4.5.3 Vegetation and Plant Species of Special Concern

4.5.3.1 Introduction

The following section discusses the environmental setting for plants of special concern and vegetation. The discussion is focused primarily on vegetation types in Forest and Range settings that are most likely to be affected by the Vegetation Treatment Program.

4.5.3.2 Plant Species of Special Concern

Rare, Threatened, Endangered, and candidate plant species are recognized by the state as having inherent value. Authority for the protection of these species is provided primarily through CEQA standards, Fish and Game Codes, the Native Plant Protection Act, and the California Endangered Species Act (CESA). Protection of plant species is also authorized by California Forest Practice Act, Forest Practice Rules, and the Timber Harvest Plan review process. However consultation with the DFG and memoranda of understanding with other agencies also are important in the preservation of plant diversity.

California leads the nation in the number of native plants with 6,500 species/subspecies or nearly 25% of all plant taxa found in North America north of Mexico (per. comm. Bittman, 2011). Approximately 2,145 taxa are considered endemic or found only within California (per. comm. Bittman, 2011). Regions of high topographic, moisture and temperature gradient such as the Sierra Nevada, Klamath Mountains, and San Bernardino Mountains support the greatest levels of plant species richness (CDFG, 2003).

With such a large flora, high level of human activity and development pressure, influence of non-native invasive plants as well as innate species rarity, the state supports more special status plant taxa (2,070) than anywhere else in the nation (RareFind 4, November 2011).

The DFG and California Native Plant Society each maintain a database of listed and other plant species of concern and their habitat requirements. The current legal status for each plant species is provided online at http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEPlants.pdf and is updated quarterly. Species accounts are contained in the most current report from the DFG in the mandated periodic report on the status of listed species (http://www.dfg.ca.gov/_wildlife/nongame/t_e_spp/docs/2004/t_eplants.pdf).

The Resources Agency and the DFG have developed guidelines for assessing the effects of proposed projects on rare, threatened, or endangered plants and natural communities (http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf). The California Native Plant Society has also developed botanical survey guidelines (http://www.cnps.org/cnps/rareplants/pdf/cnps_survey_guidelines.pdf).

4.5.3.3 Land cover extent and Habitat Diversity

Habitat diversity is assessed at the coarsest or broadest scale by classifying, mapping, and measuring the extent of the major land cover types in California. Land cover is a general term describing major vegetation life forms, natural features, or land uses. Measuring land cover helps determine the degree of ecosystem alteration at the coarsest scale.

Definitions of land cover classes used in this setting discussion are found in the Glossary.

Forests and rangelands cover approximately 80 percent of California. The term "forest and rangeland" includes nearly all lands except urban, irrigated agriculture, barren, and water. Conifer Forest and Woodlands, Hardwood Forest and Woodland, Shrub, Grassland, Desert Shrub and Woodland, and Wetland cover contain forests and rangelands. Conifer Forest and Desert Shrub are the two largest land cover classes, covering nearly 43 percent of California and are predominantly in public ownership (Table 4.5.3.1).

Table 4.5.3.1
Area of Land Cover Classes by Major Ownership (thousand acres)

Land cover	Private	USFS	BLM	NPS	Other public	Total
Conifer Forest	6,432	10,644	394	1,108	426	19,004
Conifer Woodland	458	1,051	482	220	151	2,363
Hardwood Forest	2,901	1,287	176	134	193	4,691
Hardwood Woodland	4,292	310	239	36	309	5,188
Shrub	5,433	5,673	2,261	319	878	14,565
Grassland	9,621	233	496	43	526	10,919
Desert Shrub	4,272	197	10,216	4,659	4,117	23,641
Desert Woodland	27	3	37	18	2	87
Wetland	334	69	12	22	103	540
Agriculture	11,201	4	42	(L)	174	11,421
Barren	229	918	203	680	254	2,283
Urban	4,606	17	29	8	250	4,909
Water						1,486
Total	**49,805**	**20,406**	**14,587**	**7,247**	**7,384**	**100,915**

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

Source: Fire and Resource Assessment Program (FRAP), 1999; CAL FIRE, 2002b

The complete vegetation map product can be viewed and downloaded at Land cover map.

The forest and rangeland land covers of the state are an aggregation of habitats (Figure 4.5.3.1). Of the 59 habitats in the California Wildlife Habitat Relationships (CWHR) system, 42 of these habitat types (Table 4.5.3.2) are considered forest and rangeland. Of all habitats found in the state, Desert Scrub (19 percent) and Annual Grassland (11 percent) are the most extensive, while Palm Oasis, Aspen (see sidebar: Aspen in California), and Perennial Grassland are the most rare (less than one percent) (Table 4.5.3.2). Detailed tables of habitat information by owner and by county can be found at Habitat types: state-county.

