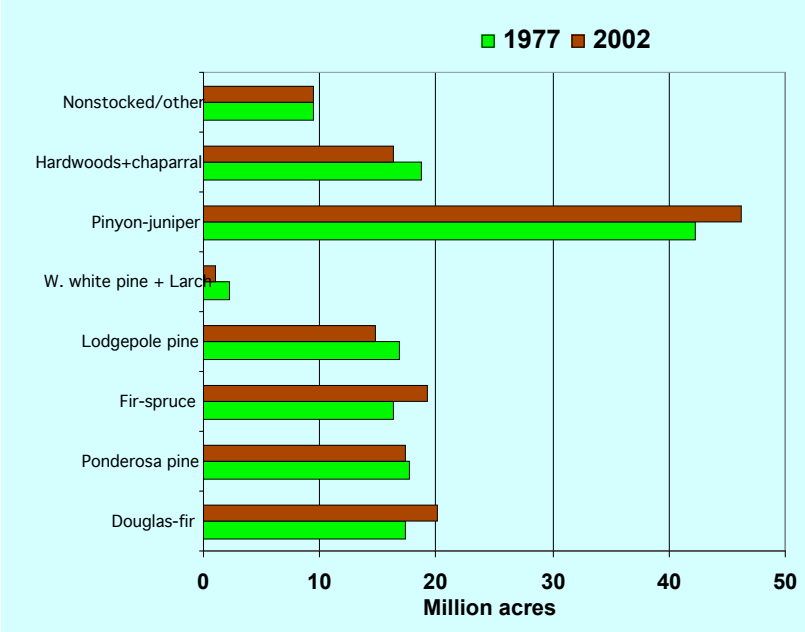

Figure 1-7. Trends in major forest covertypes in the Rocky Mountain Region, 1977–2002

Although they are minor types in the region, western white pine (*Pinus monticola*) and larch (*Larix* spp.*)* types lost a combined 43 percent of their acreage in the past 25 years marking the only significant covertype losses in the region. Other smaller percentage losses came in ponderosa (*Pinus ponderosa*) and lodgepole pine (*Pinus contorta*) types at 1 and 13 percent respectively. Much of this loss comes as a result of decades of fire suppression and transition of these types to other dominant covers, particularly fir-spruce (*Abies* spp.*/Picea* spp.*)* at the higher elevations and Douglas-fir (*Pseudotsuga menziesii*) at mid elevations. Fire suppression is also responsible for many forests of this region occurring where they were traditionally did not occur in the protected rills, gullies, and draws of the interior west. Juniper (*Juniperis* spp.) and scrub broadleaves being the major benefactors. Harvesting pressure is very low in this region as well, amounting to only about 25 percent of net growth over the past two decades. These forces, along with generally slow growth due to sparse rainfall, have combined to create a forest landscape that has not changed significantly in the past 25 years.

Forests of the Pacific Coast Region
Overall, the forests of the Pacific Coast Region (figure 1-8) have been stable, declined by 1.3 million acres (1 percent) since 1977.

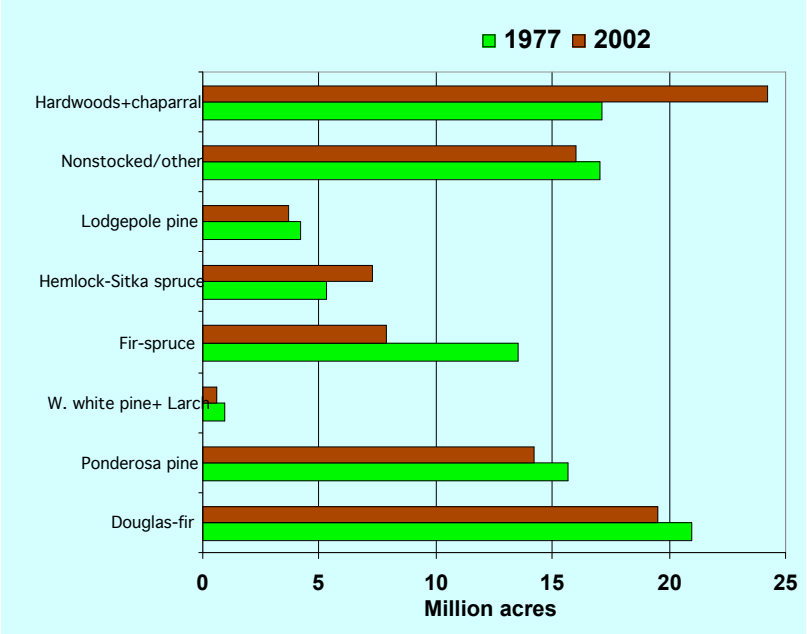

Figure 1-8. Trends in major forest covertypes in the Pacific Coast Region, 1977–2002

Like the Rocky Mountain Region, western white pine and larch with a total of 600 thousand acres are minor types but have lost ground to other covertypes, declining a combined 33 percent (300 thousand acres) since 1977. Douglas-fir currently accounting for 19.5 million acres and Ponderosa pine at 14.2 million acres declined 7 and 10 percent respectively. The most significant loss of a major type was fir-spruce that declined 41 percent from 13.5 to 7.9 million acres. Increases came in the hemlock-Sitka spruce type and the combined broadleaves and chaparral types.

Forests of the Alaska Region
Changes in Alaska are difficult to interpret clearly due to a lack of historic field data. In general, the area of western broadleaves declined between 1977 and 1997. Much of this change may be attributed to new field inventory data in southwest Alaska that reclassified areas that were thought to be trees on remote sensing but turned out to be tall shrubs during field verification. Other losses may have come from the loss of birch in mixed spruce-birch stands. The latter occurrence would also explain some of the increases in the other conifer type, which is predominantly a spruce-birch mixture. The area of hemlock-Sitka spruce has remained stable. Data for this type, which is found predominantly along the southeast coast, is the most reliable since historic field data are available for this region of Alaska. Much of the data for interior Alaska (approximately 100 million acres) is based on remote sensing estimates. Until more field data are available for the interior, the overall classification picture will remain murky for Alaska.

General Trends

Specific forest types or species associations reflect successional stages of a forest. As a general rule, immature forests contain trees that are less shade tolerant than mature forests. Thus one indicator of a maturing forest landscape is an increase in acreage of forests comprised of more shade tolerant species.

Generally, as eastern broadleaf forests mature, less tolerant species (i.e., aspen and birch) are naturally replaced by more tolerant ones (i.e., oaks, hickories, maples, firs) as critical light needed for regeneration on the forest floor is reduced. This is demonstrated by the increase in the area of forest types such as oak-hickory and maple-beech-birch (figure 1-4) that are more representative of later stages of succession and the decrease in the area of forest types that are more representative of earlier successional stages such as aspen-birch. And, without human intervention, the area of aspen-birch forest type and longleaf-slash pine will continue to decline. The loss of longleaf-slash pine is due primarily to decades of successful fire suppression. The sharp loss in elm-ash-cottonwood and oak-gum-cypress, found in lowland landscapes, is attributed to agricultural clearing, which has subsided in recent years. Overall forest acreage in the east has increased by about 1 percent over this period with urban and agricultural clearing losses being offset by reversion of nonforest areas and planting gains.

