

Oaks 2040



The Status and Future of Oaks in California

*By Tom Gaman and Jeffrey Firman
Published by the California Oak Foundation*

Oaks 2040: The Status and Future of Oaks in California¹

Produced for the California Oak Foundation

by Tom Gaman And Jeffrey Firman

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This is the unabridged web edition

Abstract

California oaks are seriously threatened as a burgeoning state population makes ever more use of the wildland. Most California oaks are not covered by the Forest Practice Act, are on private lands and are potentially at risk. The Oak Woodlands Conservation Act of 2004 requires cities and counties to assess their oak resources and to adopt Oak Woodlands Management Plans in order to meet the needs for healthy watersheds. Therefore *Oaks 2040* is designed to provide localized information for planners. This paper presents a forest and woodland map of the ten oak types found in California. The most recent statewide forest survey data from the Forest Inventory and Analysis (FIA) program are compiled into an inventory. The inventory data are then merged to describe the mapped oak types. By merging this inventory with state growth projections, the authors determine which oak woodlands are most likely to face development between now and 2040. Findings are reported for each of six regions: North Coast, North Interior, Central Coast, Sacramento, San Joaquin and Southern.

Introduction: Developing Planning Tools for Oak Futures

Ecological functions, wildlife habitat, recreational opportunities and scenic values are seriously impaired as population densities and other landscape use pressures increase. Managers of oak woodlands and forests need to balance the biological, sociological and economic interests of private landowners, public agencies, business, universities, environmental groups and concerned individuals. Planning must address the complexities of local, regional and statewide oak issues within the context of practical on-the-ground land use decisions.

Oaks 2040 is based on objective oak data and is designed to serve decision makers who may develop local and regional Oak Woodlands Management Plans or

¹ Tom Gaman tgaman@forestdata.com and Jeffrey Firman jfirman@forestdata.com of Forest Data, PO Box 276, Inverness, CA 94937. Gaman and Firman (see www.forestdata.com) have been active many years in forest inventory, data analysis, mapping and forest conservation. Both have master's degrees in forestry from Yale University. Gaman is a registered professional forester and a board member of the California Oak Foundation. Thanks to Sally Campbell, Janet Cobb, Amy Larson, Doug McCreary, Bruce Pavlik, Mark Rosenberg and Dale Weyermann for their help in developing this research project. Thanks also to the Richard and Rhoda Goldman Fund for their financial assistance.

advance other conservation strategies. A statewide map of oak distribution and current forest and woodland inventory tree plot data, created by state and federal researchers, were the starting points for *Oaks 2040*. From those, regional analyses of forest structure and oak types as well as region-specific oak inventory summaries have been developed. By evaluating these maps and inventories against current economic growth projection *Oaks 2040* identifies the location and extent of oaks most at risk of development.

This document, the oak maps and inventory, constitute Part I of the oak story. This web-based version of *Oaks 2040: The Status and Future of California Oaks* includes more detail on regional oak forests and woodlands than does the printed version. It is provided for those who desire further regional detail. A companion document, “*Oaks 2040: Sustaining California’s Oak Woodlands and Forests*” will be available in the future. Both of these documents and supporting details, charts and tables will also be available on the COF website: <http://www.californiaoaks.org/oaks2040>.

We provide this information so that the many individuals and groups that are interested in oak woodland conservation can identify where threats are greatest and how conservation efforts should be focused to encourage sustainable land use and development with conservation priorities. Methods are described in the print version and in the full-length web version.

Methods

Mapping Oak Types

A number of overall vegetation maps, maps of hardwoods in general, and oak-specific maps have been generated over the years. Currently, the most reliable statewide vegetation map available is the “LCMMP Vegetation Map” (FRAP map) produced by the California Department of Forestry and Fire Protection’s Fire and Resource Assessment Program (FRAP) in conjunction with the U.S. Forest Service (USFS) Region 5 Remote Sensing Lab (RSL) in Sacramento. While these maps do not focus specifically on oaks, oak habitat types can be extracted from mapped vegetation types. Using the FRAP map as a foundation (supplemented by other earlier mapping efforts), we have generated species-specific range maps of oak types throughout the state.

The FRAP map uses the *Calveg* classification system which first divides all vegetation into *Covertypes*. For finding wildland oak habitat, only two *Covertypes* (HDW and MIX) are relevant. All *woodland* classified as ‘hardwood’ (HDW) or *forest* classified as ‘conifer/hardwood mix’ (MIX) can potentially be oak habitat, provided it contains the relevant hardwood species. All other *Covertypes* were eliminated from the analysis.

After *Covertypes*, the *Calveg* system also specifies *Vegtype*, which identifies the dominant species association. For both HDW and MIX *covertypes*, the data were screened to ensure that the hardwood associations being mapped in a particular location are oaks. Nine such associations are dominated by a single species, each forming its own Oak Habitat Type, or “Oak Type”. Three heterogeneous hardwood types were combined

to generate a “mixed” Oak Type. The 10 resulting Oak Types, each potentially occurring in both “woodlands” and “forests”², are listed below:

Table 1. Oak Types

Oak Type	Scientific Name	Calveg Type(s)
Black Oak	<i>Quercus kelloggii</i>	QK
Blue Oak	<i>Quercus douglasii</i>	QD
Canyon Live Oak	<i>Quercus chrysolepis</i>	QC
Coast Live Oak	<i>Quercus agrifolia</i>	QA
Engelmann Oak	<i>Quercus engelmannii</i>	QN
Interior Live Oak	<i>Quercus wislizeni</i>	QW
Oregon White Oak	<i>Quercus garryana</i>	QG
Tanbark Oak	<i>Lithocarpus densiflorus</i>	QT
Valley Oak	<i>Quercus lobata</i>	QL
Mixed Oaks	not applicable	EX/NX/TX

This selection and reclassification process was applied to the FRAP maps. The results are GIS layers and maps depicting the distribution of woodland and forest oak habitat types throughout the state of California. See the tables in Appendix A for acres of cover where oaks dominate the woodland by county and Oak Type and acres of cover where oaks are present in the forest by county and Oak Type.

Ownership & At Risk Analysis

Two additional layers are added to further intensify the oak mapping analysis. Land ownership and development risk layers are both incorporated into the map to assess pertinent conservation issues. The land ownership data is courtesy of the California Department of Forestry’s Forest and Rangeland Resources Assessment Program (FRAP). Using their layer, the state is divided into a variety of public and private ownership categories. The statewide ownership layer overlaid on top of the Oak Type map reveals ownership patterns among California’s oaks.

The development risk data has been derived from the California Department of Finance’s projected development layer. This dataset is based on US Census Data (see FRAP Development Projections). This layer tracks past development by decade and predicts future development through 2040. Using this information, three categories were defined. ‘Developed’ is defined as anything that has developed (greater than 32 housing units per square mile) by 2000. ‘At Risk’ refers to anything that has not developed by 2000 but is expected to develop by 2040. And ‘Stable’ refers to anything that has not developed by 2000 and is unlikely to develop before 2040. Once the layer was divided into these three categories, it was overlaid on top of the Oak Type Map. The oak woodlands of the state were thereby divided into groups by oak type, ownership and development risk.

² “Oak Woodlands” are considered to be those mapped vegetation types where oaks dominate the landscape. “Oak Forests” include oaks, but oaks may not necessarily be among the dominant species. By definition forests and woodlands must have at least 10% canopy cover and be at least 1 hectare in extent.

