



## Forest Land Base

To understand and evaluate the productive capacity of forests, scientists need to know the capability, availability, and composition of the land base that support forest resources. This section of the Assessment presents a statistical description of forest lands within California, which focuses on the portion used for timber production, called timberlands. Basic measures of California's timberland base include extent, ownership, management patterns, composition characteristics (age and species), and productivity. These indicators, as well as other metrics, help evaluate productive capacity and the ability of timberlands to provide goods and services to society in a sustainable manner.

*Forest lands have at least 10 percent cover of live trees. Timberlands are forest lands available and capable of growing at least 20 cubic feet per acre per year of industrial wood.*

California Department of Forestry and Fire Protection's Fire and Resource Assessment Program (FRAP) defines California's forest lands as those lands that currently have at least 10 percent cover of live trees as interpreted from satellite imagery. This definition includes not only conifer and hardwood forests but also considerable areas of woodlands. FRAP has made estimates of forest land based solely on the 10 percent cover rule. This estimate varies from published U.S. Forest Service (USFS), Pacific Northwest Experiment Station (PNW) forest land estimates. The USFS/PNW includes forest lands that

*The FRAP estimate of forest land is based on lands currently stocked with trees. The USFS/FIA has a broader estimate of forest lands that includes nonstocked lands that had trees in the past.*

were stocked in the past in their estimates. In contrast, FRAP estimations are based on current vegetation rather than potential vegetation. FRAP's Land Cover Mapping and Monitoring Program estimates include conifer and hardwood forests in the forest land base, but unlike USFS/PNW excludes chaparral, shrub lands, and other nonstocked lands capable of producing trees.

A primary source of information for the forest land base is timberland statistics, which are reported by the Pacific Resource Inventory, Monitoring and Evaluation Program (PRIME) of PNW. This reporting mechanism is often referred to as the Forest Inventory and Analysis (FIA). Every decade, PRIME conducts the Forest Inventory and Analysis, which is a national mandate authorized by the Forest and Rangeland Renewable Resource Research Act of 1978. Beginning in 2001, FIA began collecting data annually rather than once per decade. The FIA is a field plot based survey and statistical analysis of all forest lands outside the National Forest System. The most recent forest statistics reported by FIA were collected from 1991 to 1994 and are referred to as the 1994 reporting period. The survey and analysis is documented in a series of publications called "Timber Resource Statistics for Resource Areas of California." See [FIA Timber Resource Statistics](#) for more information. For more discussion on FIA sampling statistics and geographic scope see [FIA Sampling Methods and Resource Areas](#).

## Findings on area of forest land base as defined by FRAP VEG

FRAP classified and mapped California's forest lands according to habitat types from the California Wildlife Habitat Relationship (CWHR) system. This system called FRAP Multi-Source Vegetation, or FRAP VEG, combines map information from various independent sources into a single map of all land covers in California. See [CWHR](#) and [Methods](#). Currently, forests and woodlands cover about 31 percent (31.3 million acres) of the total land base in California (Table 1). Conifer Forests and Woodlands (21.4 million acres) account for about 68 percent of the State's forests. Hardwood Forests and Woodlands (9.9 million acres) account for the remaining 32 percent.

Table 1 displays the composition of forest land habitat types by ownership in the State. Figure 2 shows the location of forest lands in the State as calculated from FRAP VEG. Complete forest land statistics including ownership, county, and bioregional summaries can be found at [Habitat Types: state-county](#) with corresponding maps at [Wildlife Habitat Maps](#).

Table 1. Area of forest land by CWHR type and ownership (thousand acres)

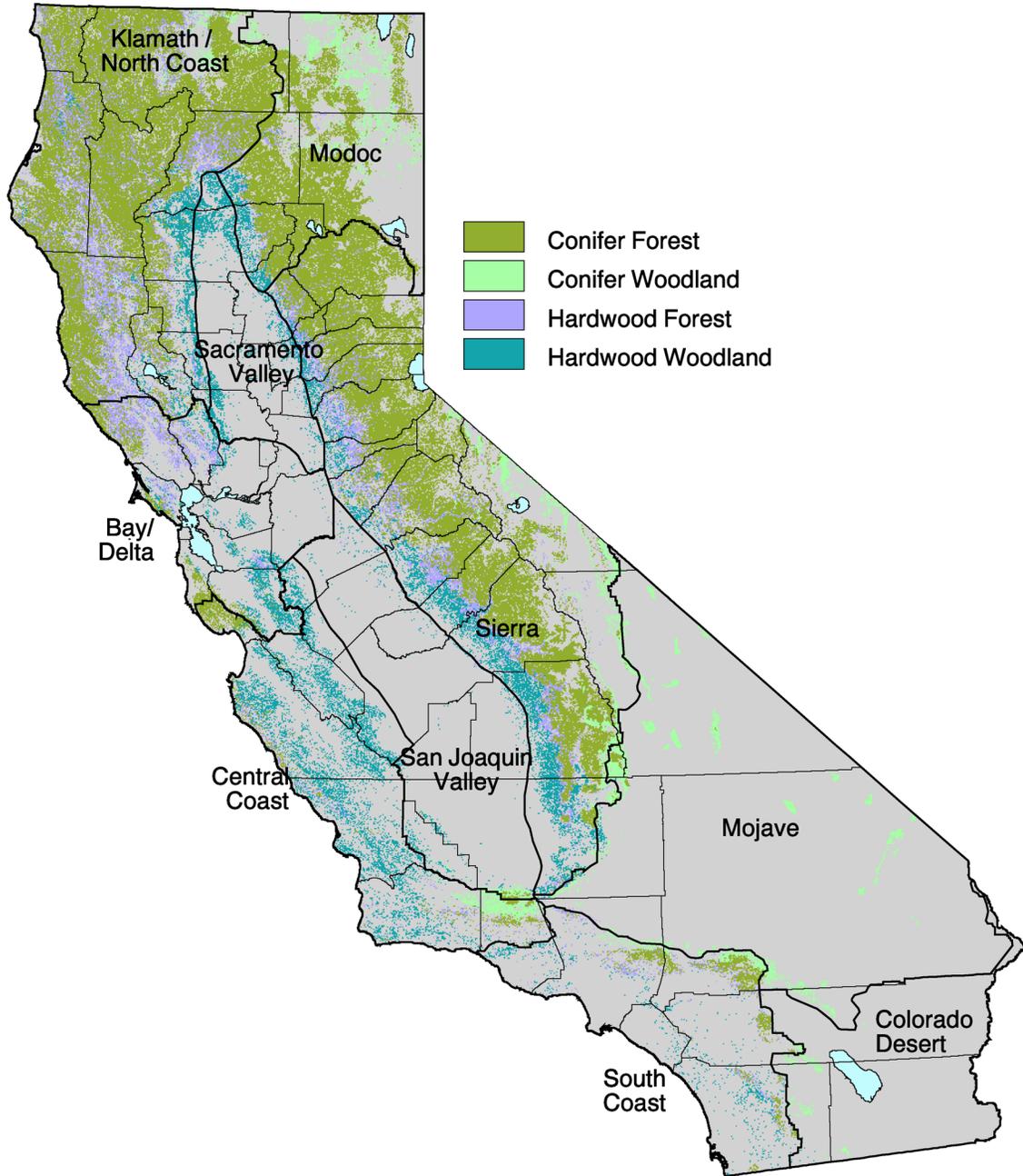
Habitat type	Private	USFS	BLM	NPS	Other public	Total
<b>Conifer Forest</b>						
Closed-Cone Pine-Cypress	56	50	25	12	11	155
Douglas Fir	1,323	1,726	163	21	102	3,335
Eastside Pine	443	929	40	(L)	8	1,420
Jeffrey Pine	38	409	8	109	6	570
Klamath Mixed Conifer	340	1,011	16	9	6	1,381
Lodgepole Pine	35	310	(L)	245	1	591
Montane Hardwood-Conifer	723	801	41	11	49	1,626
Ponderosa Pine	424	369	38	62	13	906
Red Fir	117	998	(L)	296	2	1,414
Redwood	1,079	5	1	45	167	1,297
Sierran Mixed Conifer	1,598	2,912	48	131	44	4,734
Subalpine Conifer	17	495	6	121	4	642
White Fir	153	628	2	38	4	826
Unknown Conifer	85	1	6	6	10	107
<b>Total</b>	<b>6,432</b>	<b>10,644</b>	<b>394</b>	<b>1,108</b>	<b>426</b>	<b>19,004</b>
<b>Conifer Woodland</b>						
Juniper	339	317	234	66	59	1,015
Pinyon-Juniper	119	734	249	154	92	1,348
<b>Total</b>	<b>458</b>	<b>1,051</b>	<b>482</b>	<b>220</b>	<b>151</b>	<b>2,363</b>
<b>Hardwood Woodland</b>						
Blue Oak-Foothill Pine	754	39	121	17	49	979
Blue Oak Woodland	2,457	129	104	9	120	2,819
Coastal Oak Woodland	832	138	12	8	104	1,095
Eucalyptus	9	(L)	(L)	(L)	1	11
Valley Foothill Riparian	114	4	2	1	27	147
Valley Oak Woodland	126	1	2	(L)	9	137
<b>Total</b>	<b>4,292</b>	<b>310</b>	<b>239</b>	<b>36</b>	<b>309</b>	<b>5,188</b>
<b>Hardwood Forest</b>						
Aspen	3	32	1	2	1	40
Montane Hardwood	2,797	1,215	174	89	165	4,439
Montane Riparian	100	40	1	43	27	211
<b>Total</b>	<b>2,901</b>	<b>1,287</b>	<b>176</b>	<b>134</b>	<b>193</b>	<b>4,691</b>
<b>TOTAL</b>	<b>14,083</b>	<b>13,293</b>	<b>1,292</b>	<b>1,499</b>	<b>1,079</b>	<b>31,245</b>

BLM – Bureau of Land Management; (L) Less than 500 acres; NPS – National Park Service; USFS – U.S. Forest Service

*totals may not add due to rounding*

*Source: FRAP, 1999; FRAP, 2002a*

Figure 1. Forest land in California with CBC bioregion boundaries

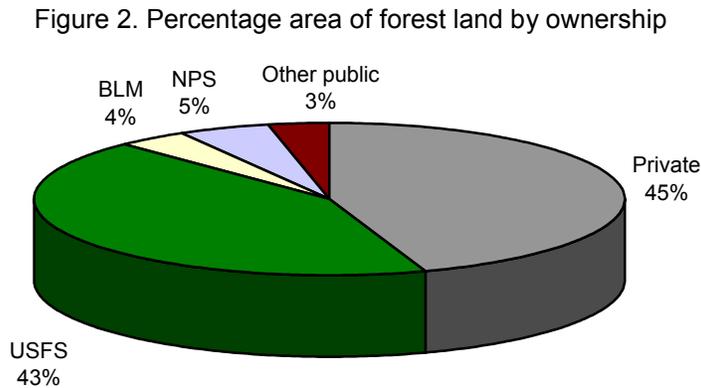


Source: FRAP, 1998; FRAP, 2002a

**Findings on forest land ownership as defined by FRAP**

As shown in Figure 2 reflecting FRAP VEG data, the U.S. Forest Service (USFS) and private land owners own the majority of forest lands in the State (43 and 45 percent, respectively). The Sierra is the only bioregion where USFS ownership exceeds private ownership (Table 2).