The predominant forces shaping forests in the West (Rocky Mountains and Pacific Coast regions) over the last 20 years are fire, fire suppression, grazing, and forest management activities. Pinyon-juniper, one of the most widely found forest types in the arid Rocky Mountain region, is increasing due to past grazing and lack of fire. Ponderosa pine area has remained stable over the past 20 years while area of Douglas-fir forests has increased by 8 percent (figure 1-5). Douglas-fir and ponderosa pine are the most frequently planted species in the west. Hemlock-Sitka spruce area has increased slightly. A large percentage of the Hemlock-Sitka spruce type is in parks and wilderness. Overall forest area in the west (excluding Alaska) declined by less than 1 percent over this period. Losses in larch and lodgepole pine offset by increases in western broadleaves and other conifers.

Plantation forests

Although included in the discussions above, it should be noted that an estimated 54 million acres of forests (7 percent of the total) in the United States were established through tree planting. More than 90 percent of all planted forests are conifer species. Not all forest that has been planted, however, are considered plantations. While most planted stands in the South are intensively managed for a single planted species, much of the planting in the West is for augmentation of natural stocking. These augmented stands are very difficult to detect with remote sensing or field inventories so data are incomplete. The discussion in Indicator 13 provides more detail.

Impacts of forest ownership

Forest ownership is not explicitly identified as an indicator in the Montreal process. But ownership patterns have implications that cut across all of the indicators, having a profound effect on forest management policies and activities and coloring the interpretation of forest sustainability. While forests of the North and South are predominantly in private ownership, the forests of the western regions are predominantly in public ownership (figure 1-6). Nearly 60 percent of all U.S. forests are

in private ownership. The diverse objectives of the nearly 10 million private individuals and 100's of corporations, partnerships, and private institutions (Birch, 1996) that own forest land will have a profound affect on how policies and trends found in this report are interpreted, and on how they might be implemented. While most of the Nation's timber production is concentrated on private forest land in the East, most of the Nation's protected forests are concentrated on public forest lands in the West.

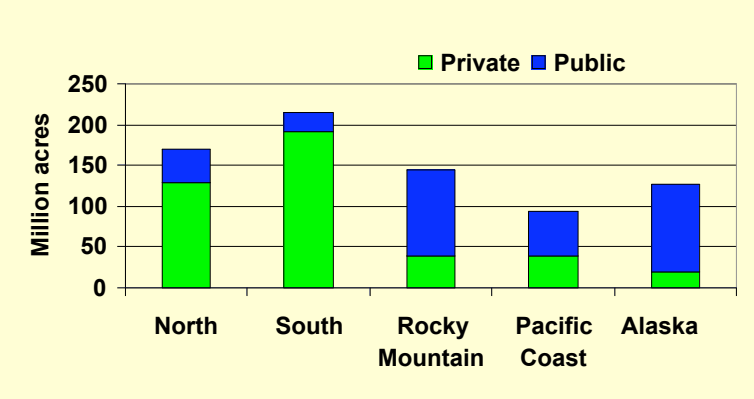

Figure 1-9. Forest land ownership in the United States by geographic region

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Table 1—Forest area in the United States[a] by region and subregion, 1630-2002

Year		United States	EAST TOTAL	EAST North	EAST South	WEST TOTAL	WEST Rocky Mountain	WEST Pacific Coast	Alaska
				Thousand acres					
2002		**748,743**	**384,289**	169,684	214,605	**364,454**	144,343	93,422	126,689
1997	b	**746,958**	**384,426**	170,326	214,100	**362,532**	143,244	91,908	127,380
1987	c	**737,815**	**376,648**	165,504	211,144	**361,167**	139,634	92,423	129,110
1977	d	**743,643**	**381,228**	164,185	217,043	**362,415**	138,176	95,129	129,110
1970	e	**763,511**	**395,050**	171,289	223,761	**368,461**	141,467	97,884	129,110
1963	f	**761,946**	**394,168**	165,747	228,421	**367,778**	140,356	98,312	129,110
1953	g	**756,177**	**386,835**	160,809	226,026	**369,342**	141,562	98,670	129,110
1938	h	**759,824**	**380,214**	158,890	221,324	**379,610**	145,276	105,224	129,110
1930	i	**747,595**	**371,013**	153,956	217,058	**376,582**	145,943	101,529	129,110
1920	j	**735,365**	**361,812**	149,021	212,791	**373,553**	146,610	97,833	129,110
1907	k	**759,150**	**374,428**	138,700	235,728	**384,722**	148,612	107,000	129,110
1900	m	**781,540**	**395,755**	144,143	251,612	**385,785**	148,612	108,063	129,110
1890	m	**812,554**	**425,786**	156,005	269,781	**386,768**	148,612	109,046	129,110
1880	m	**841,157**	**453,223**	164,489	288,734	**387,934**	148,612	110,212	129,110
1870	m	**890,504**	**499,980**	191,014	308,966	**390,524**	148,612	112,802	129,110
1860	m	**909,968**	**518,257**	205,617	312,640	**391,711**	148,612	113,989	129,110
1850	m	**949,573**	**556,087**	226,766	329,321	**393,486**	148,612	115,764	129,110
1630	n	**1,045,445**	**651,615**	297,595	354,020	**393,830**	154,490	110,230	129,110

a Estimates for 1938 includes forest area for regions that would become the States of Alaska and Hawaii. Estimates for 1907 includes forest area for regions that would become the States of Alaska, Arizona, Hawaii and New Mexico. Estimates for 1630 represent the forest area in North America for regions that would become the 50 States within the current United States.

Smith et al. 2001. Forest Resources of the United States, 1997. Gen. Tech Rep. NC-219. St. Paul, MN: USDA; Forest Service. 190p. Loss of forest area in Alaska form 1987 to 1997 due to reclassification after 1994 inventory of Southwest Alaska. Historic data not adjusted.

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k Kellogg, R.S. 1909. The Timber Supply of the United States . Forest Resource Circular No. 166. Wash., DC: USDA; Forest Service. 24p.

m Primack, Martin Leonard. 1922. Farm formed capital in American agriculture 1850 to 1910. Arno Press.

n Data for 1630 were also from Kellogg (1909) as an estimate of the original forest area based on the current estimate of forest and historic land clearing information. These data are provided here for general reference purposes only to convey the relative extent of the forest estate, in what is now the United States, at the time of European settlement.