Inventory and Analysis

The other critical element for assessment of mapped oak types is the inventory summary, which is based upon data obtained from the USFS Forest Inventory & Analysis Program (FIA; see <http://fia.fs.fed.us/tools-data/>). This statewide grid of permanent forest survey sample “plots” yields information about what the mapped oak forests and woodlands look like on the ground. The plots provide information not obtainable via remote sensing techniques—an inventory of forest fuels, species distribution, specific size, growth, regeneration, habitat features, pest and disease. With point-specific data ranging from species composition to seedling regeneration to tree size and density, these plots help one understand the makeup of each of the 10 oak types.

The 2001-2004 FIA field data were obtained to provide an inventory of each of the oak types discussed above. Combining the ground-based survey data and the GIS mapping data enabled us to provide a new comprehensive oak inventory as shown in Appendix B.

California Oaks: A Statewide and Regional Analysis

To facilitate regional analysis, California has been divided into six distinct regions. In an attempt to represent the levels at which conservation policy is often decided, county boundaries have been utilized for this regional split, rather than natural boundaries such as watersheds or bioregions. These are the same regions used in Bolsinger's 1988 *The Hardwoods of California's Timberlands, Woodlands, and Savannas*, except that the San Joaquin Valley has been separated from the rest of Southern California. The six different regions and their associated counties are shown below:



North Coast: Del Norte, Humboldt, Mendocino, Sonoma

North Interior: Lassen, Modoc, Shasta, Siskiyou, Trinity

Central Coast: Alameda, Contra Costa, Marin, Monterey, San Benito, San Francisco, San Mateo, San Luis Obispo, Santa Barbara, Santa Clara, Santa Cruz, Ventura

Sacramento: Butte, Colusa, El Dorado, Glenn, Lake, Napa, Nevada, Placer, Plumas, Sacramento, Sierra, Solano, Sutter, Tehama, Yolo, Yuba

San Joaquin: Alpine, Amador, Calaveras, Fresno, Inyo, Kern, Kings, Madera, Mariposa, Merced, Mono, San Joaquin, Stanislaus, Tulare, Tuolumne

Southern: Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego

Forest Oaks and Woodland Oaks

For the purposes of this report “Oak Woodlands” are considered to be those mapped vegetation types where oaks dominate the landscape. By definition, they have at least 10% canopy cover. “Oak Forests” are those vegetation types dominated by trees, but *Quercus* spp. or *Lithocarpus densiflorus* may not necessarily be among the dominant species. The two broad categories are further subdivided each into the 10 “Oak Types” which describe the oak association (Table 1). Generally oak forests tend to occur at higher elevations with higher rainfall. They are generally denser and are located further from existing urban population centers so they are generally less at risk from development. There is also less concern about oak regeneration in these forest types. Note also that the 9 broad vegetation types of woodlands and forests each characterized by a single oak species usually contain multiple oak species.

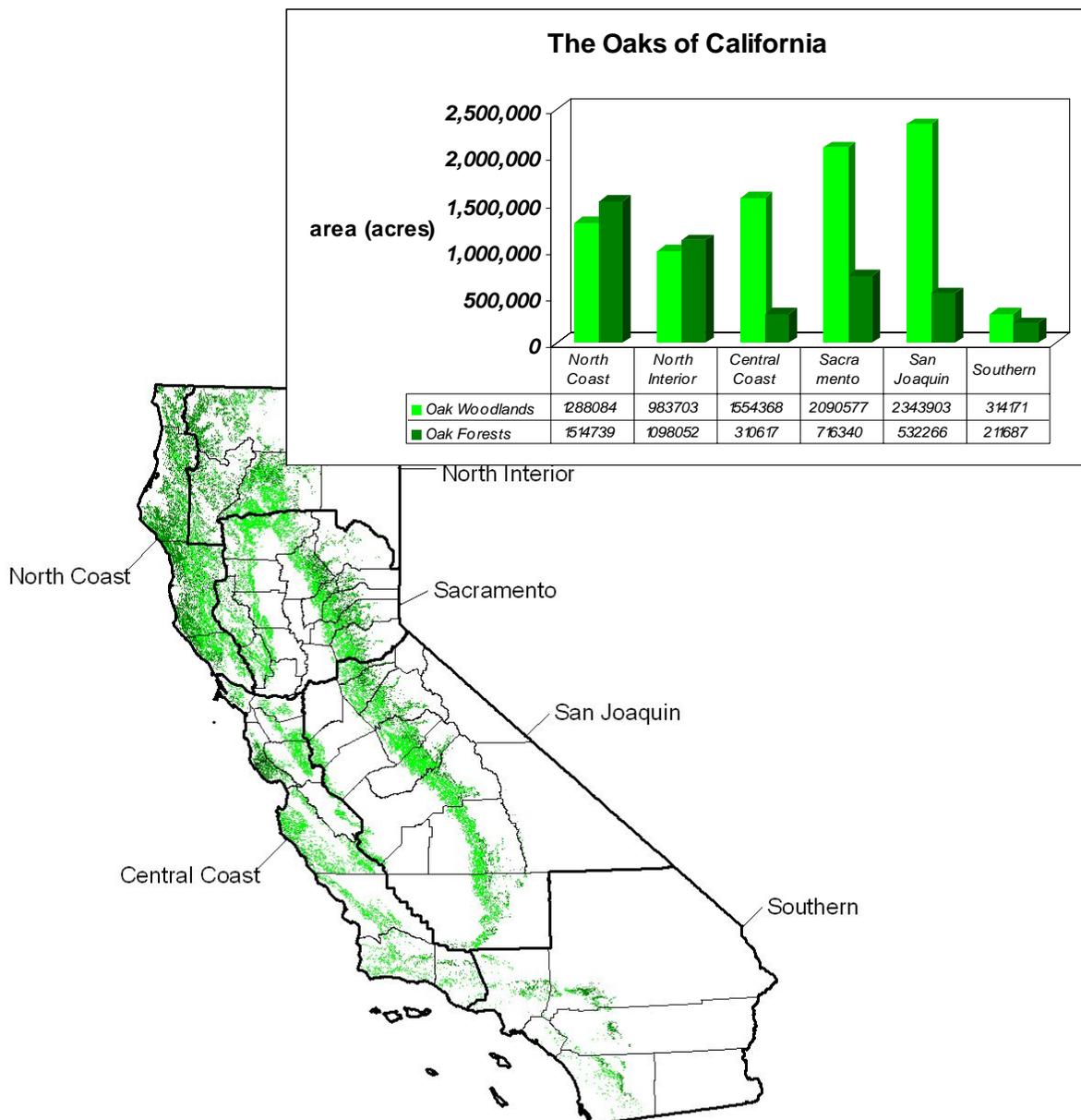
Table 2. Oak Types:

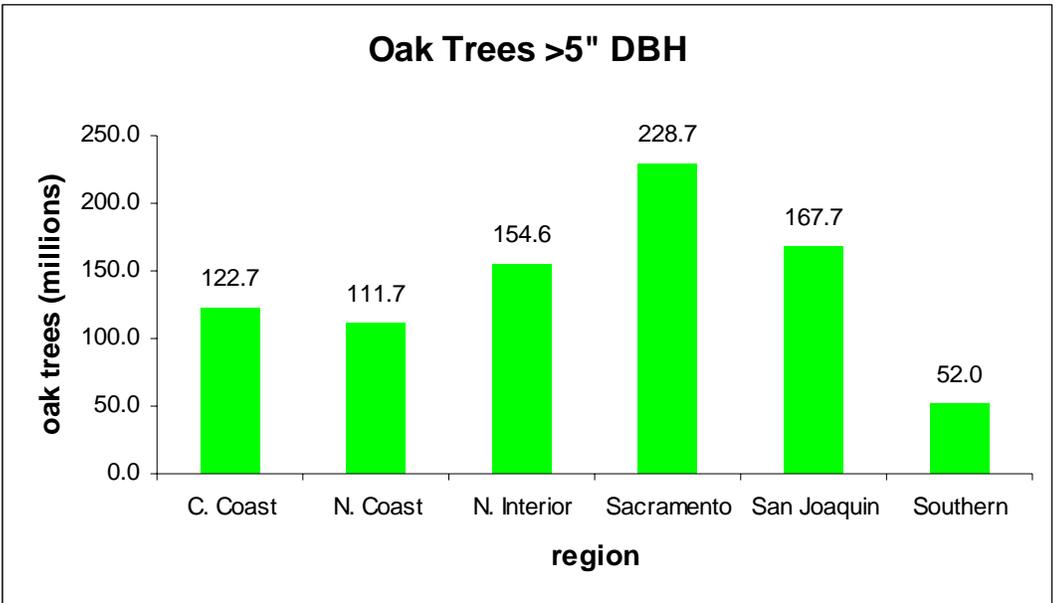
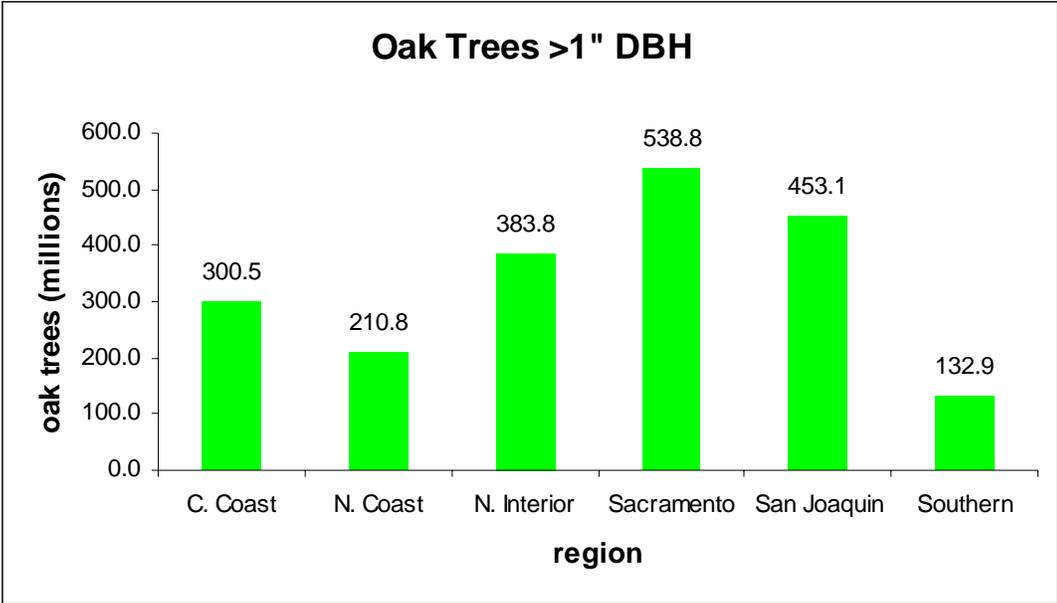
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Oregon White Oak	<i>Quercus garryana</i>	QG
Tanoak	<i>Lithocarpus densiflorus</i>	QT
Valley Oak	<i>Quercus lobata</i>	QL
Mixed Oaks	not applicable	EX/NX/TX

An analysis of the state as a whole and then each of these six regions individually follows. It delves into acreages of oak woodlands and forest oaks, densities of oak woodlands, distribution of various oak types, oak woodland ownership patterns, past development of oak woodlands, and categorization of oak woodlands at risk. All of these analyses are presented first at the state and regional levels. Then, within each region, the same factors are summarized at the county level to identify patterns and trends that pertain to oak conservation. The following statewide and regional analyses both paint a picture of California’s oaks and highlight crucial areas for oak conservation throughout the state.

Oaks Play a Major Role in the California Landscape

- California has approximately 8.5 million acres of oak woodland and 4.5 million acres of oak forest.
- These 13 million acres comprise more than one-eighth of the state's area.
- The Sacramento and San Joaquin regions are home to more than half of California's oak woodland.
- Oak forests are concentrated in the North Coast and North Interior regions.
- California currently has approximately two billion oaks greater than 1" DBH.
- More than 800 million of these oaks are larger than 5" DBH.