***Public ownership accounts for 55 percent of forest lands in the State.***



Source: FRAP, 1999; FRAP, 2002a

Table 2. Percentage area of forest land by ownership and bioregion

Owner	California bioregions						
	Klamath/ North Coast	Modoc	Sierra	Central Coast	South Coast	Bay/Delta	All others*
BLM	4	17	6	4	2	1	28
NPS	1	2	9	0	0	1	14
Other public	3	5	3	7	8	7	41
Private	52	42	35	69	65	91	16
USFS	40	34	46	20	25	0	0

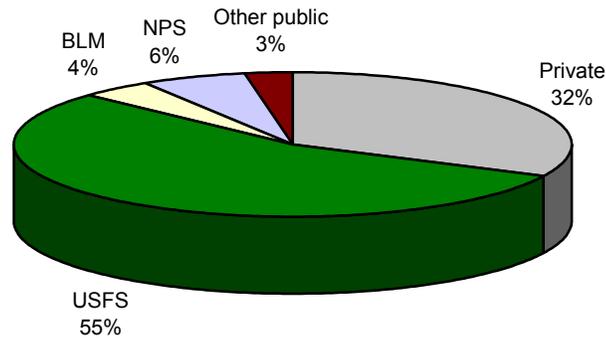
\*All others include Mojave, Colorado Desert, Sacramento Valley, and San Joaquin Valley

Some totals may not add due to rounding

Source: FRAP, 1999; FRAP, 2002a

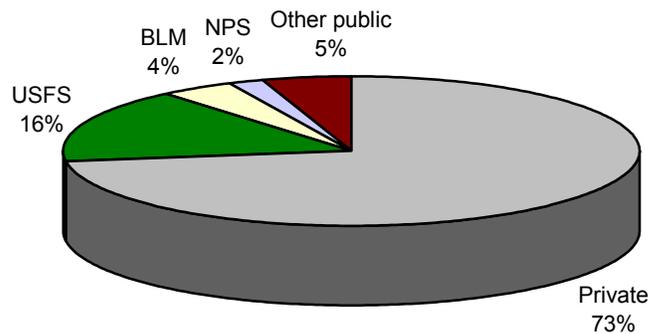
While the total amount of forests in California have somewhat even percentages of public and private ownership, Conifer Forests and Woodlands and Hardwood Forests and Woodlands have quite different ownership patterns. Figures 3 and 4 show that hardwood lands are mostly in private ownership, while conifer lands are mostly in public ownership.

Figure 3. Percentage area of Conifer Forest and Woodland by ownership



Source: FRAP, 1999; FRAP, 2002a

Figure 4. Percentage area of Hardwood Forest and Woodland by ownership

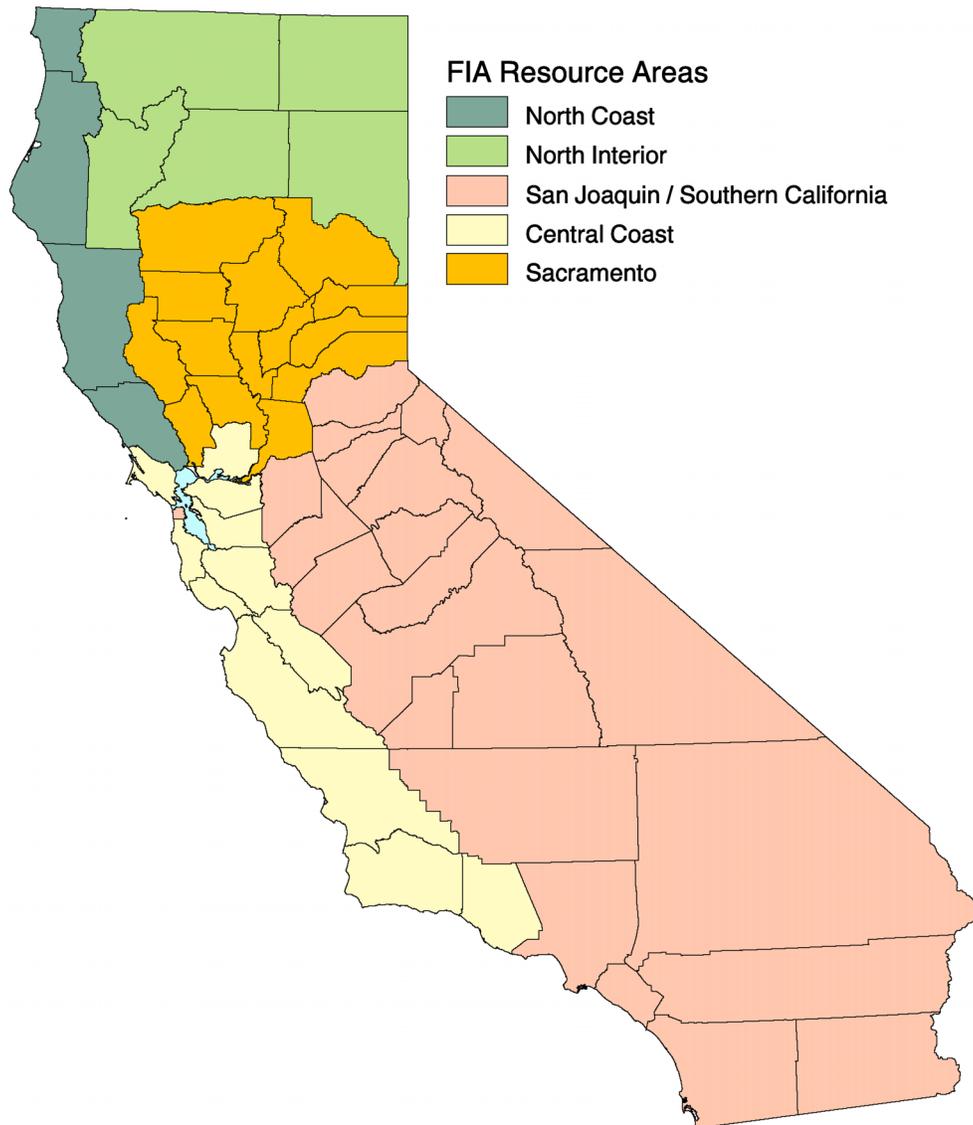


Source: FRAP 1999; FRAP, 2002a

### Findings on forests by FIA land class and administrative status

FIA statistics are collected and reported for several regions or resource areas. These include North Coast, Central Coast, North Interior, Sacramento, San Joaquin/Southern (Figure 5). Under FIA, the forest land base is classified into several categories that describe capability and availability for timber production.

Figure 5. FIA Resource Areas and county boundaries



Source: Waddell and Bassett, 1996, 1997

The classes are defined by FIA based on productive capacity and administrative status, which often remove land from commodity production. As mentioned, forest land totals differ from the FRAP definition due to inclusion of nonstocked lands, which include recently harvested areas and productive shrub lands that are currently not forested. FIA groups forest land into the following five categories:

**Timberland:** Forest land capable of growing 20 cubic feet or more of industrial wood per acre per year (mean increment at culmination in fully stocked, natural stands). Timberland is not in a reserved status through removal of the area from timber utilization by statute, ordinance, or administrative order and is not in a withdrawn status pending consideration for reserved. Timberlands account for 42 percent (16.6 million acres) of the forest lands in the State. These lands correspond closely to

lands that can be viably managed sustainably for timber production. Nearly all forest acres owned by industry meet this definition. Roughly one quarter of non-industrial private forest land (NIPF) meets these criteria, the percentage is low due to the large acreage of private hardwood woodlands.

**Reserved and withdrawn timberland:** Forest land capable of growing 20 cubic feet or more of industrial wood per acre per year (mean annual increment at culmination in fully stocked, natural stands). Reserved timberland has been dedicated to non-commodity use through statute, ordinance, or administrative order. Examples of reserved timberland include portions of national parks, national forest wilderness areas, state and county parks, or other special areas where commodity production activities are incompatible with agency missions. Reserved timberland covers 10 percent (3,176,000 acres) of forest land Statewide.

**Other forest:** Forest land incapable of growing 20 cubic feet of industrial wood per acre per year (mean annual increment at culmination in fully stocked, natural stands) due to adverse conditions. Such conditions include sterile soils, dry climate, poor drainage, subalpine sites, steepness, or rockiness.

**Reserved other forest:** Forest land not capable of growing 20 cubic feet of industrial wood per acre per year that are statutorily reserved from harvesting.