Table 2. Forest area in the United States by SAF covertype and major geographic region, 2002

Forest type		North	South	Rocky Mountain	Pacific Coast	Alaska	TOTAL
				thousand acres			
WHITE-RED-JACK PINE	*Pinus strobus, resinosa, banksiana*	253	1,185	-	-	-	1,438
Jack pine	*Pinus banksiana*	1,628	-	-	-	-	1,628
Red pine	*Pinus resinosa*	2,319	6	-	-	-	2,326
White pine	*Pinus strobus*	3,403	493	-	-	-	3,896
White pine - hemlock	*Pinus strobus , Tsuga canadensis*	807	156	-	-	-	963
Hemlock	*Tsuga canadensis*	2,205	56	-	-	-	2,261
Scotch pine	*Pinus sylvestris*	333	15	4	-	-	351
SPRUCE-FIR	*Picea spp, Abies spp*	405	33	-	-	-	438
Balsam fir	*Abies balsamea*	4,128	5	-	-	-	4,133
Black spruce	*Picea mariana*	3,259	-	-	-	57,955	61,213
Red spruce - Balsam fir	*Picea rubens, Abies balsamea*	3,137	6	21	-	-	3,164
Northern white-cedar	*Thuja occidentalis*	4,047	-	-	-	-	4,047
Tamarack	*Larix laricina*	1,539	-	-	-	-	1,539
White spruce	*Picea glauca*	626	-	51	-	42,677	43,354
LONGLEAF-SLASH PINE	*Pinus palustris, P. elliottii*	-	69	-	-	-	69
Longleaf pine	*Pinus palustris*	-	2,917	-	-	-	2,917
Slash pine	*Pinus elliottii*	-	10,597	-	-	-	10,597
LOBLOLLY-SHORTLEAF PINE	*Pinus taeda, Pinus echinata*	-	173	-	-	-	173
Loblolly pine	*Pinus taeda*	294	40,919	-	-	-	41,213
Shortleaf pine	*Pinus echinata*	312	4,769	-	-	-	5,081
Virginia pine	*Pinus virginiana*	459	3,002	-	-	-	3,461
Sand pine	*Pinus clausa*	-	686	-	-	-	686
Eastern redcedar	*Juniperus virginiana*	472	991	84	-	-	1,546
Pond pine	*Pinus serotina*	-	929	-	-	-	929
Spruce pine	*Pinus glabra*	-	31	-	-	-	31
Pitch pine	*Pinus rigida*	634	217	-	-	-	851
Table-mountain pine	*Pinus pungens*	9	96	-	-	-	104
OAK-PINE	*Quercus spp., Pinus spp.*	29	421	-	-	-	450
White pine - northern red oak - white ash	*Pinus strobus, Quercus rubra, Fraxinus americana*	1,303	703	-	-	-	2,006
Eastern redcedar - hardwood	*Juniperus virginiana, broadleaf spp.*	855	2,077	111	-	-	3,042
Longleaf pine - scrub oak	*Pinus palustris, Quercus spp.*	-	1,286	-	-	-	1,286
Shortleaf pine - oak	*Pinus echinata, Quercus spp.*	409	4,577	-	-	-	4,985
Virginia pine - southern red oak	*Pinus virginiana, quercus velutina*	380	2,073	-	-	-	2,453
Loblolly pine - hardwood	*Pinus taeda, broadleaf spp.*	205	15,750	-	-	-	15,955
Slash pine - hardwood	*Pinus elliottii, broadleaf spp.*	-	1,881	-	-	-	1,881
Other oak - pine	*Quercus spp., Pinus spp.*	597	1,175	-	-	-	1,772

Table 2 continued

Forest type		North	South	Rocky Mountain	Pacific Coast	Alaska	TOTAL
				thousand acres			
OAK-HICKORY	*Quercus spp., Carya. spp.*	6,545	5,921	21	-	-	12,488
Post oak, black oak or bear oak	*Quercus stellata, Q. velutina, Q. ilicifolia*	3,229	4,053	90	-	-	7,372
Chestnut oak	*Quercus prinus*	2,244	3,589	-	-	-	5,834
White oak - red oak - hickory	*Quercus alba, Q. rubra, Carya spp.*	11,765	26,136	344	-	-	38,245
White oak	*Quercus alba*	4,857	1,379	-	-	-	6,236
Northern red oak	*Quercus rubra*	1,924	161	-	-	-	2,085
Yellow poplar - white oak - northern red oak	*Liriodendron tulipifera, Quercus alba, Q. rubra*	2,053	6,326	-	-	-	8,379
Southern scrub oak	*Quercus spp.*	214	1,526	-	-	-	1,740
Sweetgum - yellow poplar	*Liquidambar styraciflua, Liriodendron*	124	5,973	-	-	-	6,097
Mixed broadleaf		18,976	25,253	217	-	-	44,446
OAK-GUM-CYPRESS	*Quercus, Nyssa, Taxodium spp.*	203	3,979	-	-	-	4,182
Swamp chestnut oak - cherrybark oak	*Quercus michauxii, Q. falcata*	77	467	-	-	-	544
Sweetgum - Nuttall oak - willow oak	*Liquidambar styraciflua, Quercus texana, Salix spp.*	88	9,304	-	-	-	9,392
Sugarberry - American elm - green ash	*Celtis laevigata, Ulmus americana, Fraxinus pennsylvatica*	181	4,175	-	-	-	4,356
Overcup oak - water hickory	*Quercus lyrata, Carya aquatica*	-	1,112	-	-	-	1,112
Atlantic white cedar	*Chamaecyparis thyoides*	59	75	-	-	-	134
Baldcypress - water tupelo	*Taxodium distichum, Nyssa aquatica*	11	3,943	-	-	-	3,954
Sweetbay - swamp tupelo - red maple	*Magnolia virginiana, Nyssa biflora, Acer rubrum*	66	6,353	-	-	-	6,420
Palm-mangrove-other tropical	*Roystonea spp., Avicennia*	-	246	-	-	-	246
ELM-ASH-COTTONWOOD	*Ulmus, Fraxinus, Populus spp*	5,164	-	-	-	-	5,164
Black ash - American elm - Red maple	*Fraxinus nigra, Ulmus americana, Acer rubrum*	3,651	199	305	-	-	4,155
River birch - sycamore	*Betula nigra, Platanus occidentalis*	204	718	-	-	-	923
Cottonwood	*Populus deltoides*	326	228	256	-	-	810
Willow	*Salix spp.*	617	789	17	-	-	1,424
Sycamore - pecan - American elm	*Platanus occidentalis, Carya illinoinensis, Ulmus americana*	243	786	-	-	-	1,028
Red maple-lowland broadleaf	*Acre rubrum, lowland broadleaf*	646	7	-	-	-	653
MAPLE-BEECH-BIRCH	*Acer,Fagus,Betula spp*	24,980	212	698	-	-	25,890
Sugar maple - beech - yellow birch	*Acer saccharum, Fagus grandifolia, Betula alleghaniensis*	17,873	790	-	-	-	18,663
Black cherry	*Prunus serotina*	3,181	37	424	-	-	3,641
Black walnut	*Juglans nigra*	132	39	-	-	-	171
Red maple-upland broadleaf	*Acer rubrum, upland broadleaf*	7,565	22	246	-	-	7,832
ASPEN-BIRCH	*Populus spp, Betula spp.*	339	-	-	-	-	339
Aspen	*Populus tremuloides, Populus grandidentata*	13,777	-	169	-	-	13,947
Paper birch	*Betula papyrifera*	3,060	-	115	-	6,224	9,398
Balsam poplar	*Populus balsamifera*	651	-	-	-	55	706
Other Eastern types		-	2	-	-	-	2
Nonstocked, East		614	464	410	-	-	1,483