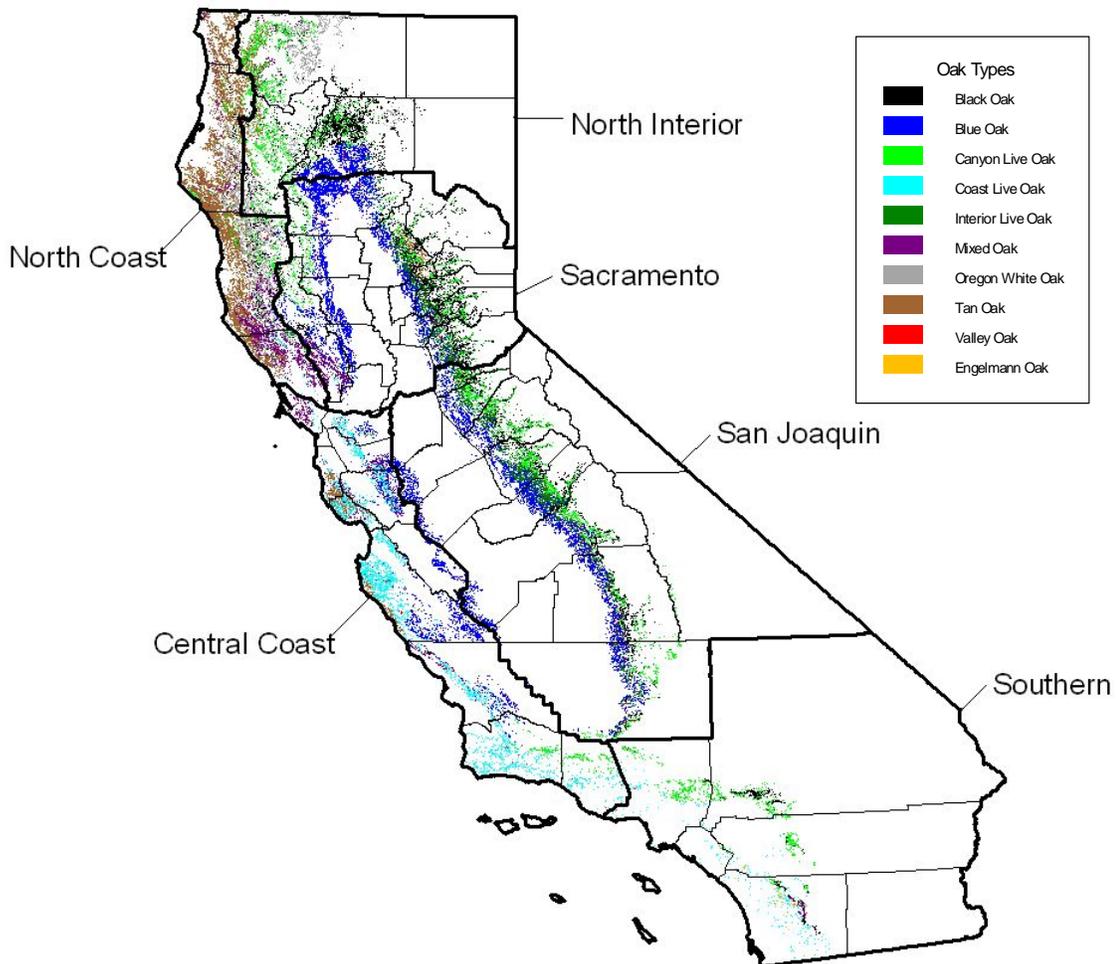


California's Diverse Oaks

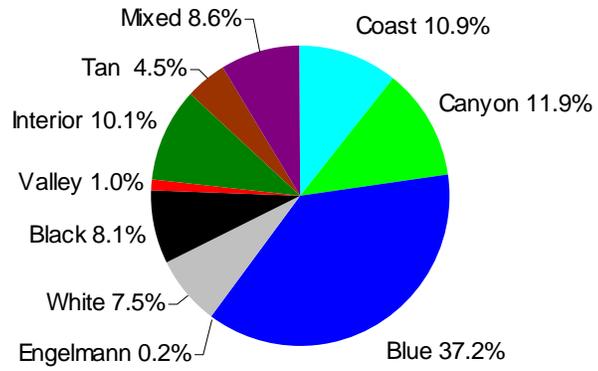
- Blue oak is California's dominant oak species by total acreage, representing more than one-third of the state's oak woodlands.
- Canyon, coast and interior live oak woodlands comprise approximately one-third of California's oak woodlands.
- Tanoak, black and canyon live oak forests account for more than 80% of California oak forests.

Oak Type	Woodlands (ac)	Forest (ac)
Blue	3,185,000	15,000
Canyon	1,015,000	995,000
Coast	930,000	115,000
Interior	870,000	70,000
Mixed	740,000	305,000
Black	695,000	1,125,000
White	640,000	300,000
Tan*	390,000	1,460,000
Valley	85,000	0
Engelmann	20,000	0
Totals	8,575,000	4,385,000

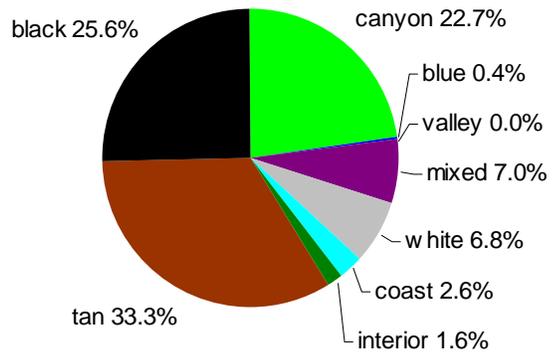
**Tanoak is the only native North American member of the genus Lithocarpus while all other California oaks are Quercus spp. While not a "true oak" tanoak is included in this report as it is a significant part of California's oak forest, produces an important acorn crop, and serves a similar biological role.*



Oak Woodland Diversity of California

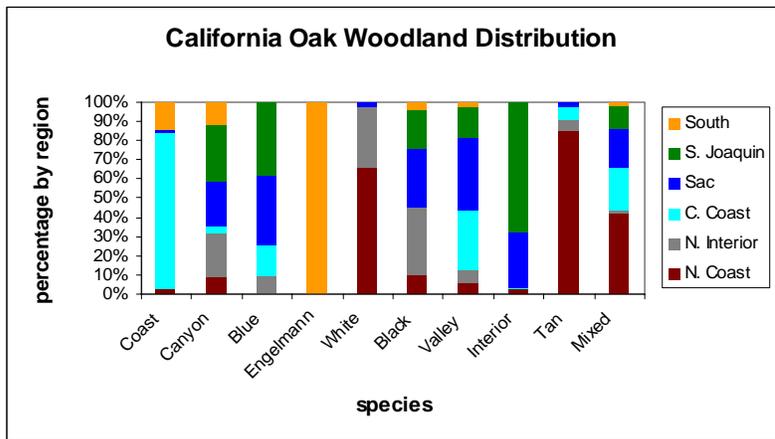


Oak Forest Diversity of California

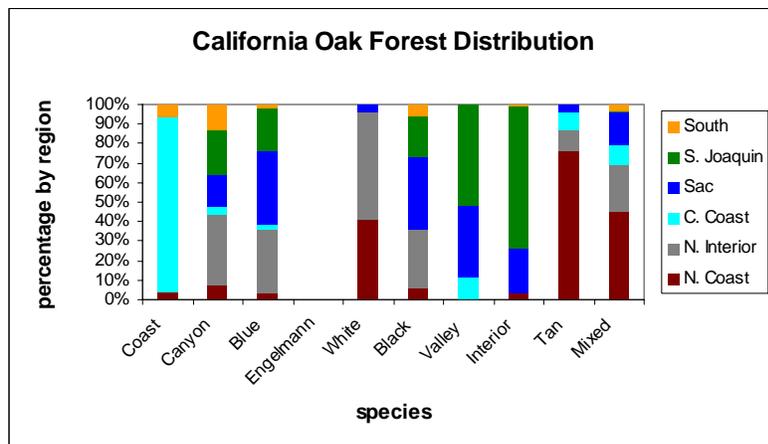


The Heterogeneous Distribution of California's Oaks

- **Coast Live Oak:** 80% of oak woodlands and 90% of oak forests are found in the Central Coast
- **Tanoak:** 85% of oak woodlands and 75% of oak forests are found in the North Coast
- **Blue Oak:** Concentrated in the San Joaquin and Sacramento Regions
- **Interior Live Oak:** Almost exclusively restricted to the San Joaquin and Sacramento Regions
- **Black Oak:** Most concentrated at higher elevations in the North Interior and Sacramento Regions
- **Oregon White Oak:** Mostly found in the North Coast and North Interior Regions
- **Canyon Live Oak:** Most common in the North Interior, Sacramento, and San Joaquin Regions
- **Valley Oak:** Most prominent in the Sacramento, Central Coast, and San Joaquin Regions
- **Engelmann Oak:** Restricted solely to the Southern Region

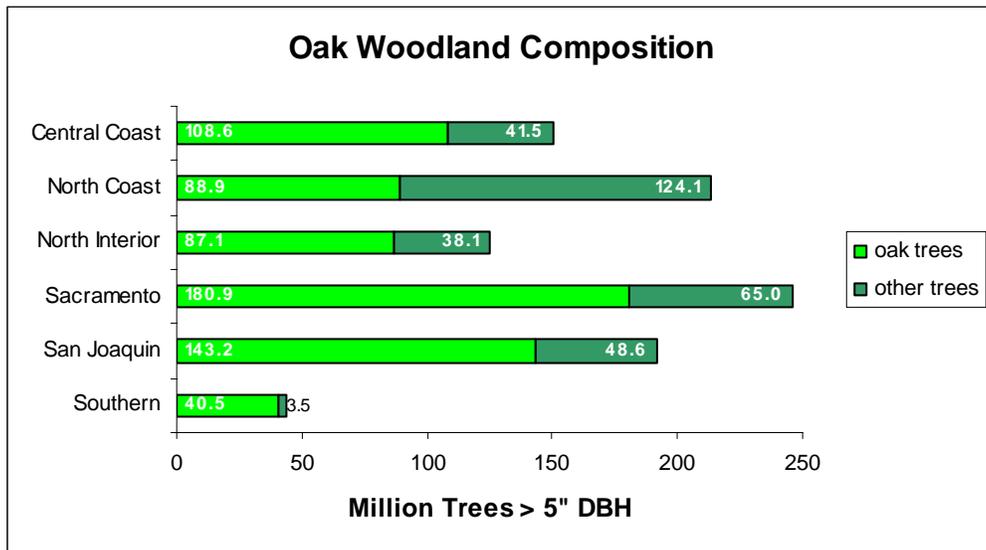


In Oak Woodland...