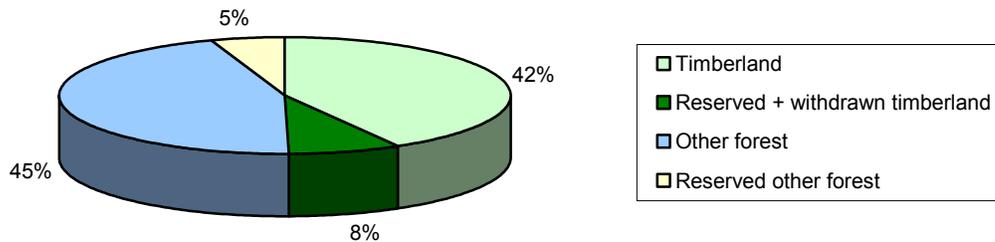
The current distribution of forest land by classification category is shown in Table 3 and Figure 6. Most of California's timberland is found in the North Coast, North Interior, and Sacramento resource areas. Most of the reserved forests and timberlands are found in the San Joaquin/Southern, North Interior, and North Coast resource areas.

Table 3. Area of forest land by classification and resource area (thousand acres), 1994

FIA Resource Area	Timberland	Reserved and withdrawn timberland	Other forest	Reserved other forest	Total forest
California	16,651	3,175	17,964	2,094	39,884
Central Coast	307	129	4,199	325	4,959
North Coast	3,413	385	787	112	4,697
North Interior	5,945	784	2,477	358	9,564
Sacramento	4,298	251	2,694	191	7,434
San Joaquin/Southern	2,688	1,626	7,807	1,108	13,228

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

Figure 6. Percentage area of forest land by classification, 1994



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

### Trends in forest land classification using FIA data

While most land classes have had relatively stable or slightly declining land bases over the last 40 years, timberlands transferred to reserved status have steadily increased (Table 4). Nearly two million acres were added to the reserved timberland class between 1953 and 1994. This trend has continued since 1994, with substantial amounts of timberlands shifting to reserved status. Examples include Pacific Lumber Company's 7,500 acre Headwaters land transfer in 1999 and reclassification of over 330,000 acres of the Sequoia National Forest to a national monument.

*While most forest land classes have had slightly declining land bases over the last 40 years, reserved status lands have steadily increased.*

Table 4. Changes in area of forest land by class (thousand acres), 1953 to 1994

Land class	1953	1975	1984	1994	1953-1994 (percent)
Timberland	17,317	16,299	16,264	16,651	-4
Reserved and withdrawn timberland	1,202	1,645	2,072	3,175	164
Other forest land	24,022	22,216	20,613	19,849	-17
Total forest land	42,541	40,160	38,949	39,675	-7

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

These numbers are somewhat limited due to changes in FIA procedures and definitions between survey periods. However, the trend is clear; the timberland base has decreased.

### Findings on land available and capable for timber production: timberland

Timberlands, a subset of the forest land base, are lands available and capable of growing at least 20 cubic feet of industrial wood per acre per year and managed for continuous fiber production (See [FIA Timber Resource Statistics, Statewide Results, California](#)). The following information is focused on timberlands as they are the land base that provide wood products for use by society.

## Timberland ownership

Timberland ownership is classified by FIA into four groups:

**Forest industry:** Companies that grow timber for industrial use. Includes those with and without wood processing plants.

**Other private:** Private lands not owned by forest industry. This includes farmer and rancher owned lands, private managed timberland, Native American lands, and miscellaneous private lands.

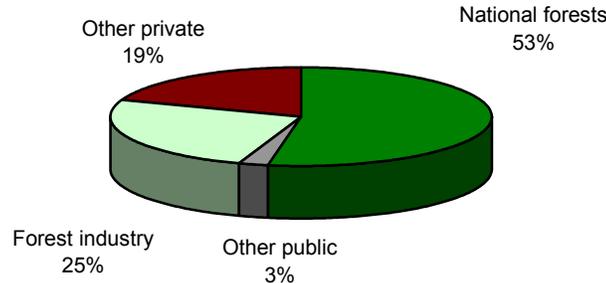
**National forests:** Land administered by the U.S. Forest Service.

**Other public:** Land administered by other federal, state, or local agencies.

Timberlands are concentrated on national forests, forest industry, and other private ownerships. National forests are the largest timberland owner in the State. The U.S. Forest Service holds 53 percent (8.8 millions acres) of timberlands while the forest industry holds 25 percent (4.2 million acres) of timberlands (Figure 7). Other private owners also have a large share of timberlands holding over 19 percent (3.2 million acres).

*Timberlands in California are concentrated on national forests (53 percent), forest industry (25 percent), and other private ownerships (19 percent).*

Figure 7: Percentage area of timberlands by ownership in California, 1994 (total timberland area: 16.6 million acres)



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

## Regional timberland ownership

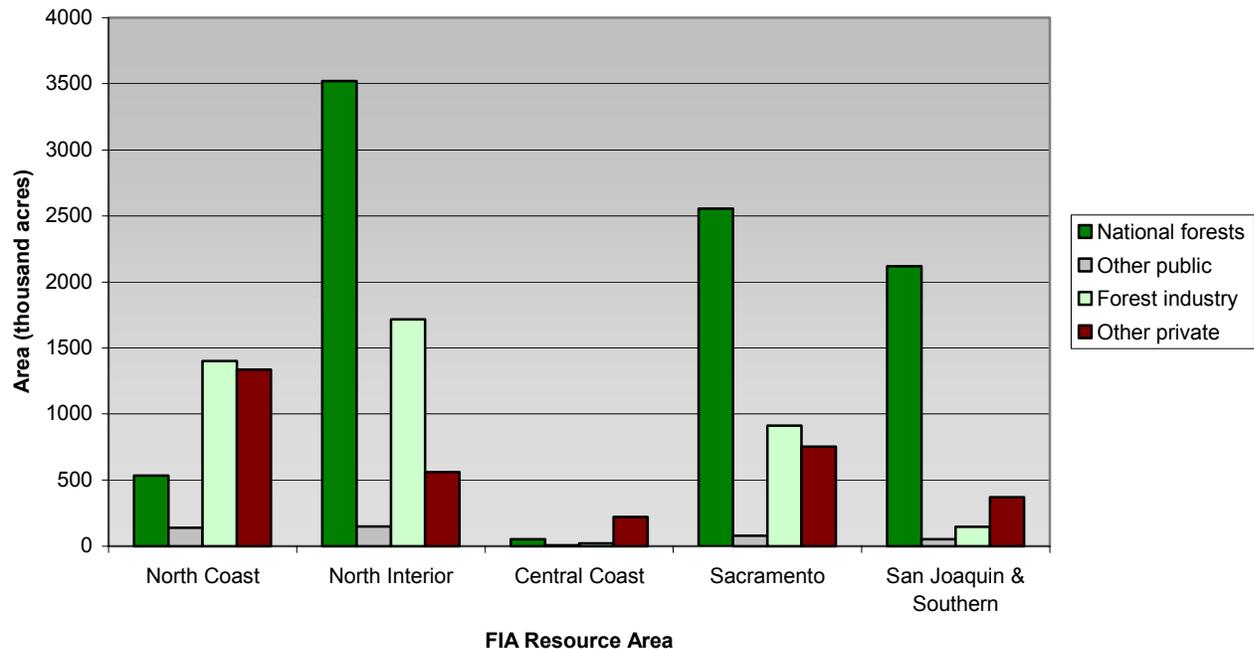
Distribution of timberland ownership differs considerably from one region to another (Table 5). National forests are the predominant timberland owners in the North Interior, Sacramento, and the combined San Joaquin/Southern resource areas. Forest industry has the largest holdings in the North Coast and substantial holdings in the North Interior. Other private owners are the predominant ownership category in the Central Coast. Figure 8 shows the relationship of timberland area by ownership and resource area.

Table 5. Area of timberland by ownership and FIA Resource Area (thousand acres)

Resource Area	Total private	Forest industry	Other private	Total public	USFS	Other public	Total
North Coast	2,738	1,402	1,336	675	535	140	3,413
North Interior	2,276	1,717	559	3,669	3,519	150	5,945
Sacramento	1,663	911	752	2,635	2,556	79	4,298
San Joaquin/Southern	515	146	369	2,173	2,120	53	2,688
Central Coast	245	22	223	62	55	7	307
California	7,437	4,198	3,239	9,214	8,785	429	16,651

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

Figure 8. Area of timberland by ownership and FIA Resource Area, 1994



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

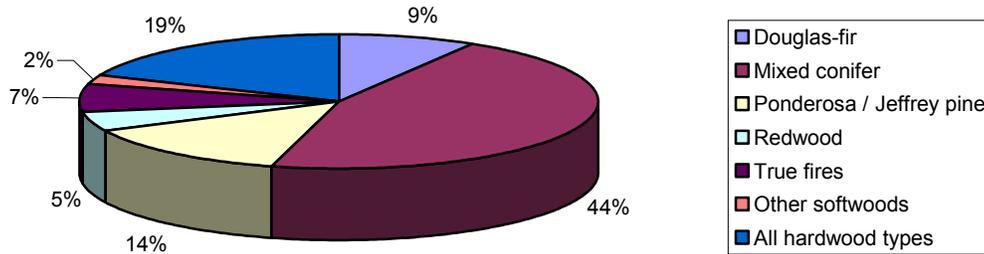
### Timberland area by forest type

Forest types relate to dominance of a tree species within forest stands. Different from habitat classification, which is related to use by wildlife, forest types help define silvicultural practices and commodity values. As defined in the FIA, stands with 70 percent or more stocking of a single species are assigned that dominant species' name.

Softwood forest types (stands dominated by coniferous trees, usually evergreen with needle like leaves) dominate California's timberlands. Approximately 77 percent of timberlands in the State are softwood dominant and approximately 18 percent are hardwood dominant. The forest types on timberlands have been grouped into seven general types (Figure 9), and a detailed listing of timberland area by forest types is shown in Table 6. The mixed conifer forest type is the most extensive in the State, covering 43 percent (7.2 million acres) of all timberlands. Mixed conifer is defined in FIA as various

combinations of sugar pine, ponderosa pine, Jeffery pine, incense cedar, Douglas fir, white fir, or red fir. Mixed conifer is found in every FIA resource area in the State, but is the predominant type found in the North Interior, Sacramento, and San Joaquin resource areas.