Table 2 continued

Forest type		North	South	Rocky Mountain	Pacific Coast	Alaska	TOTAL
				thousand acres			
DOUGLAS-FIR	*Pseudotsuga menziesii*	-	-	1,411	67	-	1,478
Douglas-fir	*Pseudotsuga menziesii*	-	-	18,730	19,338	-	38,068
Port-Orford-cedar - Douglas-fir	*Chamaecyparis lawsoniana,*	-	-	-	54	-	54
PONDEROSA PINE	*Pinus ponderosa*	-	-	1,131	2,692	-	3,823
Ponderosa pine	*Pinus ponderosa*	-	2	16,144	8,390	-	24,536
Ponderosa pine - sugar pine - fir	*Pinus ponderosa, P. lambertiana, Abies spp.*	-	-	-	3,111	-	3,111
Western white pine	*Pinus monticola*	-	-	124	242	-	365
FIR-SPRUCE	*Abies spp., Picea spp.*	-	-	4,125	3,556	2,353	10,034
White fir and grand fir	*Abies concolor, A. grandis*	-	-	851	902	-	1,753
Red fir	*Abies magnifica*	-	-	40	922	-	962
Pacific silver fir - hemlock	*Abies amabilis, Tsuga heterophylla*	-	-	7	2,265	-	2,272
Engelmann spruce	*Picea engelmannii*	-	-	3,723	7	-	3,730
Engelmann spruce - subalpine fir	*Picea engelmannii, Abies lasiocarpa*	-	-	10,493	209	-	10,702
HEMLOCK-SITKA SPRUCE	*Thuja plicata, Picea sitchensis*	-	-	-	-	3,331	3,331
Western redcedar	*Thuja plicata*	-	-	893	600	680	2,172
Sitka spruce	*Picea sitchensis*	-	-	-	171	1,419	1,590
Mountain hemlock - subalpine	*Tsuga mertensiana, Abies lasiocarpa*	-	-	341	2,485	2,552	5,378
Western hemlock	*Tsuga heterophylla*	-	-	347	4,022	2,263	6,631
Alaska-cedar		-	-	-	71	404	474
LARCH	*Larix spp.*	-	-	1,011	338	-	1,349
LODGEPOLE PINE	*Pinus contorta*	-	-	3,493	-	-	3,493
Lodgepole pine	*Pinus contorta*	-	-	11,203	3,702	354	15,259
REDWOOD	*Sequoia sempervirens*	-	-	-	12	-	12
Redwood	*Sequoia sempervirens*	-	-	-	909	-	909
WESTERN BROADLEAF		-	-	3,063	9,268	-	12,330
Red alder	*Alnus rubra*	-	-	-	2,696	28	2,724
Poplar - birch	*Populus spp., Betutla spp.*	-	-	152	33	508	692
Aspen	*Populus spp.*	-	-	6,712	170	1,917	8,799
California black oak	*Quercus kelloggii*	-	-	-	1,333	-	1,333
Cottonwood - willow	*Populus spp., Salix spp.*	-	-	563	152	520	1,235
Canyon live oak	*Quercus chrysolepis*	-	-	-	1,864	-	1,864
Oak - Madrone	*Quercus spp., Arbutus menziesii*	-	-	-	691	-	691
Other oaks	*Quercus spp.*	-	-	2,812	5,750	-	8,562
Ohia	*Metrosideros polymorpha*	-	-	-	47	-	47
Other Western types	(incl AZ cypress-w juniper)	-	-	2,079	6,106	-	8,185
Pinyon-juniper	*Juniperis spp.*	-	-	45,951	5,514	-	51,465
Knobcone pine	*Pinus attenuata*	-	-	-	110	-	110
Bristlecone pine	*Pinus aristata*	-	-	156	28	-	183
Whitebark pine	*Pinus albicaulis*	-	-	1,666	305	-	1,971
Chaparral		-	-	-	2,151	-	2,151
Limber pine	*Pinus flexilis*	-	-	1,119	60	-	1,179
Nonstocked, West		-	-	2,150	3,080	2,860	8,089
Not classifed		-	3,044	274	-	771	3,044
ALL U.S. TYPES		**169,685**	**214,603**	**144,344**	**93,422**	**126,869**	**747,872**

Table 3- Forest land area in the United States by forest type group and major region, 1977 and 2002

Forest type	Total East		North		South	
	1977	2002	1977	2002	1977	2002
	million acres					
EAST						
White-red-jack pine	12.5	12.8	12.0	10.9	0.5	1.9
Spruce-fir	21.1	17.1	21.1	17.1	0.0	0.0
Longleaf-slash pine	17.1	13.6	0.0	0.0	17.1	13.6
Loblolly-shortleaf pine	50.3	54.0	3.5	2.2	46.8	51.8
Oak-pine	35.1	33.7	4.4	3.8	30.7	29.9
Oak-hickory	112.0	132.2	50.2	51.9	61.8	80.3
Oak-gum-cypress	29.2	30.4	0.6	0.7	28.6	29.7
Elm-ash-cottonwood	22.1	13.6	18.9	10.9	3.2	2.7
Maple-beech-birch	38.7	54.9	38.3	53.8	0.4	1.1
Aspen-birch	20.3	17.8	20.3	17.8	0.0	0.0
Other forest types	5.3	0.0	0.1	0.0	5.2	0.0
Nonstocked	17.5	4.2	4.7	0.6	12.8	3.6
Total East	**381.2**	**384.3**	**174.1**	**169.7**	**207.1**	**214.6**

	Total West		Rocky Mountain		Pacific Coast		Alaska	
	1977	2002	1977	2002	1977	2002	1977	2002
WEST	*million acres*							
Douglas-fir	38.4	39.6	17.4	20.1	21.0	19.5	0.0	0.0
Ponderosa pine	33.4	31.5	17.7	17.3	15.7	14.2	0.0	0.0
Western white pine	0.5	0.4	0.3	0.1	0.2	0.3	0.0	0.0
Fir-spruce	59.9	72.8	16.4	19.2	13.5	7.9	30.0	45.7
Hemlock-Sitka spruce	19.9	19.4	1.5	1.6	5.3	7.3	13.1	10.5
Larch	2.7	1.3	2.0	1.0	0.7	0.3	0.0	0.0
Lodgepole pine	21.4	18.8	16.9	14.7	4.2	3.7	0.3	0.4
Redwood	0.7	0.9	0.0	0.0	0.7	0.9	0.0	0.0
Other conifers	58.1	72.6	4.7	5.2	0.0	6.6	53.4	60.8
Pinyon-juniper	47.4	51.7	42.2	46.2	5.2	5.5	0.0	0.0
Nonstocked	6.6	5.8	2.6	2.6	3.9	3.0	0.1	0.2
Western broadleaves	58.5	49.8	18.7	16.3	17.1	24.2	22.7	9.3
Unclassified	7.9	0.0	0.7	0.0	7.2	0.0	0.0	0.0
Total West	**355.4**	**364.6**	**141.1**	**144.3**	**94.7**	**93.4**	**119.6**	**126.9**

Table 4- Forest land area in the United States by ownership, region, 2002

Region	All owner-ships	Public							Private		
		Total public	Federal				State	County and muni-cipal	Total private	Forest industry	Non-industrial private
			Total Federal	National forest	Bureau of Land Man-agement	Other					
	Thousand acres										
North	169,685	41,318	13,739	11,395	29	2,315	20,259	7,320	128,367	14,829	113,538
South	214,603	23,753	17,850	12,358	9	5,484	4,795	1,108	190,849	35,916	153,795
Total East	384,288	65,072	31,590	23,753	38	7,799	25,054	8,428	319,216	50,745	267,333
Rocky Mountain	144,344	106,119	100,090	73,520	21,563	5,006	5,837	192	38,225	2,926	35,299
Pacific Coast	93,422	54,907	49,545	40,728	5,519	3,299	4,510	853	38,515	12,711	25,804
Alaska	126,869	107,982	71,962	10,455	22,936	38,570	35,919	101	18,887	0	18,887
Total West	364,635	269,007	221,597	124,703	50,018	46,875	46,265	1,145	95,627	15,637	79,990
United States	748,922	334,079	253,186	148,456	50,056	54,674	71,319	9,573	414,843	66,382	347,323

Note: Data may not add to totals because of rounding.