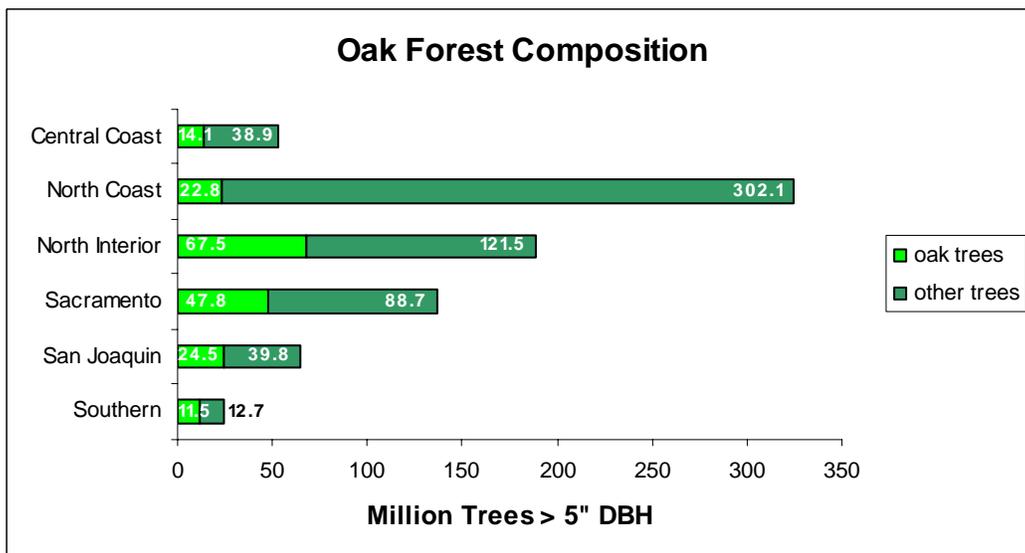


- Oaks comprise 60% of the total tree basal area.
- Oaks account for 67% of trees greater than 5" DBH.
- Oaks account for 37% of trees greater than 24" DBH.

In Oak Forest...

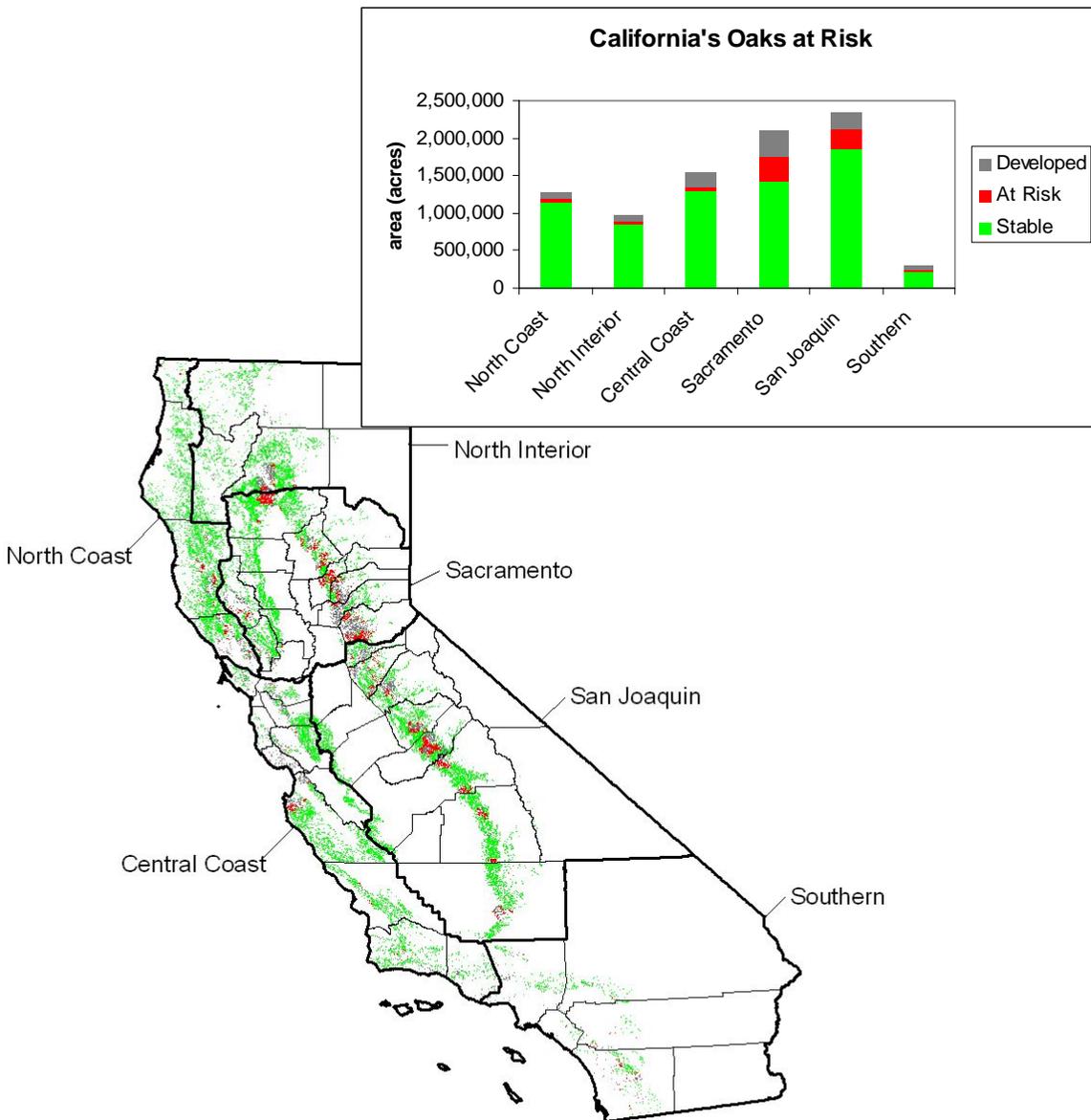


- Oaks comprise 18% of the total tree basal area.
- Oaks account for less than 24% of trees greater than 5" DBH.
- Oaks account for only 8% of trees greater than 24" DBH.