Figure 9. Percentage area of timberland by forest type, 1994



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

Table 6. Area of timberland by ownership and forest type, 1994

Forest type	National forest	Other public	Forest industry	Other private	All owners
Redwood	13	85	436	206	740
Douglas fir	865	18	210	291	1,384
Mixed conifer	4,430	150	1,849	731	7,160
Ponderosa Pine	1,164	19	256	198	1,637
Bishop Pine	-	-	-	3	3
Knobcone Pine	14	-	21	11	46
Jeffery Pine	341	15	71	99	526
Lodgepole Pine	119	4	30	23	176
Alpine types	55	-	-	-	55
Coulter Pine	21	-	-	3	24
Spruce	-	-	-	6	6
True firs	807	11	248	31	1,097
Other pines	-	2	3	4	9
Mountain Hemlock	-	-	-	-	-
Giant Sequoia	-	-	-	-	-
Other softwoods	-	-	-	-	-
Total softwoods	7,829	304	3,124	1,606	12,863
Bigleaf Maple	-	3	-	32	35
Red Alder	-	-	55	21	76
Pacific Madrone	-	11	61	108	180
Giant Chikapin	-	-	6	-	6
Eucalyptus	-	-	-	4	4
Tanoak	17	-	564	454	1,035
Black Cottonwood	-	2	5	-	7
Coast Live Oak	-	23	-	71	94
Canyon Live Oak	-	42	112	202	356
Oregon White Oak	-	9	10	151	170
California Black Oak	262	17	105	368	752
Valley White Oak	-	-	-	13	13
Interior Live Oak	-	2	6	62	70
Willow	-	-	-	12	12
California laurel	-	-	35	77	112
Pacific Dogwood	-	3	-	-	3
Blue Oak	-	-	-	4	4
White Alder	-	-	3	4	7
Quaking Aspen	-	13	-	-	13
Total hardwoods	279	125	962	1,583	2,949
Nonstocked	670	6	110	59	846
TOTAL	8,778	435	4,196	3,248	16,658

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

### Findings on timberland area by stand structure age class

FIA classifies timberlands by stand structure and age class. The stand structures included are evenaged, unevenaged, nonstocked, and undetermined. Age classes are decadal classes for evenaged stands and century classes for unevenaged stands.

Evenaged stands are in a forest where all trees are of similar age. The term is specifically defined as a forest stand where 70 percent or more of the tree stocking falls within three adjacent, decadal, age classes. Within FIA, all other stands were classified as unevenaged, which represents a wider distribution of age classes in



Evenaged stand.

the forest stands as compared to evenaged stands.

Information on area of evenaged stands is provided in age class groups with 21 ten-year intervals. For unevenaged stands, the age class groups are based on either an average stand age of less than or greater than 100 years (see Table 7).

Table 7. Area of timberland by ownership and age class, 1994 (thousand acres)

	National forest	Other public	Forest industry	Other private	All owners
<b>Evenaged</b>					
0-9	395	40	181	73	687
10-19	27	13	107	48	195
20-29	109	6	141	52	307
30-39	107	15	206	259	587
40-49	12	4	225	167	409
50-59	55	16	277	228	576
60-69	20	16	318	216	567
70-79	277	42	293	221	832
80-89	252	27	145	198	622
90-99	606	18	91	242	955
100-109	941	6	52	96	1094
110-119	857	0	40	45	943
120-129	1050	0	0	10	1060
130-139	404	0	20	6	430
140-149	481	0	0	0	481
150-159	626	0	0	5	631
160-169	143	0	23	0	165
170-179	276	1	0	0	278
180-189	364	0	4	0	368
190-199	453	1	8	0	461
200-299	404	0	20	14	439
300+	30	9	13	11	64
Total evenaged	7889	214	2164	1891	12151
<b>Unevenaged</b>					
< 100	0	134	1252	832	2215
100+	0	77	668	450	1195
Total unevenaged	0	211	1920	1282	3410
Nonstocked*	671	6	116	72	866
Undetermined					226
Total <100	1860	331	3236	2536	7952
Total 100+	6029	94	848	637	7609
Total all aged	8784	429	4198	3239	16650

(0) – None found; recent clear cuts scheduled for planting are included

\*Non-stocked areas are less than 10 percent stocked with live trees.

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

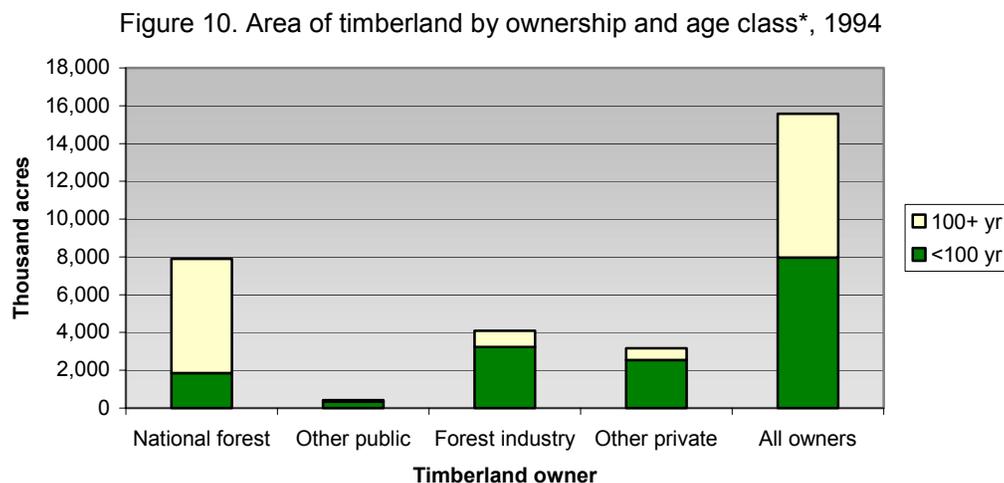
In reviewing the proportions of stand structures under FIA classifications, nearly 73 percent of the timberlands in California were classified as evenaged by the FIA. However, this is not a clear representation of the stand structures in the State. Timberlands in national forests were all classified as evenaged, although a substantial portion of these lands may be similar to unevenaged stand structure identified on non-Forest Service lands. When considering the proportion of even and unevenaged stand structures on all ownerships except national forests, 57 percent of timberlands are classified as evenaged and 43 percent are classified as unevenaged.

## Distribution of timberland area by age classes for all ownerships

The current distribution of timberlands based on the average stand age as determined by U.S. Forest Service field crews provides considerable information on what has occurred within the timberlands over the past centuries as well as what the timberlands will look like in decades to come. The picture is somewhat limited by differences in protocols used on national forest and other forest lands as well as the difference between the decade based determinations for evenaged stands and the century based determinations for unevenaged stands (used only outside the national forests).

*Timberland area is evenly distributed between stands greater than 100 years of age and those less than 100 years of age.*

By grouping age class information from Table 7 in century age class groupings, a broad picture age class distribution of California's timberland areas (including both even and unevenaged stands) can be made. As shown in Figure 10, timberlands have a large proportion of the area in mature forest stands greater than 100 years of age. There is almost an even distribution between stands greater than 100 years of age and those less than 100 years of age.



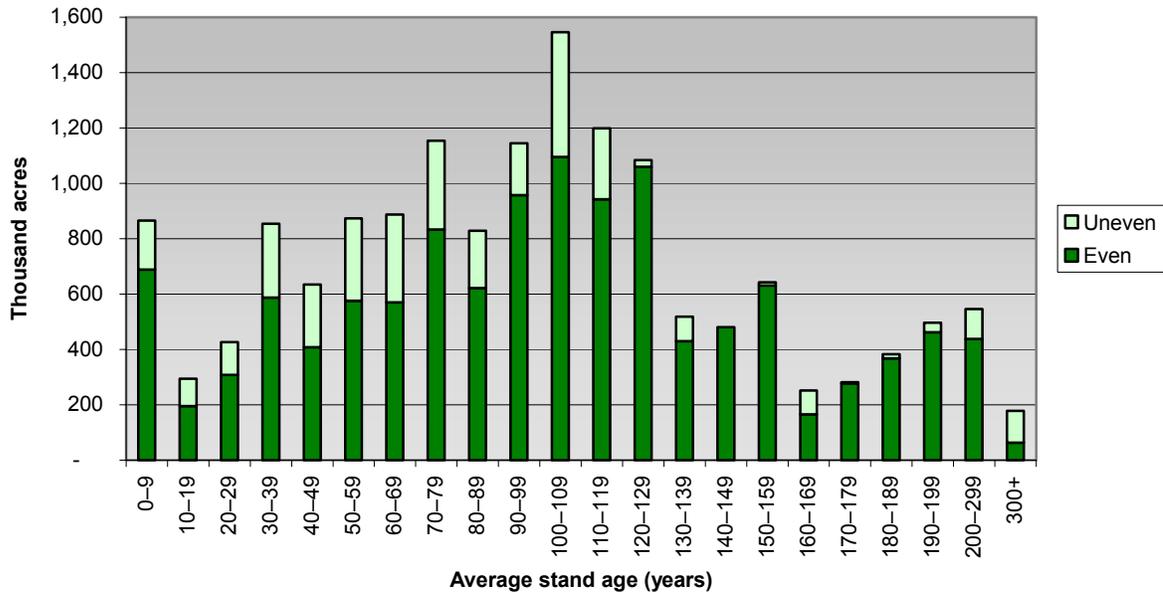
\*Excludes nonstocked and undetermined age classes

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

However, a more comprehensive view of the pattern of timberland forest structures is gained by viewing all timberlands (both evenaged and unevenaged) in ten-year age class groups. To accomplish this, two assumptions are made. The first assumption is that the decades of evenaged harvest activity for each ownership are the best proxy for unevenaged forest management activities. The second assumption is that this is a reasonable median age estimate for unevenaged stands. Unevenaged stand acres are then allocated from century-based age groups to decade-based age groups based on the evenaged decade's area as a percentage of each century's area. Since no national forest stands were classified as unevenaged, the only significant implication of this synthesis is that forest industry lands have slightly more of their unevenaged acres placed in younger decade-based age classes compared to other private acres. While this allocation of unevenaged stands to decadal groups may not be a complete picture of timberland age distribution, it serves as an approximation.