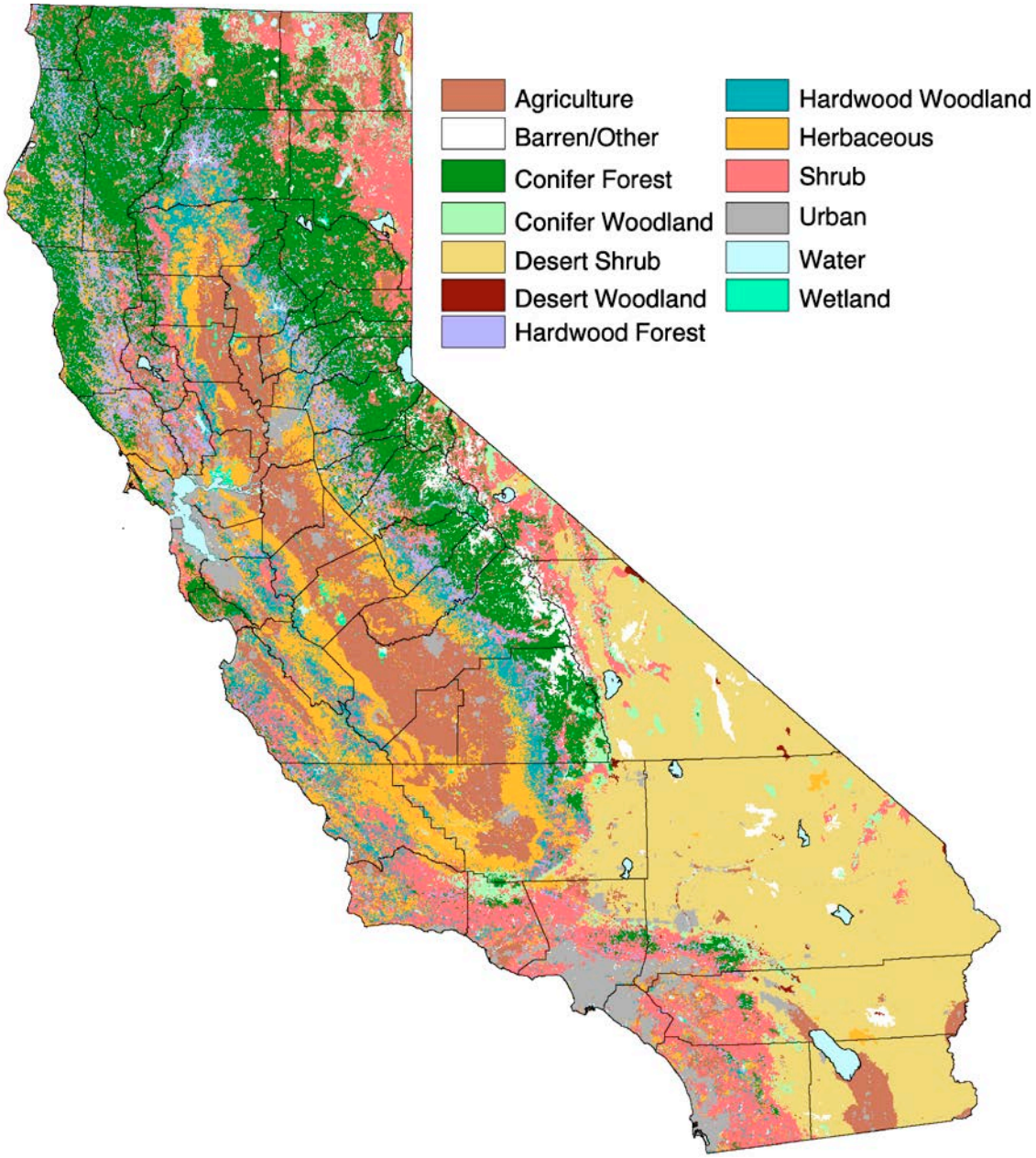

Figure 4.5.3.1 Land Cover of California
Source: CAL FIRE, 2002b

Table 4.5.3.2
Area of Forest and Rangeland California Wildlife Habitat Relationship Types by Owner (thousand acres)

Habitats	Private	USFS	BLM	NPS	Other Public	Total
Conifer Forest						
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
Unclassified Conifer	85	1	6	6	10	107
Total	**6,432**	**10,644**	**394**	**1,108**	**426**	**19,004**
Conifer Woodland						
Juniper	339	317	234	66	59	1,015
Pinyon-Juniper	119	734	249	154	92	1,348
Total	**458**	**1,051**	**482**	**220**	**151**	**2,363**
Hardwood Woodland						
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
Total	**4,292**	**310**	**239**	**36**	**309**	**5,188**
Hardwood Forest						
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
Total	**2,901**	**1,287**	**176**	**134**	**193**	**4,691**
Shrub						
Alpine Dwarf Shrub	1	201	(L)	18	(L)	219
Bitterbrush	81	162	25	26	5	299
Chamise-Redshank Chaparral	671	399	187	12	114	1,383
Coastal Scrub	1,175	218	74	28	235	1,730
Low Sagebrush	19	151	48	1	11	230
Mixed Chaparral	1,813	2,152	457	16	301	4,739
Montane Chaparral	369	1,032	23	43	14	1,481
Sagebrush	880	1,347	1,407	168	174	3,976
Unclassfied Shrub	426	12	40	8	24	509
Total	**5,433**	**5,673**	**2,261**	**319**	**878**	**14,565**
Grassland						

Annual Grassland	9,592	233	496	38	494	10,852
Perennial Grassland	30	(L)	(L)	4	32	67
Total	**9,621**	**233**	**496**	**43**	**526**	**10,919**
Desert Shrub						
Alkali Desert Scrub	630	70	1,184	470	648	3,003
Desert Riparian	15		18	3	11	47
Desert Scrub	3,348	126	8,326	4,136	3,099	19,036
Desert Succulent Shrub	115		216	17	156	503
Desert Wash	164	(L)	471	33	204	872
Total	**4,272**	**197**	**10,216**	**4,659**	**4,117**	**23,461**
Desert Woodland						
Joshua Tree	27	3	34	18	2	84
Palm Oasis	(L)		3		(L)	3
Total	**27**	**3**	**37**	**18**	**2**	**87**
Wetland						
Wet Meadow	145	69	11	20	23	268
TOTAL	**33,582**	**19,468**	**14,312**	**6,558**	**6,626**	**80,545**

BLM – U.S. 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: CAL FIRE, 1999; CAL FIRE, 2002b

The spatial locations of specific California habitats are important data for assessing wildlife species distribution and habitat value. For example, spatial modeling permits analysis of the distribution and extent of one habitat type relative to another, degree of habitat fragmentation, and level of wildlife use. Habitat location and wildlife use data provides for an analysis of threats and effect on habitat condition from disturbance that would come from urbanization, fire, or exotic plant invasion.