Oaks 2040: Future Prospects for California's Oaks

- Approximately 750,000 acres of California's oak woodlands are at risk of development before 2040.
- More than one million acres of California's oak woodlands have already been developed.
- In total, 20% of California's oak woodlands will be facing rapid urbanization by 2040.
- The oak woodlands of the Central Valley and Sierra Foothills face the most immediate threats.
- Eighty percent (80%) of California's oak woodlands that are at risk of development are in the Sacramento and San Joaquin Region.





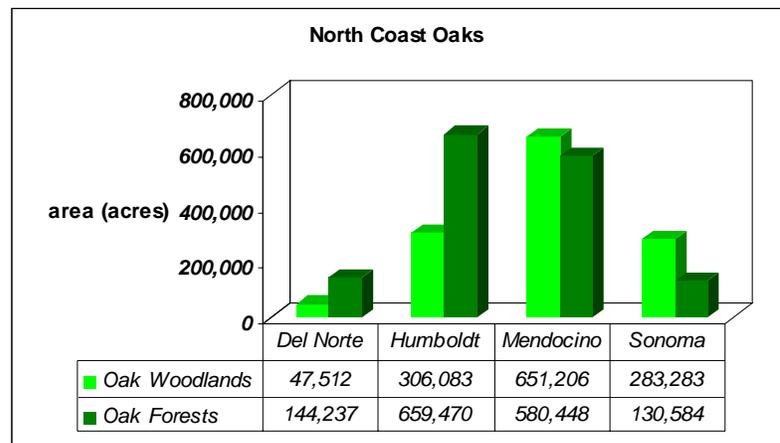
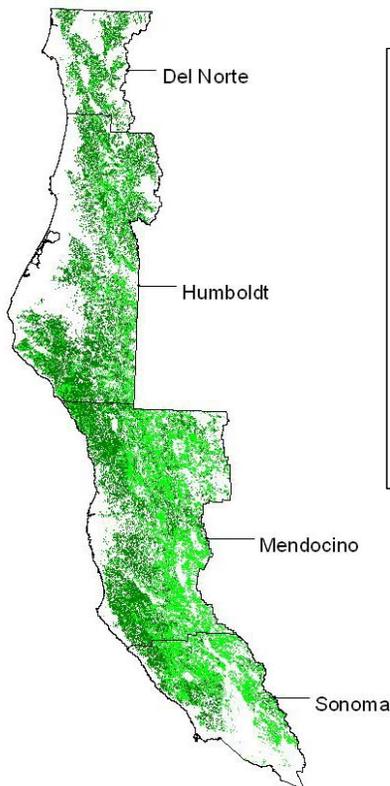
The North Coast Region

Del Norte, Humboldt, Mendocino, Sonoma

(Data Availability: This entire region is adequately covered by the FRAP maps.)

Oak Mapping:

- The North Coast Region has 1.3 million acres of oak woodland and 1.5 million acres of oak forest.
- Thirty-five percent (35%) of California’s oak forest is found in the North Coast region.
- Oaks are present on 45% of the region’s land (more than any other region).
- Mendocino contains more than one-half of the region’s oak woodland, but Humboldt and Sonoma also have significant stands.
- The North Coast’s oak forests are found primarily within Humboldt and Mendocino counties.
- 210 million oaks greater than 1” DBH and 110 million oaks greater than 5” DBH are found in the region.
- Only the Central Coast tops the North Coast’s two million oaks greater than 24” DBH.



North Coast Oak Diversity

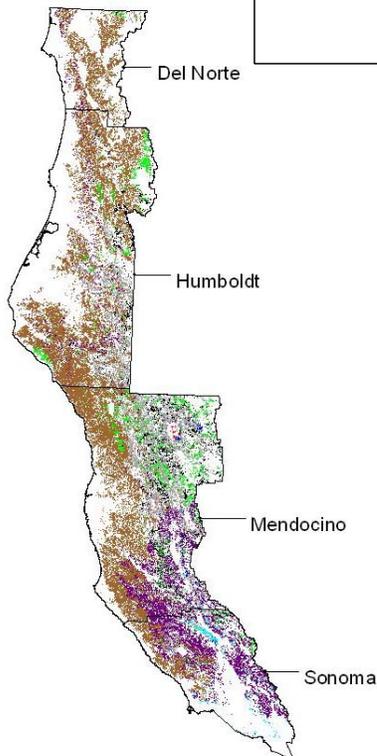
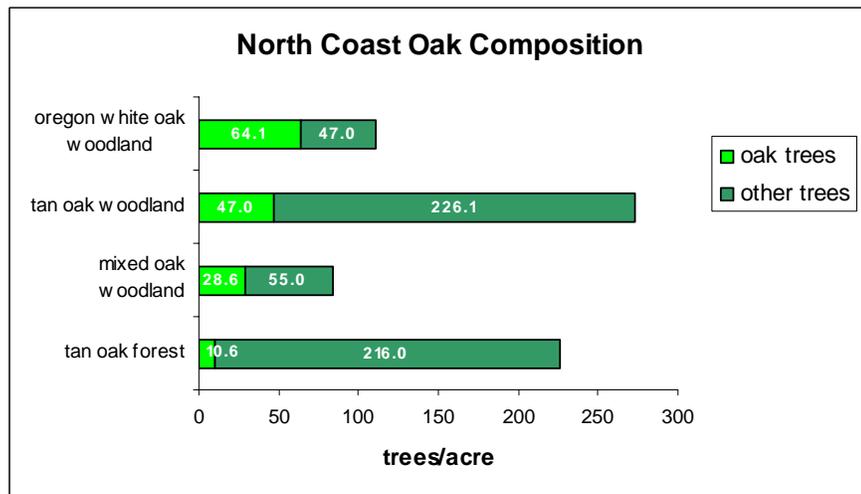
Oak Woodlands

- The North Coast's oak woodland features Oregon white oak, tanoak and mixed oak.
- Canyon live oaks and black oaks are also present, mixing in with Douglas-fir, madrone, and bay.
- Oaks comprise approximately one half of the basal area, trees/acre, and trees greater than 5" DBH/acre in Oregon white oak woodlands.

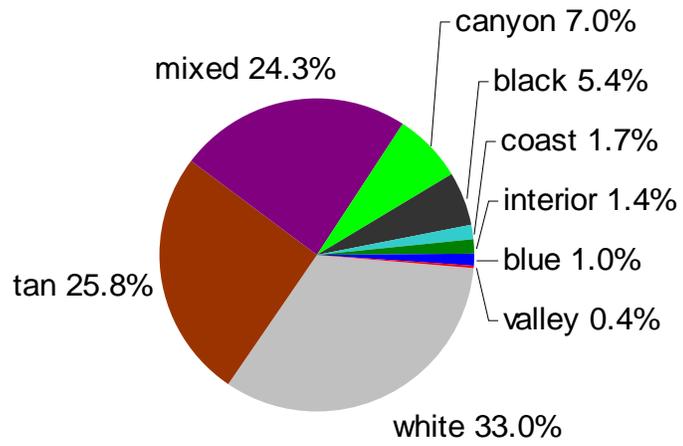
- In tanoak woodlands, oaks comprise less than 20% of the basal area, trees/acre, and trees greater than 5" DBH/acre.