Figure 11 summarizes the estimated age class distribution of all timberlands in the State. Approximately half of all timberlands have stand ages between 50 and 120 years. A quarter of the stands are younger than 50 years and another quarter are older than 120 years. Within many of stands, some of the trees will be older or younger than the average age of the stand. This will be most pronounced in the unevenaged stands.

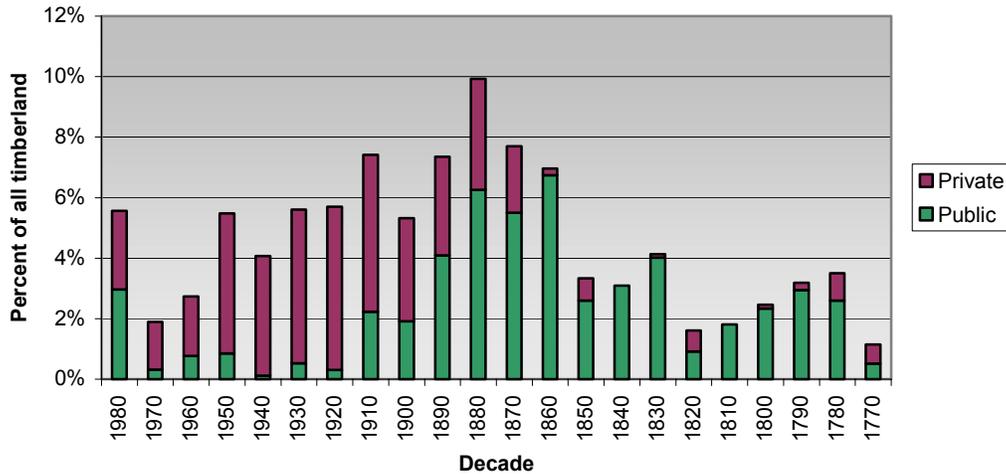
Figure 11. Area of timberland by age class, 1994



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

Another way to consider the average stand age is the length of time since the last major stand-replacing event. Until the 1920s, major fires were probably the most significant determinant of stand structure. Since the advent of effective forest fire suppression, harvests have become the most likely major determinant. In all periods, insects, diseases, and major storms have also played roles in causing stand-replacing events. Based on this reconstruction of stand history, it appears that the last three decades of the nineteenth century had far more stand replacing events than any other period in California's history (Figure 12).

Figure 12. Estimated decade of last major stand replacing event (fires, total harvest, insects, disease, storms)

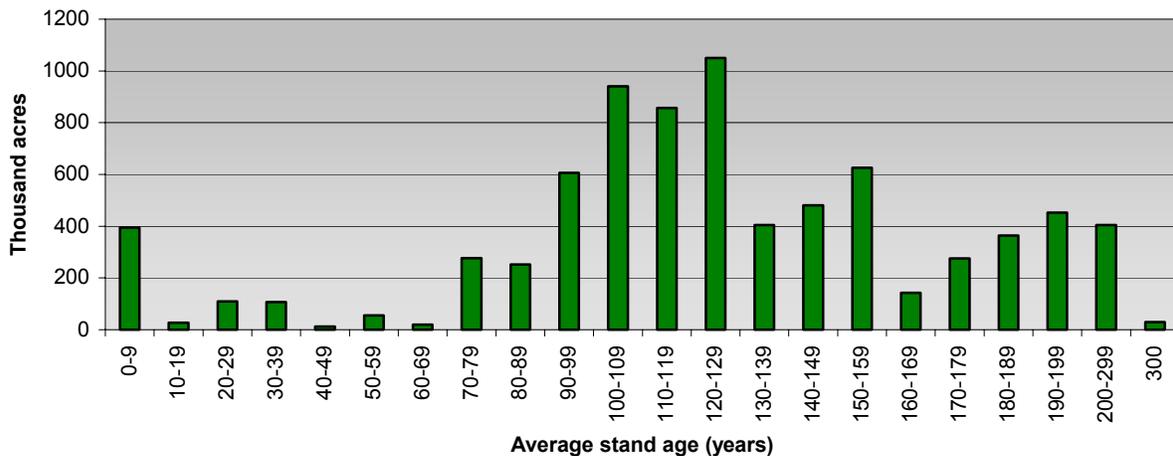


Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

### Distribution of timberland area by age classes: national forests

Selective timber harvesting was the dominant silvicultural method of the U.S. Forest Service until the 1980s. At that time, their inventory system classifies all stands into dominant evenaged classes. The age distribution for national forests is a near opposite of private lands with 69 percent of stands on national forests are older than 100 years (Figure 13). While most accessible areas of national forest timberlands had some degree of harvesting by the mid 1990s, the dominant factor affecting the overall stand structure were large-scale fires preceding effective fire control on national forest lands in the 1920s. The use of evenaged silviculture was not widely used until the 1980s. It had a relatively small impact compared to the nearly nine million acres of timberlands in national forests.

Figure 13. Area of timberland by age class (national forests)



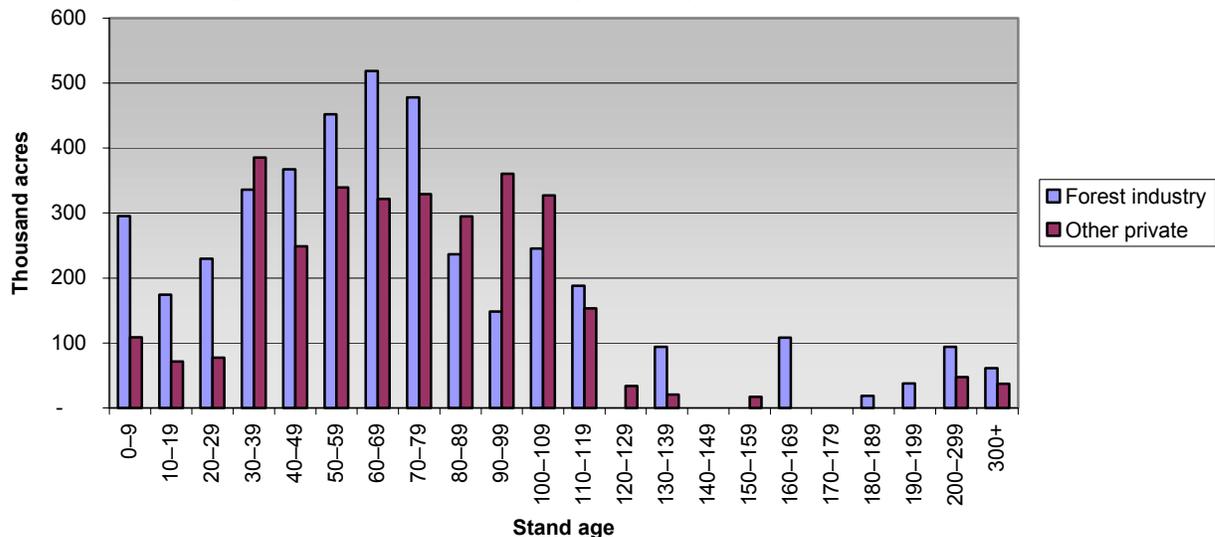
Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

### Distribution of timberland area by age classes: private timberlands

Private timberlands have a very different history than national forests and other public timberlands in California. Many private timberland ownerships were established and harvested soon after statehood throughout the Sierra Nevada foothills and around coastal areas such as Santa Cruz, San Francisco Bay, Central Mendocino, and Humboldt Bay.

Over time, there has been considerable transfer of timberlands between forest industry ownerships with associated timber mills and other private timberland owners. A comparison of the stand age structure for the two types of owners shows that the forest industry has harvested and replanted more of their lands in the past 50 years and hence have more younger stands than other private owners (Figure 14). A corollary of this pattern is that, compared to the forest industry, other private owners now have a more acres of mature, but not old, stands potentially available for harvests.

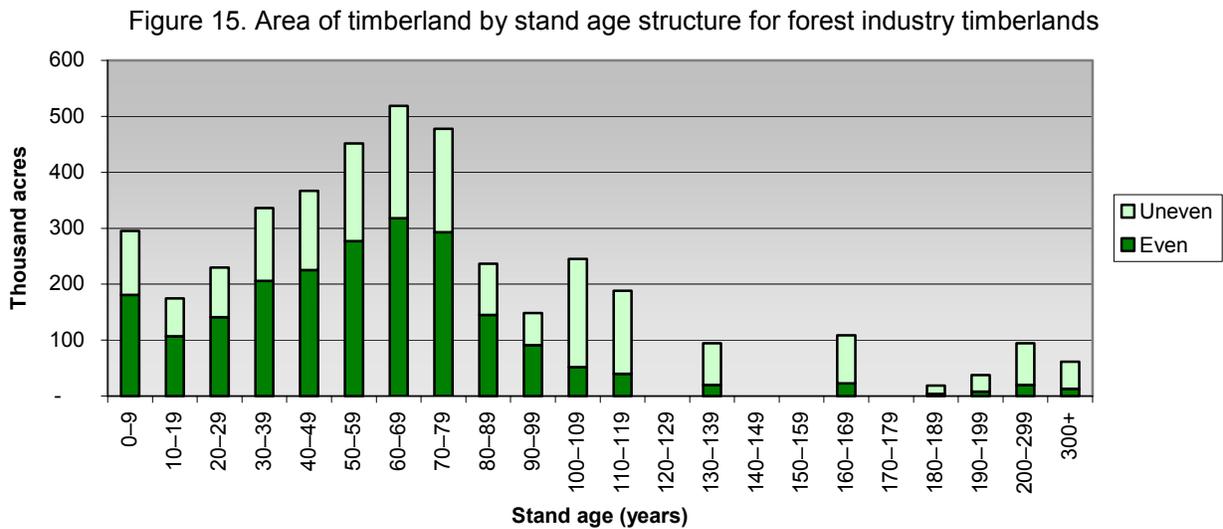
Figure 14. Area of timberland by stand age for private timberlands