4.5.3.4 Habitat Stages of California's Forests and Rangelands

The California Wildlife Habitat Relationship (CWHR) system identifies habitat stages important to terrestrial wildlife. Habitat stages are descriptions of vegetation condition and include measures such as tree size and canopy closure for forest and woodland types (http://www.dfg.ca.gov/biogeodata/cwhr/). These measures allow a more informed picture of habitat conditions by relating vegetation condition to species' breeding, feeding, and cover requirements.

California Conifer Forests support a range of tree sizes and levels of canopy closure (Table 4.5.3.3, Figure 4.5.3.2). Size class is defined by the average tree diameter at breast height (DBH). Canopy closure (CC) is defined by the horizontal area that trees cover when viewed from above.

Table 4.5.3.3
Percent of Conifer Forest by Tree Size and Canopy Closure

Canopy closure	Seedlings and Saplings <10" dbh	Small trees 11" to 24" dbh	Medium to large trees >24" dbh	Unclassified	Total
Open (10-39% CC)	6	11	2	1	20
Moderate (40-59% CC)	4	14	4	1	23
Dense (>60% CC)	7	21	24	1	53
Unclassified	<1	<1	<1	4	5
Total	**17**	**45**	**31**	**7**	**100**

CC – canopy closure; DBH – diameter at breast height (4.5'); <1 – less than one percent

Note: totals may not add due to rounding, Source: CAL FIRE, 2002b

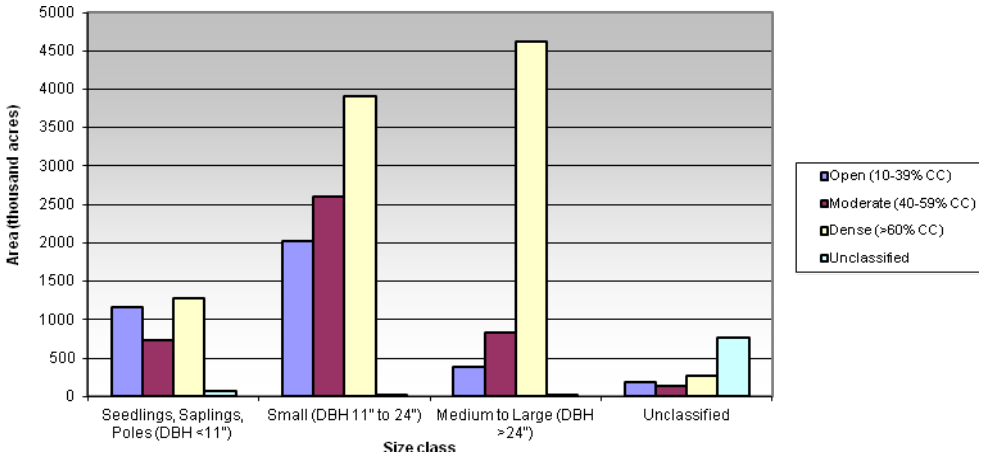

Figure 4.5.3.2 Area of Conifer Forest by tree size and canopy closure

Source: CAL FIRE, 2002b

Two dominant characteristics of California's Conifer Forest are the prevalence of smaller size trees and very dense forest stands. Forty-five percent of the Conifer Forest in California is found in the 11-24 inch size class. In terms of canopy closure, 53 percent of Conifer Forest is classified as having dense canopy closure (greater than 60 percent closure).

Although small size trees are a prominent characteristic of Conifer Forest in California, medium to large size trees (greater than 24 inch DBH) are also quite abundant. Thirty one percent of the state's Conifer Forest is classified as medium to large. Additionally, medium to large trees with dense canopy closure is the most abundant combined size and canopy closure class covering 24 percent of the state's Conifer Forest.

Hardwood Forest and Woodland size and canopy closure patterns illustrate a greater tendency towards stands with smaller tree sizes and more open canopy cover than Conifer Forests (Figure 4.5.3.3, Table 4.5.3.4). Nearly 64 percent of the Hardwood Forest and Woodland in the state have stands with average tree sizes of less than 11 inches DBH. Twenty six percent of Hardwood Forests and Woodlands are open stands.

Table 4.5.3.4
Percent Area of Hardwood Forest and Woodland by Tree Size and Canopy Closure

Canopy closure	Seedlings and saplings <11" DBH	Small trees 11-24" DBH	Medium to large trees >24" DBH	Unclassified	Total
Open (10-39% CC)	22	3	<1	<1	26
Moderate (40-59% CC)	14	5	<1	1	21
Dense (>60% CC)	27	18	2	4	51
Unclassified	<1	<1	<1	2	2
Total	**64**	**26**	**3**	**7**	**100**