Oak Forests

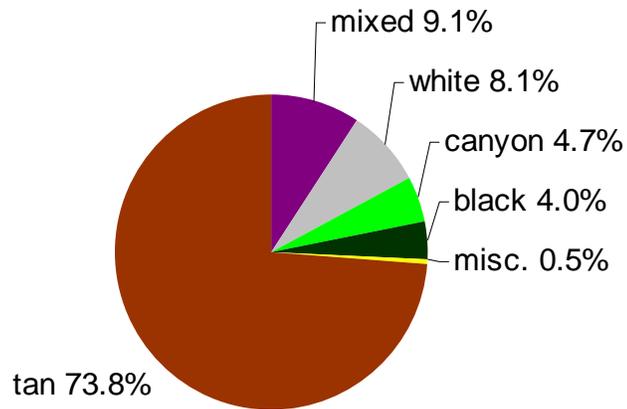
- Tanoak is predominant amongst the North Coast's oak forests.
- Associated species include Douglas-fir, redwood, madrone, bay, canyon live oak and black oak.
- In tanoak forests, true oaks provide less than five percent (5%) of the basal area and total trees, while tanoak is 37% of basal area .



North Coast Oak Woodland Diversity



North Coast Oak Forest Diversity



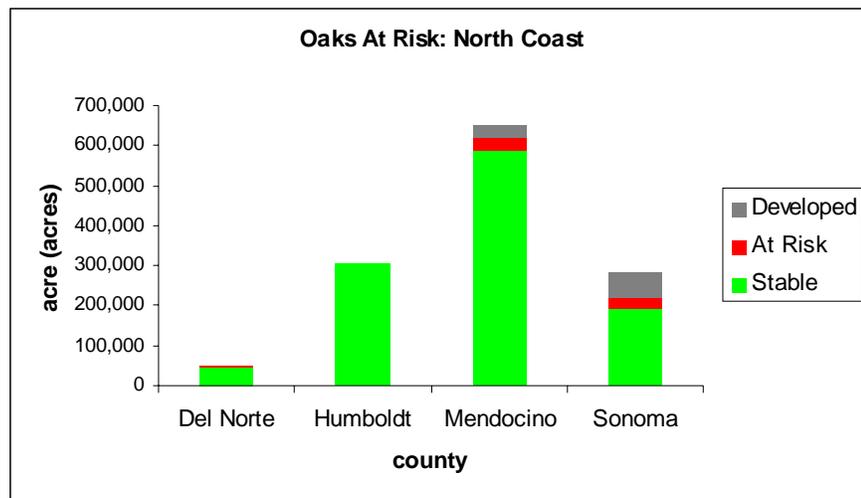
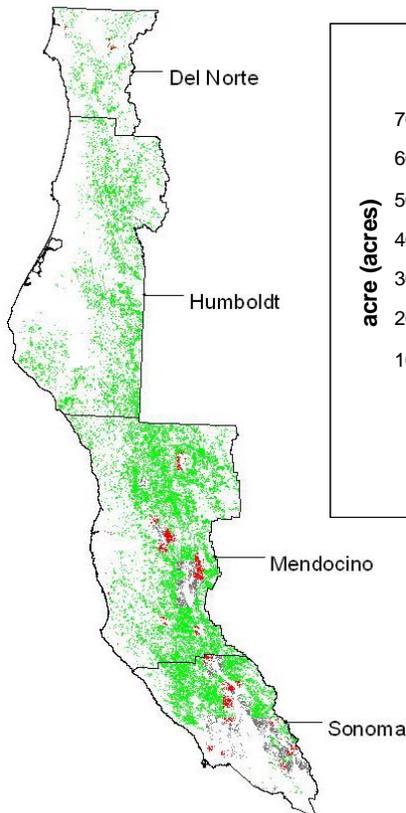
Oaks at Risk in the North Coast Region

Ownership

- Eighty-four percent of the North Coast's oak woodlands are on private property.
- Most of the remainder is owned by the USFS and various other federal government agencies.
- The land ownership patterns are fairly predictable in this region.
- Private ownership of oak woodland increases as we move southward, ranging from 40% private in Del Norte to 95% private in Sonoma.

Development

- Eight percent of North Coast oak woodlands have already been developed; four percent are at risk of near-time development. Nearly 90% of the oak woodlands are reasonably stable for the time being.
- Oak woodlands development rates are relatively low in Del Norte and Humboldt counties with more than 95% of oak woodlands being stable.
- Mendocino oak woodland is already five percent developed and another five percent is at risk of development before 2040.
- Sonoma has experienced the most urbanization with 20% of oak woodlands developed and 10% at risk.



Critical Oak Conservation Issues: North Coast

The North Coast Region is often overlooked in terms of oak conservation, but it has nearly three million acres of oak woodlands and forests. In fact, nearly half of the region has oaks. Private ownership of oak woodlands is higher in the North Coast than it is in any other region. Developmental pressures are concentrated around the Highway 101 corridor in Sonoma and Mendocino counties. Even though widescale development is unlikely to occur in this region in the near future, the long-term prospects are uncertain. This region contains some of the largest oak trees in the state and these heritage trees are in need of special protection. Additionally, Sudden Oak Death puts the region's tanoak, coast live oak and black oak at risk. The oak conservation strategy for this region must focus on the needs of private landowners. Legal protections such as conservation easements should be a top priority where possible. Furthermore, educating private landowners about ecologically-friendly land management techniques can go a long way to encourage appropriate behavior on private woodlots.

Mendocino County contains half of the region's oak woodlands. In fact, with over 650,000 acres, Mendocino County has more oak woodlands than any other county in California. Oaks are present on nearly 55% of the land in the county. Nearly 30,000 acres of oak woodland in the county is at risk of development. This accounts for more than half of the region's totals. As mentioned earlier, city and county planning should focus on the more quickly developing areas around the highway, but the real crux of the matter here depends on what happens on the private lands. Encouraging these landowners to protect their own oaks is the best strategy that can be applied to this county.

Humboldt County faces similar oak conservation challenges to Mendocino. Oaks are present on 40% of the county's area, but two-thirds of that land is oak forests rather than oak woodlands. Almost 75% of the oak woodlands are privately owned, but the USFS land covers another 10% of the area, and Indian reservations make up another 10%. Oak woodland management on these lands is important, and management of private property is even more critical to oak conservation in Humboldt County.

Sonoma County, due to its proximity to the Bay Area, has more severe developmental pressures than elsewhere in the North Coast. Being much smaller than Mendocino and Humboldt Counties, Sonoma County's overall acreage of oak woodland and forest is less impressive. Nonetheless, oaks are present on more than 40% of the county's area, and 95% of Sonoma's oak woodlands are privately owned. Twenty-three percent of Sonoma's oak woodlands have already been developed and another nine percent may be developed by 2040. County and city general plans will play a major role in how development occurs over the next 30 years or so, but decisions made by private citizens will ultimately determine which oak woodlands are converted to vineyards and sub-developments and which oak woodland are protected. Once again, public conservation planning, landowner education, and implementation of appropriate conservation methods, and donated or purchased conservation easements protecting land in perpetuity are the best tools for conservation available at this time.

Critical Oak Conservation Issues: North Coast (continued)

Del Norte County has a fraction of the oaks found in the other three counties in this region, in part because it is less than a third the size of Mendocino and Humboldt. Oak forests are far more prevalent than oak woodlands. The USFS owns 60% of Del Norte's oak woodlands. In that respect, the oak conservation issues in Del Norte are more similar to Trinity and Siskiyou Counties (see North Interior Region) than they are to Mendocino and Humboldt Counties.