Indicator 2. Extent of area by forest type and by age class or successional stage

What is the indicator and why is it important?

This indicator uses age-class distribution by broad forest type as a coarse measure of the landscape-scale structure of the Nation's forests where many species are wholly or partly dependent on a particular successional stage. A diverse distribution of forest lands across forest types and age classes is an indicator of tree size diversity and are important determinants of timber growth and yield, the occurrence of game animals, other nontimber forest products, and the forest's aesthetic and recreational values.

Most species are wholly or partly dependent on a particular successional stage or only a few stages. Therefore, all normally occurring successional stages should be present with sufficient area in a given landscape to support all native species. Ecological processes and the species associated with those processes within a forest ecosystem or forest type are often associated with vegetative structure, age of the vegetation, its diameter and height, and stratification of the canopy layer and species composition (including herbaceous, shrub, midstory and overstory layers, and relevant faunal communities). In addition, in terms of human needs, forest type and forest age are important determinants of timber growth and yield, the occurrence of game animals, other nontimber forest products, and the forest's aesthetic and recreational values.

Sufficient notions of area and juxtaposition of various forest types are critical to interpretation of the trends and provide a coarse indicator of sustainability. While this indicator does not show the complexity of the vegetation associations within each major type, it does show the broad potential for desired associations to be developed. A balance of forest types at diverse successional stages is considered essential to providing forest landscapes that are both sustainable and capable of providing desired outcomes for both wildlife and human use.

What does the data show?

The correlation between tree diameter and age is highly dependent on the species and growing conditions. For example, a 200–year-old black spruce tree in the low-productivity forests of interior Alaska may well be only 6 inches in diameter while a 200-year-old Douglas-fir on the highly productive Pacific Coast may be well over 50 inches in diameter. A general trend, however, is that trees get larger is indicative of forests that are getting, on average, older. Whether stands become more diverse as they age depends on many factors such as management history, adequate seed sources for regeneration, site conditions, climatic factors, and geophysical factors. The occurrence of insects and disease, whether endemic or epidemic, also plays a role in defining the diversity of the forest.

Currently, age-class data is only available for timber land or about two-thirds of all forest land in the United States In the East, where timber land makes up 94percent of all forest land the picture is more complete. In the East, the data shows a diversity of age classes in all major forest types with conifer types skewed to younger age classes in the South due to more intensive management for timber. Broadleaf types have a more normal distribution showing a bulge in the 40–79-year age class as second and third growth forests in the East continue to mature.

In the West the overall picture is more uncertain due to a lack of data in low productivity forests and protected areas. Preliminary inventory data on some of the missing forests, primarily parks, wilderness, and juniper forests are generally skewed toward older age classes.

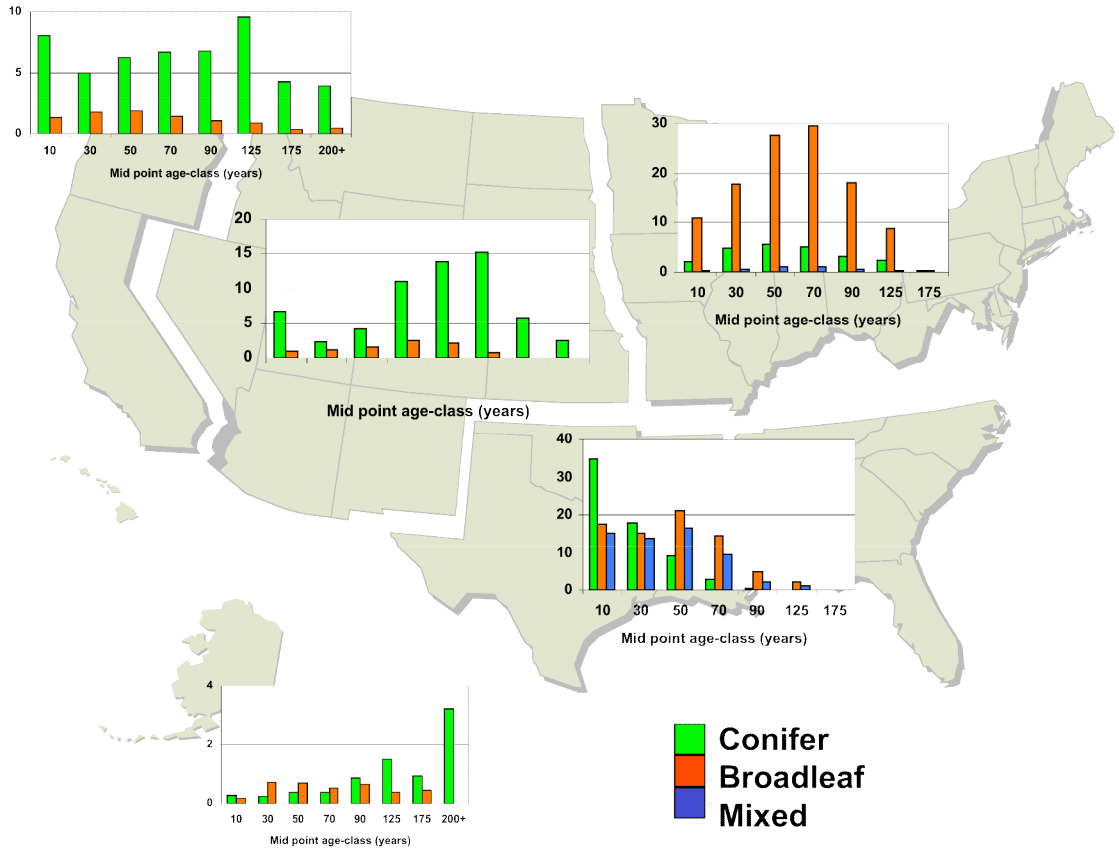

Figure 2-1. Timber land area in the United States by region, major type, and stand age class

While trend data on age class is sparse, there are historic data available for average tree size in forest stands (figure 2-2). Trends show a steady decline in nonstocked areas over the past 50 years as poorly stocked stands are regenerated or converted to other uses. Stands averaging 0 to 5 inches increased as older stands were harvested and regenerated. Nearly 3 million acres of nonforest land were planted in the South as part of the Conservation Reserve Program in the 1980s and 1990s. Intermediate stands in the 6–10-inch average diameter range have been declining, while stands over 11 inches average diameter have been rising. This latter trend is indicative of the dominant use of selective harvesting in the United States, which accounts for nearly two-thirds of all harvesting. Additionally, shifts in management policy that have reduced harvesting on public forests in the West, are increasing the acreage of larger diameter stands in that region.