DBH – diameter at breast height (4.5'); <1 – less than one

Note: totals may not add due to rounding

Source: CAL FIRE, 2002b

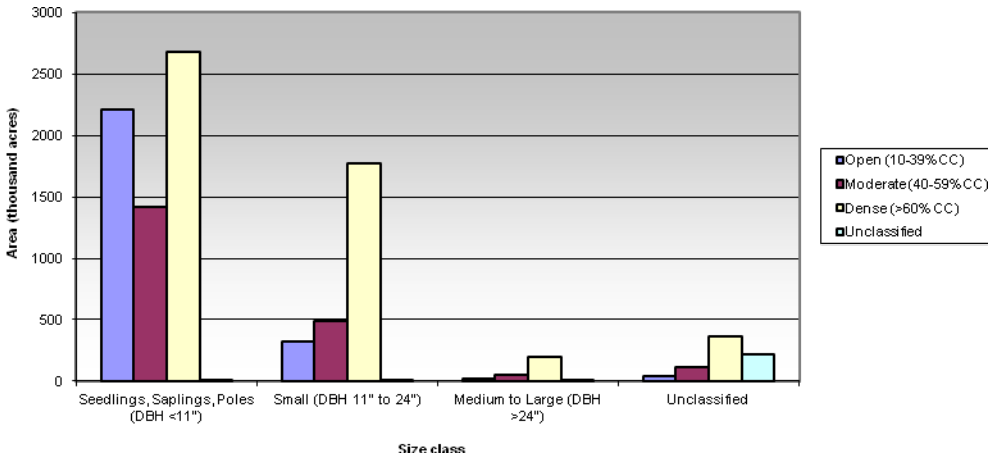

Figure 4.5.3.3 Area of Hardwood Forest and Woodland by tree size and canopy closure

Source: CAL FIRE, 2002b

Each conifer and hardwood habitat has a size and canopy closure profile.

4.5.3.5 Hardwoods

Hardwood habitats are rich sources of biological diversity. They are also lands into which significant development is projected to occur over the next four decades. A number of different land use and management practices have influence on the conditions and trends presently exhibited by California's hardwood resources. Some of these "ecosystem drivers" are the result of past practices that are centuries old and are still being played out and expressed in conditions seen today. Others are part of recent history.

This section examines several current land use and land management issues influencing hardwood resource values.

Regional extent of hardwoods

The extent of hardwood land cover varies among California's bioregions (Table 4.5.3.5). The Klamath/North Coast and Sierra bioregions have the majority of hardwood land cover (5.7 million acres or 58 percent of the state total). Each bioregion has a unique combination of hardwood habitat types (Table 4.5.3.5). Blue Oak Woodland (37 percent of bioregion total) and Montane Hardwood (47 percent of bioregion total) dominate the Sierra bioregion where blue oak, black oak, and interior live oak are the most common species. The Klamath/North Coast bioregion is predominately comprised of Montane hardwoods (77 percent of bioregion total). The Bay/Delta, Central Coast and South Coast bioregions are predominantly Coastal Oak Woodlands, which are comprised of coast live oak, California laurel, bay, and other oak species.

Table 4.5.3.5
Area of Hardwood CWHR Types and Percent Total Hardwood Area by Bioregion (thousand acres)

Habitat Type	Bay Area/Delta		Modoc		Klamath/ North Coast		Sierra		Central Coast		South Coast		Sacrament Valley		San Joaquin Valley		All other bioregions*		California	
		%	Ac		Ac		Ac		Ac				Ac	%	Ac	%	Ac	%	Ac	%
Hardwood Woodland																				
Blue Oak-Foothill Pine		11	9		185		296		329				50	10	2	1	8	15	979	10
Blue Oak Woodland		12	218		342		1,036		576				374	72	143	81	21	41	2,819	29
Coastal Oak Woodland		21			40		4		662						1	1	5	10	1,095	11
Eucalyptus		<1			L		L		2				1	<1			L	<1	11	<1
Valley Foothill Riparian		2	L		3		L		18				49	9	16	9	2	5	147	1
Valley Oak Woodland		4			11		37		26				19	4	1	1	3	6	137	1
Total		**50**	**227**		**582**		**1,374**		**1,614**				**493**	**95**	**163**	**92**	**39**	**76**	**5,188**	**53**
Hardwood Forest																				
Aspen			8		L		32										L	<1	40	<1
Montane Hardwood		50	100		2,234		1,329		114				27	5	13	8	11	22	4,439	45
Montane Riparian		<1	10		93		65		21				1	<1	L	<1	1	2	211	2
Total		**50**	**118**		**2,326**		**1,426**		**135**				**27**	**5**	**13**	**8**	**12**	**24**	**4,691**	**47**
Total Hardwoods		**100**	**346**		**2,908**		**2,799**		**1,749**				**520**	**100**	**176**	**100**	**52**	**100**	**9,879**	**100**

**All other bioregions: includes Mojave, Colorado Desert; L – less than 500 acres*
Source: CAL FIRE, 2002c

Hardwood Woodland Sustainability and Regeneration

A key factor in sustaining Hardwood Woodlands is the ability of species to regenerate. Regeneration is defined as the means by which a stand of trees maintains its structure and density by recruiting new saplings into the tree overstory to replace mature trees lost to mortality. An assessment of the success or failure of Hardwood Woodland regeneration typically examines the desired stand structure, rate of mortality in mature tree size classes, and the rate of seedling, sapling, and tree recruitment to the stand over time.

Regeneration is a dynamic process, in which periodic or only sporadic recruitment may be sufficient to balance mortality and thus maintain stand structure over the long term. A lack of

seedling reproduction and recruitment during one or several years in a stand does not necessarily constitute regeneration failure in that stand (Lang, 1988).

There has long been recognition that some species within Hardwood Woodlands are not regenerating well and researchers have examined a variety of possible causes. Sudworth (1908) (fide Standiford et al., 1997) noted apparent poor natural regeneration of several oak species, particularly blue oak. The introduction of exotic non-native grasses in hardwood woodland understory, rodent herbivory, and grazing by livestock were considered by Griffin (1977) as factors responsible for a lack of oak seedlings. Lack of precipitation as well as season and intensity of livestock grazing can also affect seedling survival.