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

### Distribution of timberland area by age classes: forest industry

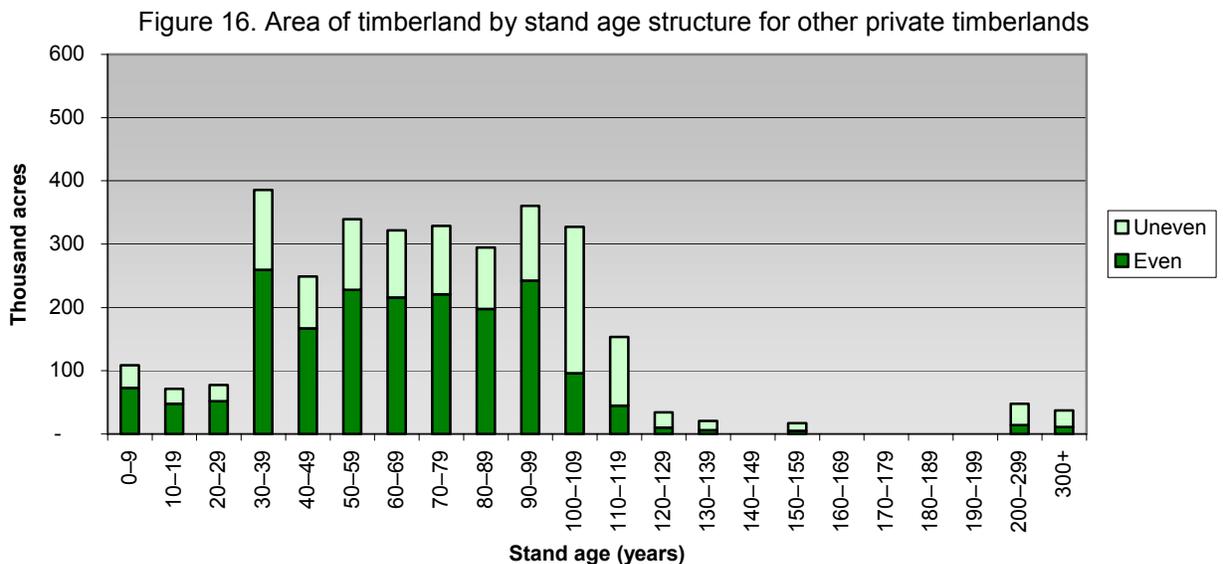
The timberlands owned by forest industry are the most productive and intensively managed timberlands in the State. Ownership of more productive sites, often in large contiguous blocks allows them to maximize financial returns from timber revenues. In 1994, approximately 77 percent of all forest industry land was covered with stands less than 100 years in age (Figure 15). In terms of stand structure, 46 percent of these acres were classified as unevenaged, 52 percent were evenaged, and the remainder was nonstocked.



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

### Distribution of timberland area by age classes: other private

Timberlands owned by other private owners differ from industrial timberlands in a number of respects. While they control around 75 percent of total timberland as the forest industry, other private owners have older stands (Figure 16). Additionally, other private owners hold roughly half of all acres of where the trees are of harvestable ages. The relative mix of even and unevenaged stands is comparable to forest industry ownerships. Compared to the industrial owners, other private owners control less than a third as many acres where stand age is greater than 150 years. Detailed analysis of tree populations as opposed to stand groups shows that other private owners and the forest industry have equal numbers of trees older than 150 years.



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

## Stages of development of timberland stands

To portray the stages of development or seral stage (the change in species composition and stand structure that occur in plant communities over time) of the State's timberlands, FIA classified forest development into several groups primarily based on the age of the stands (Table 8).

Table 8. Area of timberland by stage of development (thousand acres), 1994

Stand age	Stage of development	National forest	Other public	Forest industry	Other private	All owners
Nonstocked and 1-29 (evenaged)	Early seral	1,202	65	545	245	2,055
30-49 (evenaged)	Early mid-seral	119	19	431	426	996
50-99 (evenaged)	Late mid-seral	1210	253	2376	1937	5767
100+ (evenaged and unevenaged)	Late seral	6029	94	848	637	7609
Total		8560	431	4200	3245	16427

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

## Implications of California's timberland age and stage of development distribution

The current age and seral stage distribution in the State suggests several observations about California's forests from a timber production viewpoint. First, there is clear distinction in the age class distribution between public and private ownerships. On private lands, 77 percent of the forests are less than 100 years old, while on public lands nearly 70 percent of timberlands are over 100 years of age. The exact nature of harvest policies for public and private timberlands will have major implications on the mix of the size of the logs harvested as well as the types of timber stands entered for harvesting and regeneration.

Second, the abundance of relatively early and mid-seral age classes of trees on private lands, especially on forest industry lands, means relatively low volumes and smaller tree products are currently available compared to previous decades. A considerable portion of future harvests will probably come from stands in the late mid-seral and late seral categories. Much of this will be on other private ownerships that have not been harvested as actively as forest industry holdings over the past few decades.

Currently, the forest industry's log sources from public lands are at historic lows, and private timberland owners continue to harvest younger stands comprised of smaller trees. While these younger stands yield products of lower quality than traditional clear lumber, new types of products including panel board, and jointed lumber are emerging as viable markets for smaller diameter logs. For further discussion of the trends in forest products from California, see [Forest Products Industry](#).

## Findings on softwood timberland area by size class

Timberlands with softwood sawtimber size trees are the greatest component of timberland acres in the State. Nearly 60 percent (7.7 million acres) of the State's softwood timberland stands are classified as sawtimber size (a stand with a mean diameter larger than nine inches DBH) (Table 9). While national forests hold the greatest number of acres in sawtimber, other private owners hold the greatest percentage of its lands in sawtimber size stands (90 percent). This suggests that other private landowners could be an

important provider of commercial timber. Large portions of their holdings are at or will be of commercial size in the near future (Table 9).

Table 9. Area of softwood timberland by size class and owner (thousand acres), 1994

Owner	Sawtimber (>9" dbh)	Poletimber (5" to 9" dbh)	Seedling/Sapling (< 5" dbh)	All sizes
National forest	4,610	764	586	7,720
Other public	230	50	24	302
Forest industry	2,622	235	269	3,124
Other private	1,458	74	71	1,603
All owners	7,645	1,124	950	12,750

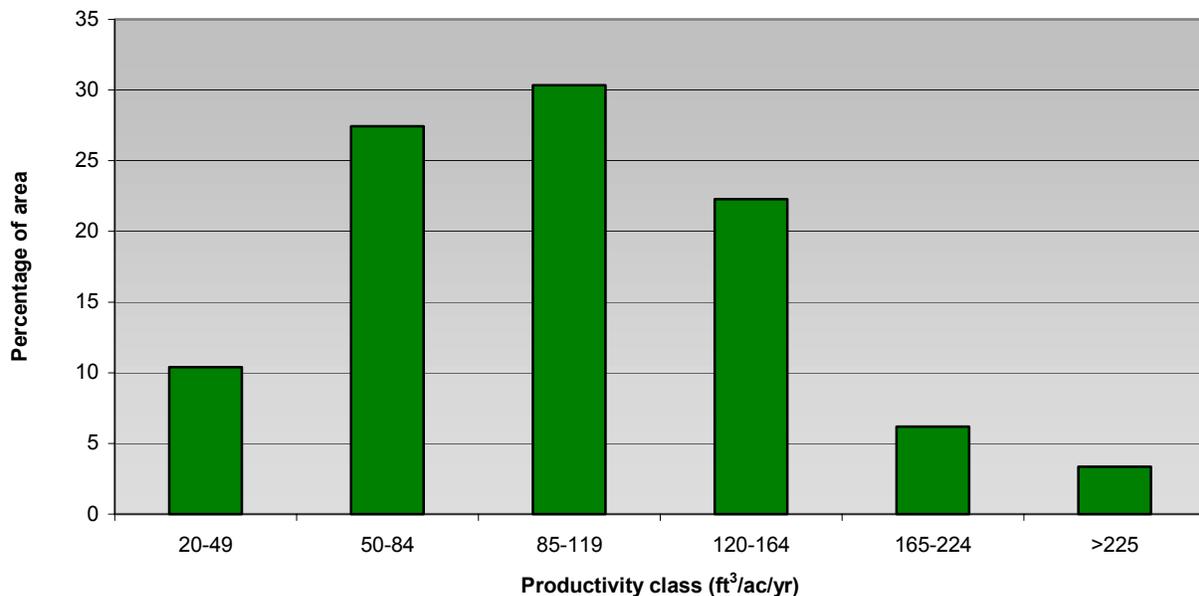
Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

### Findings on timberland by productivity class

Timberland productivity refers to the capability of the land to grow trees. In California, 32 percent of the timberlands are in the most productive classes, which can produce more than 120 cubic feet per acre per year (Figure 17). This compares to the U.S. average of 13 percent and 17 percent in the southeast (Bolsinger et al, 1997).

Forest industry holds the greatest percentage of highly productive timberlands of any owner with nearly 45 percent in the classes that can produce more than 120 cubic feet per acre per year (Table 10).

Figure 17. Percentage area of timberland by productivity class, 1994



Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

Table 10. Area of timberland by productivity class and owner (thousand acres), 1994

Owner	Productivity class					
	20-49	50-84	85-119	120-164	165-224	>225
National forest	741	2727	3164	1881	258	12
Other public	81	82	122	48	45	53
Forest industry	360	880	1085	1039	487	347
Other private	549	879	682	741	240	147
Totals	1,730	4,568	5,055	3,709	1,031	560
Timberlands (%)	10	27	30	22	6	3

Percentages may not add due to rounding

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

## Regional productivity

In terms of the percentage of timberlands within a productivity class, the Central Coast and North Coast resource areas hold the greatest portion of lands in high productivity classes. Over 84 percent of the Central Coast timberlands and 53 percent of the North Coast timberlands are in site classes capable of producing greater than 120 cubic feet per acre per year (Table 11).