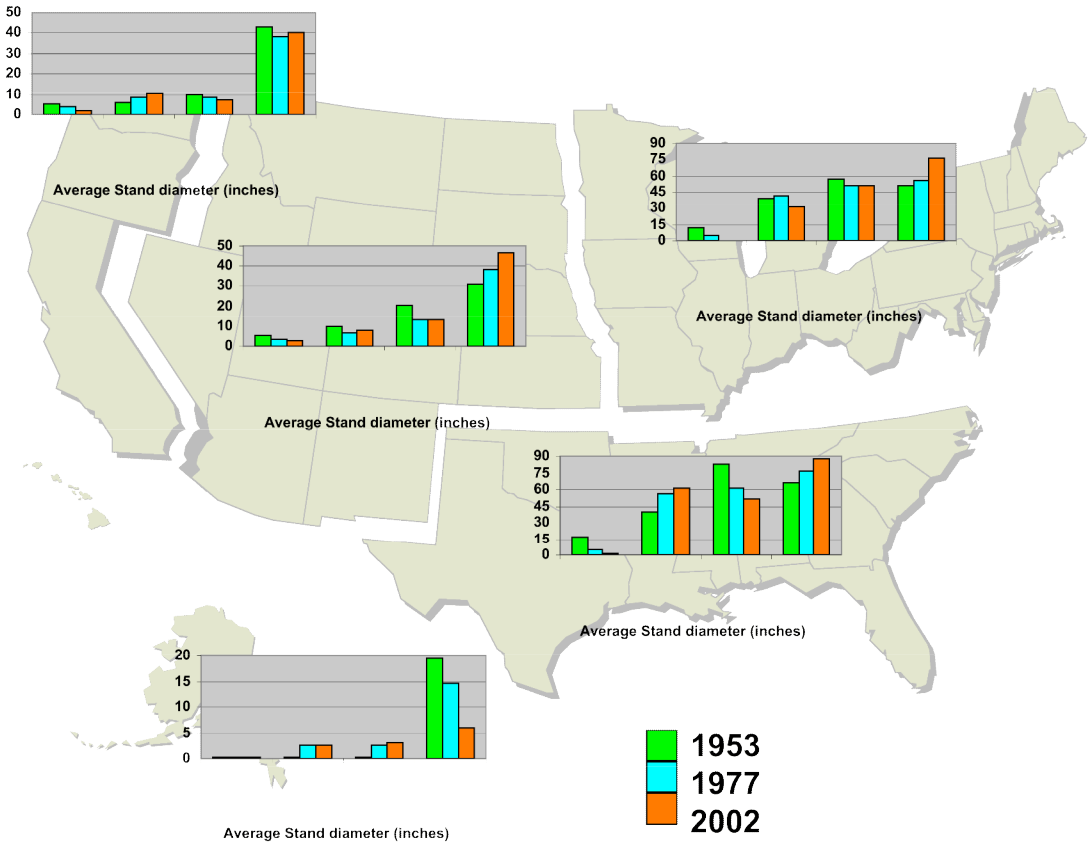

Figure 2-2. Timber land area in the United States by region and average stand diameter class for 1953, 1977, and 1997

Dominant forces affecting forests in the East over the past 50 years have been natural succession and human activities, including forest management activities, reversion of agricultural lands to forest, urban and agricultural clearing, conversion between forest types, and fire suppression. In the West, shifts in management policy have reduced harvesting, particularly on public forests, and acreage of larger diameter stands in that region are rising.

Since the data clearly shows a rising number of larger diameter stands in timber land and the protected areas have no harvesting taking place, the general trend in the United States is toward larger, older trees. Neither the age or size-class data, however, provides substantial information on the biodiversity of the Nation's forests other than the distribution of trees of various sizes and ages. The implications of this information must be interpreted with desired mixtures of species within these classes to be meaningful.

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Indicator 3. **Extent of area by forest type in protected area categories as defined by IUCN or other suitable classification system**

What is the indicator and why is it important?

In its broadest sense, the area and proportion of forest ecosystems reserved in some form of protected condition provides some indication of the emphasis being placed by a society on the preservation of representative ecosystems as a strategy to conserve biodiversity. There are also important forest management questions that can be addressed by maintaining information on a network of comprehensive, adequate, and representative forest types within protected areas. Traditionally, protected areas have been set aside, in part, for their conservation, scenic, and recreational values and might not be representative of the full range of biodiversity. And, over time, forest types within protected areas will change. Adequate protection of the ecosystems and species in reserved areas may provide more management flexibility in forests under management for timber production and other extractive purposes.

Although this indicator allows selectivity in the classification system used, currently only one system is developed well enough to provide comparative information at both the national and international scale. The system developed by the World Conservation Union (previously know as the International Union for the Conservation of Nature) or IUCN provides the necessary continuity for comparative analysis (IUCN, 1994) at multiple scales. The caveat, of course, is who decides when an area is sufficiently protected to be assigned protected status within the system? How does one verify that all of the management criteria for a category have been met? While these and related issues continue to spur debate, the IUCN system does offer the best available starting point for protected area description and analysis. This does not suggest that the following discussion is an unqualified endorsement of the IUCN system but allows meaningful discussion within a predefined and consistent context. And it is the only system available at the global scale. Some of the concerns raised about the IUCN system will appear in the section titled "Difficulties with data interpretation."

The IUCN system contains six major categories:

Category I	Strict Nature Reserve/ Wilderness Area or Strict Nature Reserve: an area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and or environmental monitoring or a large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.
Category II	National Park: a natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, educational, recreational and visitor opportunities, all of which must be environmentally and culturally comparable.
Category III	Natural Monument: an area containing one, or more, specific natural or natural/cultural feature that is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.
Category IV	Habitat/Species Management Area: an area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.
Category V	Protected Landscape/Seascape: an area of land with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological, and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.
Category VI	Managed Resource Protected Area: an area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

These broad management categories are intended to provide a common standard for classifying different types of protected areas based on primary management objectives to help facilitate comparisons and analysis at different spatial scales from regional to global. Figure 3-1 demonstrates the continuum of classes from most natural with least human intervention (i.e., pristine wilderness) to purely utilitarian (i.e., timber plantations).

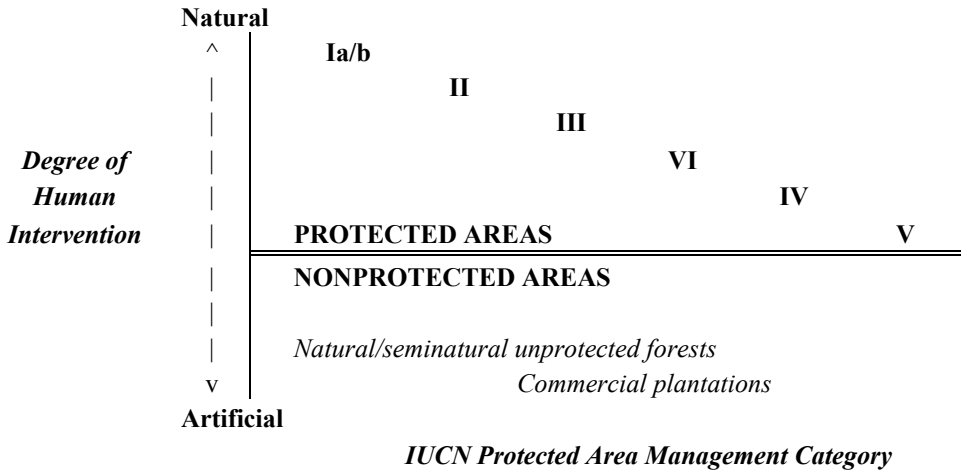


Figure 3-1. Idealized representation between IUCN protected area management and degree of human intervention (after IUCN, 1997)

Discussions in this report of Criterion 2 indicators will use national assessment data from Smith et al. (2002) as a basis for describing the state of forest resources in the United States. A small area of IUCN categories III through VI presented in this indicator will be embedded in that data due to the inability of current field inventories to effectively classify these areas, particularly on private lands. However, the proportion of these areas relative to total forest area is less than 2 percent outside of Alaska. And, the areas in Alaska are in interior forests currently deemed not suitable for timber management. Thus these embedded areas pose no significant obstacle to general analysis of baselines and trends. Clearly, however, forest inventory and monitoring systems must be refined to better accommodate proper classification of lands into the IUCN classification system. The FIA program, which is responsible for national forest inventories in the United States, is already making changes in pursuit of this goal.