Grazing, when implemented at specific levels, can reduce competing vegetation and improve oak seedling survival. Limited precipitation is also a factor. Seasons and level of livestock can increase seedling survival when competing grasses are reduced (Muick and Bartolome, 1987). Allen-Diaz and Bartolome (1992) (fide Standiford et al., 1997) evaluated natural regeneration in blue oak stands in north coastal California and concluded that blue oak as a species in this area had a successful strategy for seedling establishment. However, they were unable to determine the factors that prevented seedlings from moving into the sapling size class. Fire and sheep grazing were eliminated as factors responsible for recruitment failure.

Standiford et al., (1997) examined the factors influencing the probability of oak seedling and sapling regeneration in southern Sierra Nevada Hardwood Woodlands. Their study found that tree cover was positively correlated with the probability of seedling and sapling regeneration. Grazing influences were negatively correlated with blue oak seedlings, while no correlation was found with saplings in this particular study area. Solar radiation levels as derived from site slope and aspect were significant influences on black, interior live, and canyon live oak seedlings. Elevation was positively correlated with blue oak seedling presence.

It is noteworthy that the five oak species (valley, Engelmann, coast live, interior live, and blue oak) that are frequently the subject of regeneration studies can reproduce from both acorns and from root or stem sprouting. Younger age classes of all of these species resprout vigorously when cut, broken, burned, or browsed by livestock or wildlife. Valley and blue oak may lose sprouting vigor as they grow larger while interior live oak, coast live oak, and Engelmann oak continue to sprout vigorously in older age classes after fire or cutting (Lang, 1988).

Management guidelines have been developed for hardwood species within hardwood woodlands by the Integrated Hardwood Range Management Program. These guides help landowners, managers, and professional planners of hardwood rangeland resources develop management plans and other initiatives that maintain the sustainability of hardwood woodland ecological value as well as the profitability of individual properties. In addition, most local governments have policies that relate to these lands (IHRMP, 2001a, 2001b, and 2001c).

Hardwood Forest Sustainability and Regeneration

The dominant type on Hardwood Forests is Montane Hardwood. Within Montane Hardwoods, California black oak (*Quercus kelloggii*) is one of the most prevalent species. The continued abilities of black oak to sustain regeneration and to provide forest structure are key elements to the

sustainability of montane forest ecosystems. They are also indicators of the status of hardwood forests.

California black oak is the most widely distributed hardwood in the state, occurs on approximately 4.3 million acres outside of national forest lands, and occurs on approximately 8.6 million acres statewide (Bolsinger, 1988). The species exceeds all other California oaks in volume, distribution, and altitudinal range (McDonald, 1990). California black oak is found from the basin of the McKenzie River in western Oregon southward through the Coast Ranges and principally along the western slopes of the Sierra Nevada to the Cuyamaca Mountains in southern California. A few stands of the species are found on the east side of the Sierra Nevada. It is typically found where ponderosa pine also grows (Bolsinger, 1988). California black oak is most abundant and attains its largest size in the Sierra Nevada. Extensive stands are also found in eastern Mendocino and Humboldt counties of the north Coast Range (McDonald, 1997).

CAL FIRE/FRAP analyzed the distribution of black oak within three forest types: Sierra Mixed Conifer (SMC), Montane Hardwood/Conifer (MHC), and Montane Hardwood (MHW). On average, black oak basal area for Sierran mixed conifer sites was 20 square feet per acre. Black oak basal area in the combined Montane Hardwood/conifer and Montane Hardwood types was 35 square feet per acre. Much of the black oak basal area is found in smaller size classes. These results suggest that black oak is generally abundant, but is predominately found in trees of small size. Specific management actions will be needed to maintain current black oak stocking and to promote the development of existing stands into larger tree sizes and the associated ecological benefits trees of this size provide.

California black oak can regenerate by way of stump sprouting or germination of acorns. California black oak is shade intolerant and a vigorously sprouting species. It generally occurs in even-aged stands where intensive fire or logging is the principal means of stand replacement (McDonald, 1969). Because fire incidence throughout its natural range is high, nearly all California black oak trees originated from sprouts. Consequently most California black oak stands are even-aged. The size and vigor of the parent tree determines the number of sprouts and their height and crown spread.

4.5.3.6 Old-growth Conifer Forests

Old-growth forests provide unique habitat for wildlife, recreational opportunities, inspiration, and other values. Because these values are often hard to quantify, defining old forest, measuring the extent, and evaluating the quality at a statewide and bioregional scale has been problematic.

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

Old-growth forests, as defined by USFS ecological criteria, are estimated at about 2.8 million acres (Table 4.5.3.6), or about 13 percent of the statewide Conifer land cover.

Table 4.5.3.6
Statewide area of Old-growth by Ownership

National Forest	National Forest-Wilderness and Reserved	Other public	Other Public Reserve	Private industrial	Private non-industrial	Total
1,344,645	785,533	32,381	582,149	34,949	56,041	2,835,698

The USFS ecological old-growth definition is applicable to unreserved forest lands (private, managed portions of national forest, state forests and other public land) and includes the following characteristics:

- Minimum stand age: usually over 150 years old;
- Tree size: usually greater than 30 inches DBH minimum;
- Number of trees per stand: usually more than 6 trees per acre; and
- Snag and down log components: varying from species to species
- Old-growth forest types are most extensively found in Pine (30 percent), Mixed Conifer (26 percent), and Fir (22 percent) forest types (Figure 4.5.3.4).