Table 11. Area of timberland by site class and resource area (thousand acres), 1994

Resource Area	Site class (cubic feet/acre/year)						All classes	Percentage total timberlands in high site classes (120-164, 165-224 and >225 site classes)
	20-49	50-84	85-119	120-164	165-224	>225		
North Coast	68	523	1002	938	486	396	3,413	53
Central Coast	6	15	27	124	63	72	307	84
San Joaquin/Southern	494	707	711	659	63	34	2,688	28
Sacramento	556	995	1377	1,137	208	25	4,298	32
North Interior	606	2,328	1916	851	211	33	5,945	18
Total	1,730	4,568	5053	3,709	1,031	560	16,651	32

Source: compiled by FRAP from Waddell and Bassett, 1996, 1997

For additional information on the productivity of timberlands designated as Timber Production Zones (TPZ), see [Maintenance of Productivity of Forest Lands by Zoning](#) or [Timberland Site Class on Private Lands Zoned for Timber Production](#).

## Findings on changes in timberland area

The timberland base of California changes in response to several factors. The primary cause of change is a physical conversion to non-timber condition (e.g., orchards or agricultural lands) or permanent conversion to urbanization. Other land use changes that affect timberland are transfers to another administrative status, such as transfer to a reserved status where commodity production is not permitted or permitted only under very specific conditions.

***Over 246,000 acres of timberland became unavailable for timber management due to physical changes to the land or change in administrative status between 1984 and 1994.***

Based on FIA estimates, the total decrease in the timberland base (outside national forests) due to all causes was 246,000 acres, or three percent of the 1984 timberland base (Table 12) from 1984 to 1994. The leading cause in the timberland base reduction was change to reserve status. Nearly 70 percent (171,000 acres) of the decrease in the timberland base was a result of land transferred to the reserve status (e.g., wilderness, ecological reserves, parks, and open space uses).

Table 12. Changes in area of timberland outside national forests by FIA resource area, 1984 to 1994 (thousand acres)

	North Coast	San Joaquin/Southern	North Interior	Sacramento	Central Coast	Total
Converted timberland area, 1984	3050	558	2507	1807	295	8217
Physical change (land conversion)	-47	-14	-8	-7	0	-76
Change in administrative status	-64	-13	-42	-16	-36	-171
Timberland area, 1994	2939	531	2457	1784	260	7971
Net change	-111	-27	-50	-23	-35	-246

*Totals may not add due to rounding*

*Source: compiled by FRAP from Waddell and Bassett, 1996, 1997*

Table 13 shows physical conversion changes in timberland acres outside of national forests between 1984 and 1994 by cause for each FIA resource area. Physical conversions generally include the removal of trees and other vegetation from the land for conversion to other land uses. Results of this summary show a statewide net loss of 76,000 acres of timberland over a ten-year period (7,600 acres per year). The leading cause of timberland conversion was for use as rights-of-way that included roads, power lines, railways, and pipeline clearing, which together accounted for 46,000 acres (60 percent) of the total conversion. Also important to note is that while there was a net decrease of 76,000 acres, 108,000 were converted and 32,000 were gained. Often these are not equal trades, as lands reverted from agricultural or rights-of-way decommissioned and reforested will take a long time to resemble mature forests.

Based on FIA information, the North Coast resource area has the largest non-national forest timberland base (37 percent of the statewide timberland base outside national forests). This resource area showed the largest net change with over 47,000 acres (1.5 percent of the resource area's timberland base) being converted to another use.

Table 13. Changes in area of timberland (outside national forest) due to physical conversions, 1984 to 1994 (thousands of acres)

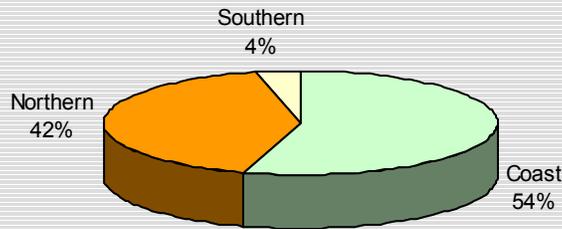
Conversion type	North Coast	San Joaquin/Southern	North Interior	Sacramento	Central Coast	Total
Timberland to rights-of-way	-41	-14	-8	-7	-	-70
Timberland to urban	-21	-	-	-	-	-21
Timberland to agriculture	-17	-	-	-	-	-17
Rights-of-way to timberland	24	-	-	-	-	24
Agriculture to timberland	8	-	-	-	-	8
Net change	-47	-14	-8	-7	0	-76

*(-): indicates no measured change in area*

*Source: compiled by FRAP from Waddell and Bassett, 1996, 1997*

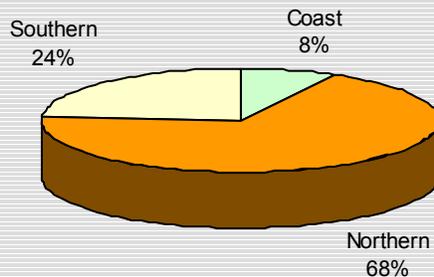
**CDF estimates of timberland conversion:** CDF's conversion statistics provide information about trends in the locations and trends purposes of conversion of private timberlands (as defined in the conversion process) from 1969 to 1998. For a detailed discussion of these records, see cited Technical Paper 1-01-02. Over this period, the concentrations of conversions as recorded by CDF have moved from the Coast (Marin County to Oregon border) to the Northern Interior (Nevada County to Oregon border) parts of the State (Figures 18 and 19).

Figure 18. Percentage area of timberland conversions by region, 1969 to 1978



Source: FRAP, 2002c

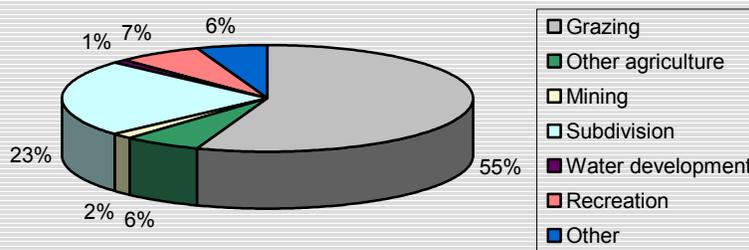
Figure 19. Percentage area of timberland conversions by region, 1989 to 1998



Source: FRAP, 2002c

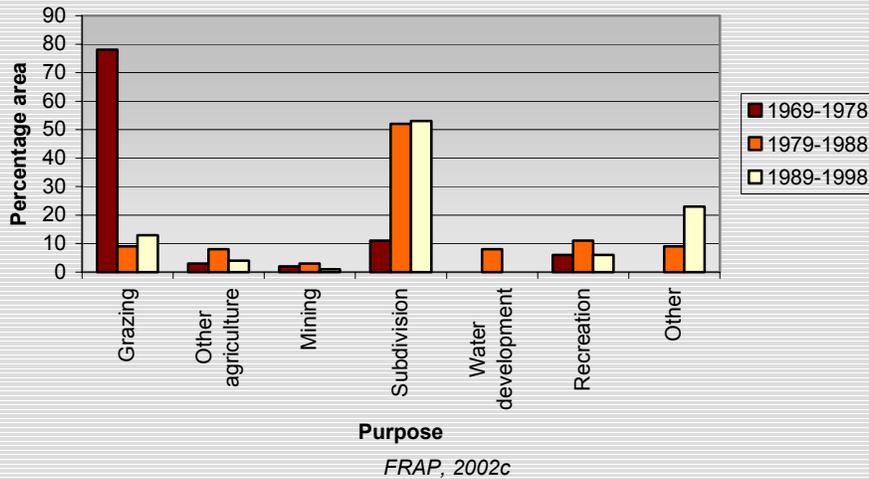
Over the last three decades, 56 percent of the total timberland conversion acreage was for grazing, 24 percent for subdivision development, and the remaining 20 percent for other agriculture, mining, water development, recreation, and other land uses (Figure 20). However, conversions for grazing have declined since 1978 and conversion for subdivisions has increased (Figure 21). For more information see the online paper [Timberland Conversion in California from 1969-1998](#).

Figure 20. Percentage area of timberland conversion by cause, 1969-1998



Source: FRAP, 2002c

Figure 21. Percentage area of change by purpose of timberland conversions, 1969-1998



**Future projection of timberland base (Excerpts from *An Analysis of the Timber Situation in the United States: 1952 to 2050: A technical document supporting the 2000 USDA Forest Service RPA Assessment*)**

**2000 RPA Timber Assessment**

To help portray the expected impacts on forest resources, the federal Secretary of Agriculture prepares a Renewable Resource Assessment every ten years as directed by the Forest and Rangeland Renewable Resources Planning Act of 1974 (amended by the National Forest Management Act of 1976). One component of the RPA is a projection of timberland area by year 2050. Future forest area (Alig et al., 1983) includes assumptions about changes in area by ownership, forest cover type, and site. The RPA uses land area projection computer models to determine land area change at regional and national scales. See [Timber Situation in the United States: 1952 to 2050](#)

Change in total timberland area is the net result of:

- conversion of timberland to other uses;
- shifting of non-forest to timberland by reforestation or afforestation; and
- public land withdrawals for non-timber uses.

Timberland conversion takes place as the result of land clearing for agriculture, highways, power lines, and reservoirs, along with urban development. The rate of loss of timberland to developed uses depends on population growth and changes in the real income of individuals. Increasing populations raise the demand for land for residences and places to work and recreate. In general, as incomes increase, more land is used for living and recreation. Incomes from land enterprises, such as agriculture and forestry, influence shifting of non-forest to timberland by reforestation or afforestation land uses. Owners shift their land use based on price of the basic commodity and the suitability of their land to produce a specific

crop. Public lands can be withdrawn for parks, wilderness, and other recreation uses. At the same time, public forest land can be reclassified as timberland including cases when new surveys result in revised forest productivity estimates (Smith et al, 2001).