Current forest inventories in the United States place most emphasis for protected forest on what is called 'reserved' forest lands or lands precluded from harvest by law or administrative regulation. These areas are predominantly in Wilderness and National Parks (IUCN categories I and II) with inclusion of most areas such as National Monuments, Wild and Scenic Rivers, and recreation areas (IUCN categories III, IV, and V). In order to properly address this indicator, other information sources that could be integrated with the traditional data were sought.

The World Wildlife Fund (WWF) and the Conservation Biology Institute (CBI) developed the Protected Areas Database (PAD) as a comprehensive GIS database for the conterminous United

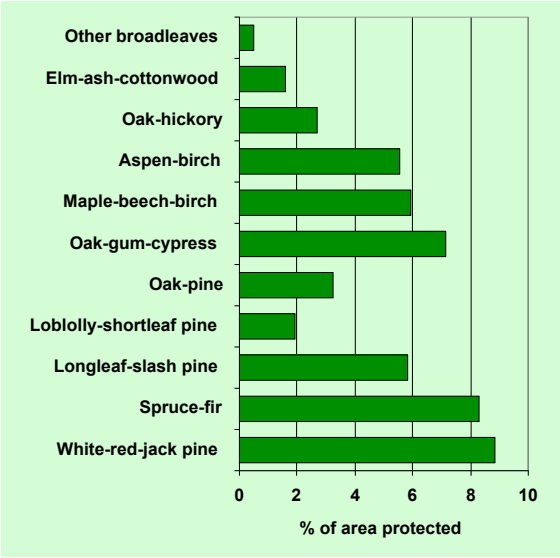
States, which includes all types of protected areas including National and State Parks and Forests, Wilderness Areas, Indian and Military Reservations, and National Wildlife Refuges, etc. Although predominantly Federal- and State-owned areas, it also includes county, city, and private reserves where data were available. The database contains information about parcel type, ownership, size, and protection level. Additional data were acquired from the University of California Santa Barbara's (UCSB) Managed Area Database (MAD), which has a similar structure and provided data for areas missing from the PAD at the time of analysis. Data for this indicator was derived by overlaying the PAD/MAD boundaries on national satellite imagery developed by the USDA Forest Service that delineated forest cover classifications (Zhu, 1994). Using this approach, estimates of forest and nonforest land within protected areas were made. These estimates should be considered a first approximation and while still needing much improvement provide an excellent starting point for future development.

Figure 3-2. Forest and protected forest using the PAD/MAD database and FIA cover map

What does the data show?

The United States has a long history of forest protection with Yellowstone, the world's first National Park, set aside in 1872. In the late 1800's, the Forest Reserves (now the National Forests) were set aside to protect water and provide timber. The passage of the Wilderness Act in 1964 (PL 88-577, 78 Stat. 890) provided further protection to millions of acres of forest throughout the Nation. Protected forest areas are scattered throughout the United States but are most abundant in the West where nearly 85 percent are located, predominantly on public land. Most protected forest occurs on Federal land, however, the Adirondack and Catskills Reserves managed by the State of New York, at nearly 3 million acres total area, and set aside nearly 90 years ago, are two of the largest areas of protected forest in non-Federal ownership.

Total protected areas within IUCN categories I-VI are estimated to cover about 154 million acres (7 percent of all land) in the United States of which an estimated 106 million acres (14 percent of all forest land) is forested. Conifer forests, particularly on public lands in the West (Rocky Mountain, Pacific Coast, and Alaska Regions), have a larger percentage of area in protected status in the United States. Ninety-five percent of all protected conifer forests are in the West. A smaller proportion of broadleaf types are currently protected. Broadleaf types occur predominantly on private lands in the East (North and South regions). And, **the East has all of the protected areas classified as mixed broadleaf/conifer forest and 71percent of all protected broadleaf forests.**



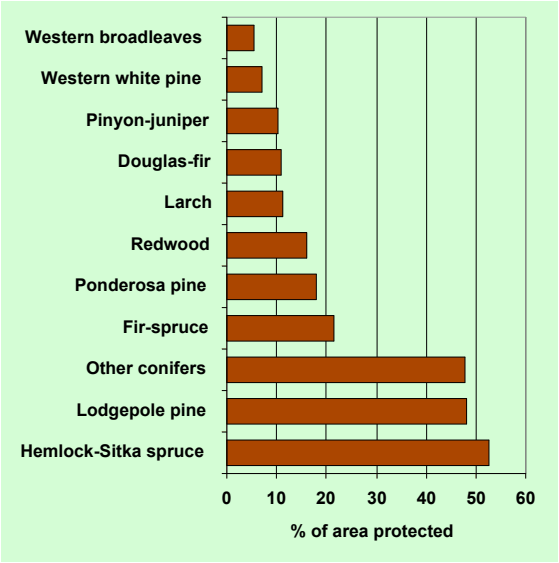


Figure 3-3a. Percent of land protected by cover type in the East, 2000 *Figure 3-3b. Percent of land protected by cover type in the West, 2000*

Conifer forests in general have a larger percentage of area in protected status in the United States The smaller proportion of broadleaf types stems from the fact that most broadleaves are in private ownership. The dominant mechanism to set aside private broadleaf forests will have to be through purchase or incentive programs that make it financially beneficial for the landowner to protect the forest.

Difficulties with data interpretation

To illustrate the difficulty in getting a consistent data set to properly evaluate protected areas, the following tabulation was derived from a Government Accounting Office (GAO) document on Federal lands with conservation restrictions (GAO, 1995). Four Federal agencies, the Forest Service, Bureau of Land Management, National Park Service, and Fish and Wildlife Service manage a combined 623 million acres of land in the United States. According to GAO, 238 million acres of these Federal lands, forest and nonforest, had management restrictions that should have placed them in IUCN protected status categories. This compares to the PAD/MAD data that shows 156 million acres of total protected land in all ownerships. This discrepancy could be due to missing data in the PAD/MAD database or could be the result of a more conservative classification of federally owned lands by the developers of the PAD/MAD data.

Given these concerns, the evidence clearly supports further investigation to reconcile differences in monitoring and reporting systems and the data presented is likely a conservative estimate. There are also overlaps in the Federal reporting presented in the GAO report as well and some lands such as Wild and Scenic Rivers within National Park wilderness areas may be accounted for three times. Such discrepancies must also be taken into account in seeking a system that accurately reports protected areas.