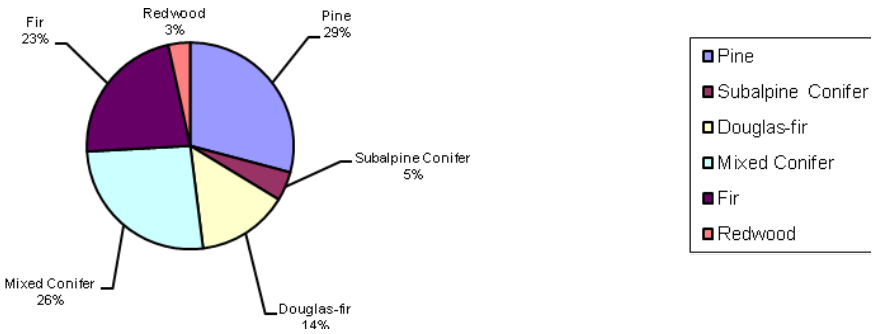

Figure 4.5.3.4 Old-growth by forest type in California

- Conifer forests attaining this structural condition are the most extensive in the Sierra and Modoc bioregions, occupying 1.6 million acres, 15 percent (1.6 million acres) of the Conifer land cover. High elevation red fir, lodgepole pine, and subalpine conifer forest types and mid elevation Sierra mixed conifer are the most common old-growth forest types in these bioregions.
- Douglas-fir (both interior and coastal) is also an extensive old-growth species, with over 409,000 acres, or 14 percent of the state old-growth total.
- Redwood old-growth forests, found within California's coastal bioregions are represented by less than 100,000 which include old-growth forest acreage and old growth icon for old-growth forests in California and the U.S., have less than 100,000 acres, 3 percent of the total old-growth in the state. Old-growth represents about eight percent of the current extent of all redwood forests.

- Late successional forests, which include old-growth forest acreage and when considered as a regulatory definition, cover about 5.8 million acres in California, or about 25 percent of the total conifer land cover. Under California's Forest Practice Rules this definition includes forests with following characteristics:
- Average DBH of greater than 24 inches;
- Canopy covers of greater than 40 percent;
- Minimum stand size of 20 acres; and
- Presence of decadent forest elements such as snags and down logs.

These forests represent those that are most available and suitable for recruitment of old-growth in the future. Approximately 48 percent of the old-growth stands are in reserve status administered by NPS, State Parks or National Forest Wilderness. Another 47 percent are within National Forest areas where timber management is permitted, but current management objectives generally do not impact these old-growth forests. Less than 5 percent of conifer old-growth forest is in private ownership.

Most late successional forests, (83 percent) are within the Working Landscape management class. This class infers that much of the acreage is subject to land management activities such as logging or conversion to non-forest uses. The long-term future of developing late succession forests in stands most resembling old-growth will be highly dependent on how these working lands are managed (Figure 4.5.3.5).

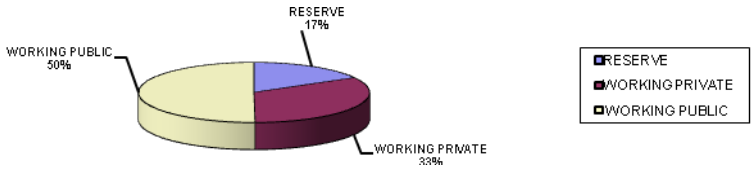

Figure 4.5.3.5 Late successional forests by ownership and management class

Snag and down log densities in California's forests

Plot data from the United States Forest Service (USFS) Forest Inventory and Analysis (FIA) program was used to describe the abundance and characteristics of snags and down logs in a variety of California forest types and ownership categories. Currently available snag and down log levels reflect conditions as of 2000 for public lands while private land data were collected between 1991 and 1994. In general, Private Industrial and Private Non-Industrial lands have 40 percent fewer snags of all size and decay classes than are found on National Forest reserve lands. When compared to down log densities on National Forest reserve lands, those on private lands exhibit markedly higher densities. Private Industrial lands carry a high level of total down logs per acre when compared to other ownerships. Statewide, they possess down log densities 65 percent higher across all log sizes and decay classes than those on National Forest reserve lands.

4.5.3.7 California's Grasslands and Shrublands

Grass and shrublands vegetation types include any natural grassland, savannas, shrublands, deserts, wetlands, or woodland that supports a vegetative cover of native grasses, grass-like plants, forbs, shrubs, and naturalized species (Table 4.5.3.7).

Table 4.5.3.7
Area of Primary Rangeland by Ownership and CWHR Type (thousand acres)

Habitat type	Private	USFS	BLM	NPS	Other public	Total
Conifer Woodland						
Juniper	339	317	234	66	59	1,015
Pinyon-Juniper	119	734	249	154	92	1,348
Total	**458**	**1,051**	**482**	**220**	**151**	**2,363**
Hardwood Woodland						
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
Total	**4,292**	**310**	**239**	**36**	**309**	**5,188**
Hardwood Forest						
Montane Riparian	100	40	1	43	27	211
Shrub						
Alpine Dwarf Shrub	1	201	(L)	18	(L)	219
Bitterbrush	81	162	25	26	5	299
Chamise-Redshank Chaparral	671	399	187	12	114	1,383
Coastal Scrub	1,175	218	74	28	235	1,730
Low Sagebrush	19	151	48	1	11	230
Mixed Chaparral	1,813	2,152	457	16	301	4,739
Montane Chaparral	369	1,032	23	43	14	1,481
Sagebrush	880	1,347	1,407	168	174	3,976
Unknown Shrub	426	12	40	8	24	509
Total	**5,433**	**5,673**	**2,261**	**319**	**878**	**14,565**
Grasslands						
Annual Grassland	9,592	233	496	38	494	10,852
Perennial Grassland	30	(L)	(L)	4	32	67
Total	**9,621**	**233**	**496**	**43**	**526**	**10,919**
Desert Shrub						
Alkali Desert Scrub	630	70	1,184	470	648	3,003
Desert Riparian	15		18	3	11	47
Desert Scrub	3,348	126	8,326	4,136	3,099	19,036
Desert Succulent Shrub	115		216	17	156	503
Desert Wash	164	(L)	471	33	204	872
Total	**4,272**	**197**	**10,216**	**4,659**	**4,117**	**23,461**
Desert Woodland						
Joshua Tree	27	3	34	18	2	84
Palm Desert	(L)		3		(L)	3
Total	**27**	**3**	**37**	**18**	**2**	**87**

Wetland						
Wet Meadow	145	69	11	20	23	268
Grand total	**24,350**	**7,577**	**13,743**	**5,359**	**6,034**	**57,062**

California's grass and shrublands occupy approximately 57% or 57 million acres. This land cover includes Desert Shrub accounting for 41 percent (23.5 million acres); Shrub accounting for 26 percent (14.6 million acres); Grassland accounting for 19 percent (10.9 million acres); and Hardwood Woodland accounting for 9 percent (5.2 million acres) (Figure 4.5.3.6).