The results of the RPA timberland area projection show a national decrease of timberland area between 1997 and 2050 of about 3 percent. The Pacific Coast region, which includes California, Oregon, Alaska, and Washington, is projected to lose approximately 4 percent of its timberland base during this period. This compares to the 3 percent timberland area decrease for California between 1984 and 1994. Table 14 summarizes the national projections. For further analysis of the historic and projected change in forest land area, see [Habitat Loss and Alteration](#).

Table 14. Area of timberland in the United States by ownership and region, 1953 to 2050 (million acres)

	1953	1963	1977*	1987*	1997**	2010	2020	2030	2040	2050
<b>Forest land</b>	756	762	744	736	747	746	742	736	730	724
<b>Region</b>										
North	161	162	164	166	170	172	171	169	166	164
South	226	228	217	211	214	213	213	212	211	211
Rocky Mountain	141	140	138	140	143	144	144	144	143	143
Pacific Coast	228	227	224	220	219	216	214	212	209	207
<b>Timberland ownership</b>										
Public	145	146	138	131	146	146	146	146	146	146
Forest industry	59	61	69	70	67	66	66	65	65	64
NIPF	304	308	258	284	291	290	287	285	281	279
Total	509	515	492	485	504	502	499	496	492	489
<b>Region</b>										
North	154	157	153	154	159	159	158	156	153	151
South	205	209	200	197	201	201	200	199	199	198
Rocky Mountain	67	67	60	61	71	71	71	71	71	71
Pacific Coast	83	83	79	72	72	71	70	70	70	69
Total	509	515	492	485	504	502	499	496	492	489

*Data may not add to totals because of rounding*

*\*Data were revised after 1989 RPA tables were developed*

*\*\*Native American lands 1953-2050 are now included in Non-industrial Private Forest; in past, reports were shown in public lands*

*Source: U.S. Forest Service, 2002*

## Glossary

**afforestation:** The establishment of a forest in an area where preceding vegetation or land was not forest (Helm, 1998).

**California Wildlife Habitat Relationship:** The California Wildlife Habitat Relationship is a state-of-the-art classification system for California's wildlife. CWHR contains life history, management, and habitat relationships information on 675 species of amphibians, reptiles, birds, and mammals known to occur in the State. CWHR products are available for purchase by anyone interested in understanding, conserving, and managing California's wildlife.

**conifer:** Trees belonging to the order Gymnospermae, comprising a wide range of trees that are mostly evergreens. Conifers bear cones and have needle-shaped or scalelike leaves. In the wood products industry the term "softwoods" refers to the conifers.

**CWHR:** See **California Wildlife Habitat Relationship**.

**DBH:** See **diameter at breast height**.

**diameter at breast height:** Tree trunk diameters are measured at breast height, defined as the diameter of the tree 4.5 feet (1.37 m) above ground on the uphill side of the tree.

**disturbance regime:** A natural or human caused event like floods, fire, and storms that shape vegetative composition and seral stage.

**evenaged stand:** A forest stand or forest type in which relatively small (10-20 year) age differences exist between individual trees. Evenaged stands are often the result of fire, or a harvesting method such as clear-cutting or the shelterwood method; Forest stand where more than 70 percent of the tree stocking falls within three adjacent, decadal, age classes.

**FIA:** See **Forest Inventory and Analysis**.

**The Forest and Rangeland Renewable Resources Planning Act of 1974:** An assessment of the nation's renewable resources every 10 years conducted by the U.S. Forest Service.

**Forest Industry:** Lands owned by companies that grow timber for industrial use. Includes companies both with and without wood processing plants; An ownership class in the USDA FS PNW Experiment Station Forest Inventory and Analysis program.

**Forest Inventory and Analysis:** Forest land and timberland statistics reported by the Pacific Resource Inventory, Monitoring and Evaluation program (PRIME) of PNW. Every decade, PRIME conducts the Forest Inventory and Analysis, which is a national mandate authorized by the Forest and Rangeland Renewable Resource Research Act of 1978. The FIA is a plot-based survey and statistical analysis with representative field based plots of all forest lands outside the National Forest System.

**forest land:** Land at least 10 percent canopy cover with live trees.

**hardwoods:** Dicotyledonous trees; trees that are generally deciduous, broad-leafed species such as oak, alder, or maple.

**National Forest:** Federal lands that have been designated by Executive Order or statute as National Forest or purchase units and other lands under the administration of the U.S. Forest Service (U.S. Department of Agriculture).

**natural reversion:** The process of abandoned crop and pastureland converting to forest land.

**Other Forest:** Forest land incapable of growing 20 cubic feet of industrial wood per acre per year (mean increment at culmination in fully stocked, natural stands) due to adverse conditions. Such conditions include sterile soils, dry climate, poor drainage, subalpine sites, steepness, or rockiness.

**Other Private:** Private lands not owned by forest industry; an ownership class in the USDA FS PNW Experiment Station Forest Inventory and Analysis program.

**pioneer species:** The first plants and animals to colonize a new habitat. Pioneer species are typically opportunistic species that can quickly inhabit the area. They have great dispersal capabilities, as well as an ability to reproduce rapidly and abundantly.

**reforestation:** The natural or artificial restocking (i.e., planting, seeding) of an area with forest trees.

**Reserved Other Forest:** Forest land not capable of growing 20 cubic feet of industrial wood per acre per year because of steepness or rockiness. Reserved other forests are statutorily reserved from harvesting.

**Reserved Timberland:** Forest land capable of growing 20 cubic feet or more per acre per year (mean annual increment at culmination in fully stocked, natural stands) of industrial wood and withdrawn from timber utilization through statute, ordinance, or administrative order.

**RPA:** See **The Forest and Rangeland Renewable Resources Planning Act of 1974.**

**sawtimber:** Live trees of commercial species containing at least one 12' sawlog or two noncontiguous 8' logs. Softwoods must be at least 9" in diameter and hardwoods at least 11" in diameter.

**seral development:** The change in species composition and structural elements such as size, canopy closure, and age distribution that occurs in a plant community over time.

**silviculture:** Generally, the science and art of cultivating (such as with growing and tending) forest crops, based on the knowledge of silvics. More explicitly, the theory and practice of controlling the establishment, composition, constitution, and growth of forests.

**site class:** The measure of the relative productive capacity of a site for a particular crop or stand, generally based on tree height at a given age.

**softwoods:** Coniferous trees, usually evergreen, having leaves that are needles or scale like.

**stand:** A group of trees sufficiently uniform in composition, age, and/or condition as to form a management entity and distinguishable from adjoining groups of trees.

**timberland:** Forest land capable of growing 20 cubic feet or more of industrial wood per acre per year (mean increment at culmination in fully stocked, natural stands). Timberland is not in a reserved status through removal of the area from timber utilization by statute, ordinance, or administrative order and is not in a withdrawn status pending consideration for reserved.

**unevenaged:** Silvicultural system in which individual trees originate at different times and result in a forest with trees of many ages and sizes; stands where less than 70 percent of the tree stocking falls in three adjacent 10 year age classes.

**withdrawn timberland:** A term used by the U.S. Forest Service to refer to timberland that is being considered for permanent reserved status, but currently has a pending status.

### Literature cited

- Alig, R., D. Adams, and B. McCarl. 1983. Long-range projection of forest area change: new approaches are needed. *Journal of Forestry* 81(11):723-727.
- Bolsinger, C.L., N. McKay, D.R. Gedney, and C. Alerich. 1997. Washington's public and private Forests. Resource Bulletin PNW-RB-218. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station.
- Helm, J. 1998. *The Dictionary of Forestry*. The Society of American Foresters. Bethesda, MD.
- Fire and Resource Assessment Program (FRAP). 1998. California Biodiversity Council Bioregions, v98\_1. Sacramento, CA. <http://frap.cdf.ca.gov/data/frapgisdata/select.asp>.
- Fire and Resource Assessment Program (FRAP). 1999. Teale Data Center Government Ownership, (GOVTOWNA, 1999). Sacramento, CA.
- Fire and Resource Assessment Program (FRAP). 2002a. Multi-source Land Cover, v02\_1. Sacramento, CA. <http://frap.cdf.ca.gov/projects/frapgisdata/select.asp>.
- Fire and Resource Assessment Program (FRAP). 2002b. Methods for development of habitat data: Forest and Range 2002 Assessment. Technical Working Paper 8-19-02. Sacramento, CA. Web site accessed June 16, 2003. [http://frap.cdf.ca.gov/projects/frap\\_veg/Methods\\_Development\\_Habitat\\_Data.pdf](http://frap.cdf.ca.gov/projects/frap_veg/Methods_Development_Habitat_Data.pdf).
- Fire and Resource Assessment Program (FRAP). 2002c. Timberland Conversion in California from 1969-1998. Technical Working paper 1-01-02. Sacramento, CA. Web site accessed June 16, 2003. [http://frap.cdf.ca.gov/publications/timberland\\_conversion.pdf](http://frap.cdf.ca.gov/publications/timberland_conversion.pdf)
- Smith, W.B., J.S. Vissage, R. Sheffield, and D.R. Darr. 2001. Forest resources of the United States, 1997. General Technical Report NC-219. St. Paul, MN: U.S. Forest Service, North Central Research Station.
- U.S. Forest Service. 2002. RPA timber assessment tables March 28, 2002. In: Haynes, R.W. (technical coordinator). An analysis of the timber situation in the United States: 1952 to 2050: A technical document supporting the 2000 USDA Forest Service RPA Assessment. Web site accessed June 16, 2003. <http://www.fs.fed.us/pnw/sev/rpa/>.
- Waddell, K.L. and P.M. Bassett. 1996. Timber resource statistics for the North Coast Resource area of California. Resource Bulletin PNW-RB-214. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station.
- Waddell, K.L. and P.M. Bassett. 1997. Timber resource statistics for resource areas of California. Resource Bulletins PNW-RB-221, PNW-RB-222, PNW-RB-220, PNW-RB-224. Portland, OR: U.S. Forest Service, Pacific Northwest Research Station.