Federally managed lands designated for conservation purposes by legislative or administrative restrictions

Type of restriction	Area
million acres	
NPS and FWS	
Wilderness	60
Other managed lands	104
Total	164
FS and BLM	
Wilderness*	36
Research Natural Areas	1
National Scenic Research Area	1
National Monument	4
Outstanding Natural Area	2
National Game Refuge	1
Wild & Scenic Rivers	1
National Recreation Area	3
Critical Environmental Concern Area	10
National Conservation Area	14
Total	74
Total Federal land potentially protected	238

** Does not include 33 million Wilderness Study Area acres.*

Additionally, there are concerns with the classification of lands covered by management plans. For example, currently only 38 million acres of National Forest System (NFS) lands in the United States are deemed ‘suitable’ for timber management. Nearly 92 million acres of NFS forest lands are deemed unsuitable for timber management and another 17 million acres have other goals as their primary management activity. Yet, only 42 million acres are shown as ‘protected’ in the PAD/MAD data classified by IUCN categories. Some suggest that all NFS lands declared ‘unsuitable’ for timber management should be, at a minimum, declared IUCN category VI lands. Other public land management agencies have similar lands and concerns covering millions more acres of forest. Management plans for these forests require public review and address many environmental concerns including biodiversity (they must pass the requirements of the National Environmental Policy Act (NEPA) and the National Forest Management Act (NFMA). It is recognized that a change to include areas restricted in

management plans would require that this category be revised as new management plans are reviewed and approved. Discussions with IUCN, other interested groups and resource specialists are sought as well to evaluate more flexibility in reporting. Yet another area of uncertainty for potential areas in this category is private lands in conservation easements under State and local authority. Information on these lands has been difficult to acquire in a consistent way due to a myriad of institutional reporting formats and legal structures. Assistance from State and local governments is also being sought to address this issue. Inclusion of these areas would increase the area reported as protected in the United States and would more accurately reflect the true commitment of all public agencies to protection of biodiversity in this country.

Forest Service FIA researchers are installing field samples in protected areas (now 25 percent complete) and working with the Conservation Biology Institute, Nature Serve, U.S. Geological Survey, and others to improve both the Protected Areas Database and remotely sensed forest cover data to significantly enhance analytical capabilities for these areas at the strategic scale.

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Table 3-1. Land area in the United States by region, forest type group, and IUCN category from PAD/MAD database, 2000

Region and IUCN category	Total Protected	Total nonforest	Total forest	Major forest type		
				Conifer	Broadleaf	Mixed
EAST Summary						
I. Wilderness	**4,300**	788	**3,512**	1,543	1,489	481
II. National Parks	**3,072**	1,953	**1,119**	299	613	208
III. Monuments	**732**	501	**231**	78	5	148
IV. Habitat/Species mgmt. areas	**6,096**	2,523	**3,573**	925	1,789	859
V. Landscape mgmt. areas	**5,224**	2,004	**3,221**	661	1,984	576
VI. Managed resource areas	**5,758**	1,880	**3,878**	807	2,093	978
All categories	**25,183**	9,649	**15,534**	4,311	7,972	3,251
Total all area in category	***947,976***	*563,550*	***384,426***	*94,885*	*225,363*	*64,182*
Percent of area protected	***3%***	***2%***	***4%***	***5%***	***4%***	***5%***
WEST Summary						
I. Wilderness	**44,022**	16,874	**27,148**	24,868	2,279	-
II. National Parks	**19,382**	8,007	**11,374**	11,177	197	-
III. Monuments	**1,474**	1,097	**377**	320	57	-
IV. Habitat/Species mgmt. areas	**30,396**	8,266	**22,130**	21,727	403	-
V. Landscape mgmt. areas	**5,390**	3,695	**1,696**	1,367	329	-
VI. Managed resource areas	**28,571**	360	**28,210**	28,178	32	-
All categories	**129,234**	38,300	**90,935**	87,637	3,297	-
Total all area in category	***1,315,244***	*952,712*	***362,532***	*314,826*	*47,706*	-
Percent of area protected	***10%***	***4%***	***25%***	***28%***	***7%***	-
United States						
I. Wilderness	**48,322**	17,662	**30,660**	26,411	3,768	481
II. National Parks	**22,454**	9,960	**12,494**	11,476	810	208
III. Monuments	**2,206**	1,598	**608**	398	62	148
IV. Habitat/Species mgmt. areas	**36,492**	10,789	**25,703**	22,651	2,192	859
V. Landscape mgmt. areas	**10,615**	5,699	**4,916**	2,028	2,312	576
VI. Managed resource areas	**34,329**	2,241	**32,088**	28,985	2,125	978
All categories	**154,417**	47,948	**106,469**	91,948	11,270	3,251
Total all area in category	***2,263,220***	***1,516,262***	***746,958***	***409,711***	***273,069***	***64,182***
Percent of area protected	***7%***	***3%***	***14%***	***22%***	***4%***	***5%***

Indicator 4. Extent of areas of forest type in protected areas defined by age class or successional stage

What is the indicator and why is it important?

In its broadest sense, the area and proportion of forest ecosystems reserved in some form of protected condition provides some indication of the emphasis being placed by society on the preservation of representative ecosystems as a strategy to conserve biodiversity.

There are also important forest management questions that can be addressed by maintaining information on a network of comprehensive, adequate, and representative forest ecosystems within protected areas. Traditionally, protected areas have been set aside, in part, for their conservation, scenic, and recreational values. The ecosystems they contain might not be representative of the full range of biodiversity. If protected areas are part of the national strategy for conserving ecosystems and species (including rare and endangered species), then some indication of what is protected is required. Over time, forest ecosystems within protected areas will change and this change also needs to be monitored as part of an overall sustainability strategy.

What does the data show?

Currently, data on age or successional class of forests in protected areas is sparse in the United States. This is because field data are lacking and forest quality and age are extremely difficult and expensive to determine from remotely sensed data, and no useful high resolution databases have been developed.

To date, area and volume classification data are available for only about 25-percent (26 out of 106 million acres) of the forest area designated as protected in Indicator 3 (Table 4-1).

Table 4-1. Availability of data on protected forest land

Forest type	Data available	Data not available	Total	Percent available
	million acres			
BROADLEAF/MIXED	6	8	15	44%
CONIFER	20	72	92	22%
Total	26	80	106	25%

Broadleaf and mixed protected forests inventoried thus far have a fairly even distribution of ages. Protected conifer forests inventoried thus far, by contrast, are heavily skewed to the stands more than 100 years old. As stands continue to remain in protected status, their age distribution will be primarily be determined by natural disturbances such as fire, weather, and insect or disease outbreaks.

Continuous monitoring through both field sampling and remote sensing are necessary to map natural disturbance events, impacts of recreational visitors, spread of nonnative species, and other changes in protected areas. This monitoring will provide critical information about status and trends in the composition and structure of these areas.

Forest managers and conservation biologists are challenged to determine the appropriate mix of active and passive management for protected areas that will result in long-term maintenance of the biodiversity values that need protection. Until inventories are completed for all protected areas, analysis for these purposes will be incomplete. It is expected that a full suite of data from new Forest Inventory and Analysis protocols should be available for these areas by 2008 for strategic level assessments.