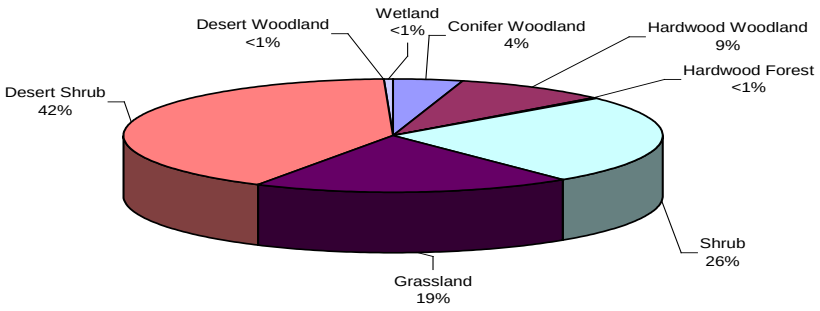

Figure 4.5.3.6 Percent of primary rangelands by land cover class

A majority of the grass and shrublands of California are in public ownership. Forty-three percent of the plant communities composing grass and shrubland within California are privately owned while 57 percent are publicly owned (Figure 4.5.3.7). This ownership pattern varies among the bioregions of the state. As shown in Table 4.5.3.8, a majority of private ownership exists in four bioregions (Bay/Delta, Klamath/North Coast, Central Coast, and South Coast). The largest acreage of private rangeland is found in the Sierra and Central Coast bioregions.

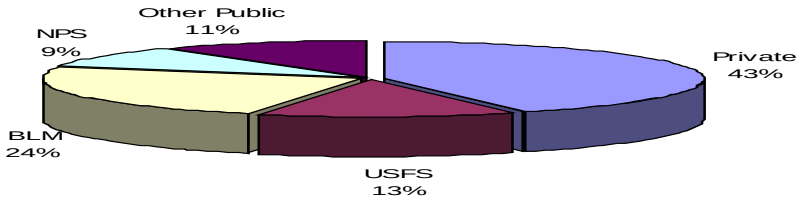

Figure 4.5.3.7 Percent of primary rangeland by ownership, 1997

Table 4.5.3.8 Area of Primary Rangelands by Major Ownership and Bioregion (thousand acres)								
Owner	Bay/Delta	Modoc	Klamath/ North Coast	Sierra	Central Coast	South Coast	All others*	Statewide
BLM	38	1,297	283	982	309	140	10,694	13,743
NPS	58	54	18	162	15	18	5,033	5,359
Other public	177	193	63	382	420	426	4,373	6,034
Private	2,031	1,549	2,457	3,396	4,598	1,992	8,328	24,350
USFS		1,325	829	2,512	1,474	1,305	132	7,577
Total	**2,304**	**4,420**	**3,650**	**7,434**	**6,815**	**3,881**	**28,559**	**57,062**

Ownership of grass and shrubland types is not evenly distributed. A majority of Hardwood Woodland, Grassland, and Wetland habitats are privately owned. In contrast, a majority of Shrub, Desert Shrub, and Desert Woodland habitats are publicly owned (Figure 4.5.3.8).

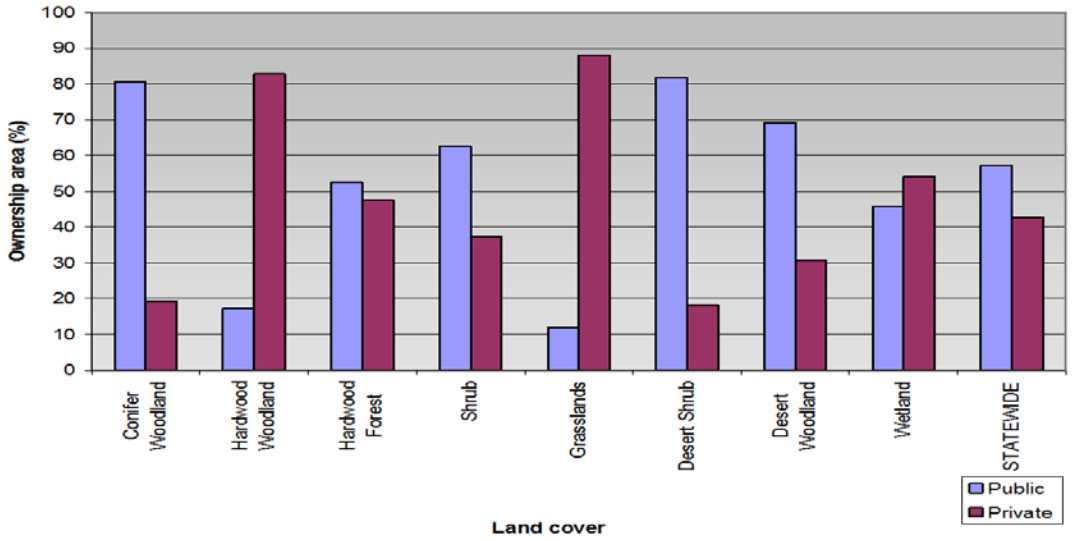

Figure 4.5.3.8 Percent of primary rangelands in public and private ownership by land cover class

Decline in Extent of Grassland and Shrubland Types

The decline in grass and shrubland extent has a variety of effects including reduction in the role of private rangeland as cost effective provider of sustainable resource based economic activity, certain wildlife habitats, and open space. In addition, the probability of conversion for residential or commercial use increases when ranching is no longer cost effective. Several estimates have been made regarding change in area of these significant plant communities. Each uses different analysis methods and different definitions resulting in estimates that are not directly comparable. However, these estimates reflect the varying degrees of change in the land base and all identify one clear trend: the grass and shrubland land base has been declining throughout the 1990s up to 90,000 acres per year.

Summarized below and displayed in Table 4.5.3.9 are three different estimates of change to the grass and shrubland land base. These estimates are not related are used here to frame the possible extent of land change.

Table 4.5.3.9
Changes in Rangeland Area or Vegetation Reported by Various Monitoring Methods (thousand acres)

	FRAP Census Housing Density Analysis	NRI	FRAP LCMMP
Period	1990 to 2000	1982 to 1997	Various 5 year periods during the 1990s
Total area change	-587	-624	-422
Annual average change	-58 per year	-42 per year	-84 per year
Area includes	Weislander Map vegetation types (1940s): eastside conifer; chaparral; coast sage; grass; sagebrush; hardwood lands; woodland grass.	All non-federal lands with natural vegetation available and suitable for grazing of domestic livestock. Excludes forested conifer and hardwood lands.	Hardwood and Shrub lands classified by FRAP.
Change reflects	Changes to high-density development (greater than one housing unit per acre) and low-density development (at least one housing unit per 20 acres). No other causes modeled.	Net transfer and land conversion to developed use, agricultural uses, forest land, and federal ownership.	Small to large changes in the vegetation canopy cover. Does not imply complete land conversion.

Future changes in grass and shrubland area

The extent of grassland and shrublands in California including that available for grazing is likely to experience continued reductions in extent in the future. Additional and permanent land conversions to housing, commercial development and other agricultural land uses are all likely to reduce the extent of these plant community types. To help identify the impact of housing development on California's grass and shrublands, FRAP has modeled the projected change in area that may be attributed to housing and commercial development. This model projects the area of new "development" high-density urbanization (housing unit density greater than one unit per acre) and low-density development (housing densities between one unit per acre and 20 units per acre) by the year 2040.

Substantial areas of grass and shrubland plant community types are projected to have development impacts over the next 40 years, with the Sierra, Mojave and South Coast bioregions expected to experience the greatest area influenced by this land use (Figure 4.5.3.9). Nearly 2.0 million acres of grass and shrubland are projected to be developed between 2000 and 2040, with the bulk of the development likely to occur in the Grassland, Shrub, Hardwood Woodlands, and Desert Shrub land covers (Table 4.5.3.10). Projected development of grass and shrublands will not be evenly distributed throughout California (Figure 4.5.3.9).

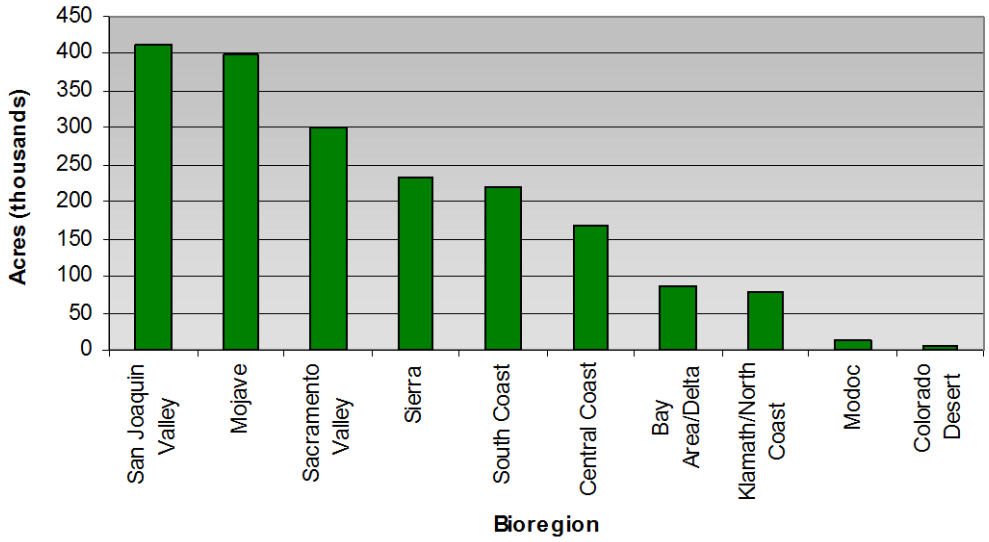

Figure 4.5.3.9 Projected rangeland development by bioregion, 2000-2040

Table 4.5.3.10
Projected Rangeland Development in California, 2000 to 2040 (thousands of acres)

Land Cover type	2000-2010	2010-2040	2000-2040
Conifer Woodland	6	11	17
Desert Shrub	49	216	265
Desert Woodland	2	2	3
Hardwood Forest	3	3	6
Hardwood Woodland	147	316	463
Grassland	190	456	646
Shrub	165	348	514
Wetland	1	2	3
Total Rangeland	**563**	**1,354**	**1,917**

The Sierra bioregion is expected to incur the highest level of development on grass and shrublands for the 1990 to 2040 period. Over 600,000 acres of grass and shrubland will potentially be affected. Complete regional statistics on projected development by natural vegetation type and CWHR habitat type can be found in Appendix A.