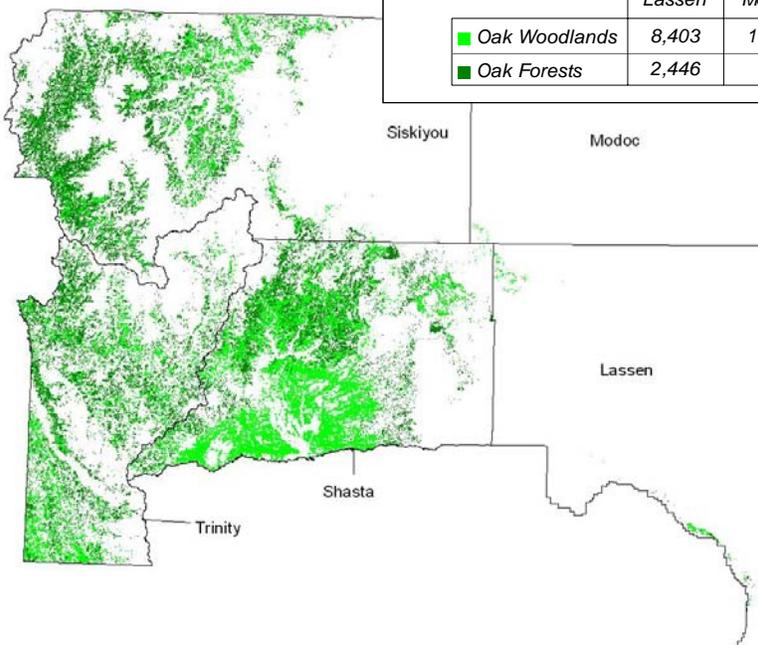
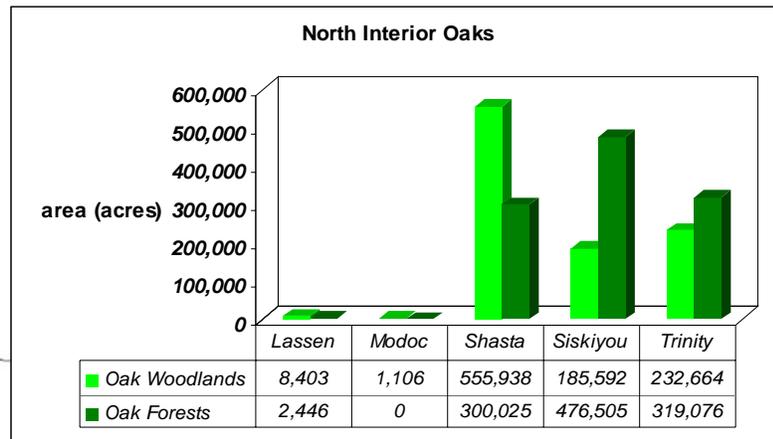
The North Interior Region

Lassen, Modoc, Shasta, Siskiyou, Trinity

(Data Availability: This entire region is adequately covered by the FRAP maps.)

Oak Mapping

- Nearly one million acres of oak woodland and 1.1 million acres of oak forest reside within the North Interior.
- The North Interior and the North Coast are the only two regions with more oak forest than oak woodland.
- With over 550,000 acres of oak woodland, Shasta County contains more than half of the region's totals.
- Trinity and Siskiyou Counties also contain large areas of oaks, with nearly 800,000 acres of oak forest and more than 400,000 acres of oak woodland in total.
- The North Interior has nearly 400 million oak trees, and 150 million of these oaks are greater than 5" DBH.



North Interior Oak Diversity

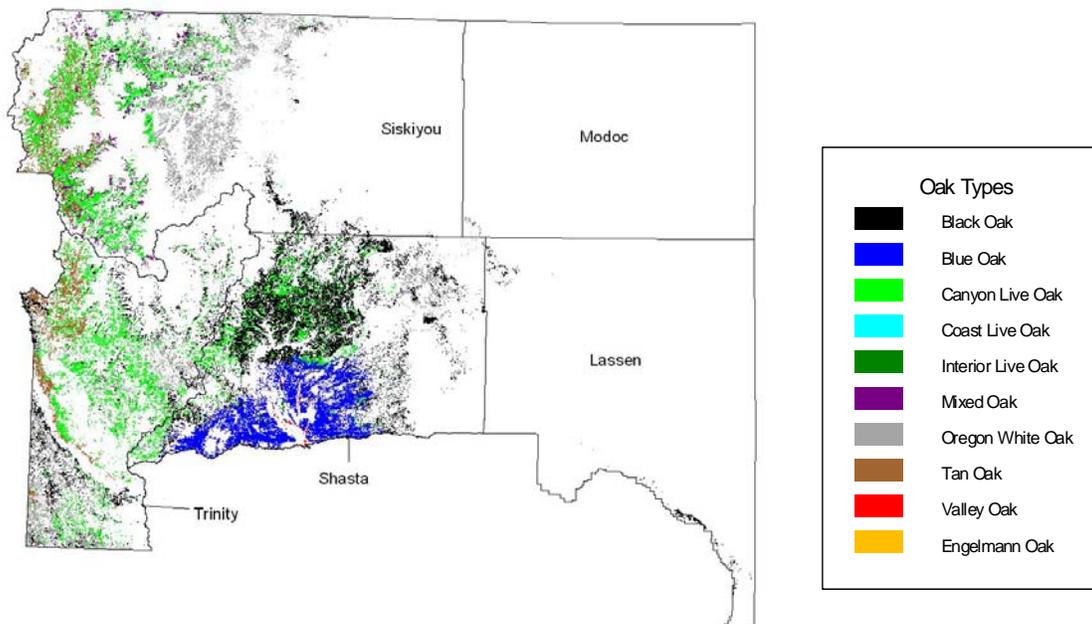
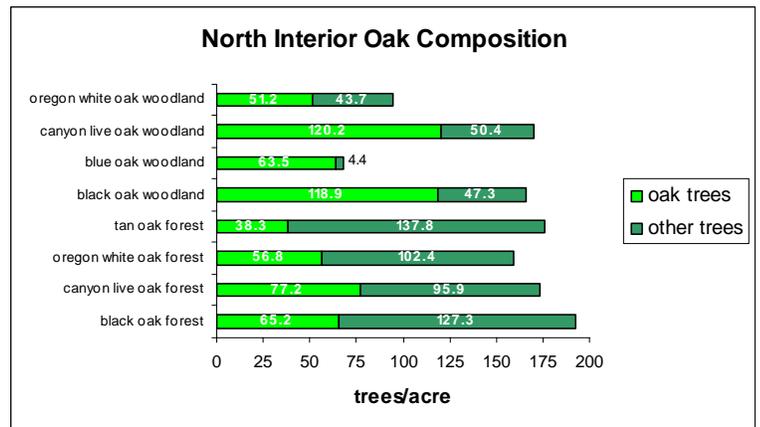
Oak Woodlands

- A balanced mixture of blue oak, black oak, canyon live oak, and Oregon white oak woodlands is found.
- Blue oak woodlands typically include gray pine and either interior or coast live oak. Oaks comprise more than 80% of the basal area and more than 90% of the trees.
- Oregon white oak woodlands include black oak, Douglas-fir, and ponderosa pine. Oaks make up 40% of the basal area and more than half of the trees greater than 5" DBH.
- In black oak and canyon live oak woodlands, oaks comprise 50% of the basal area and 70% of the trees greater than 5" DBH.

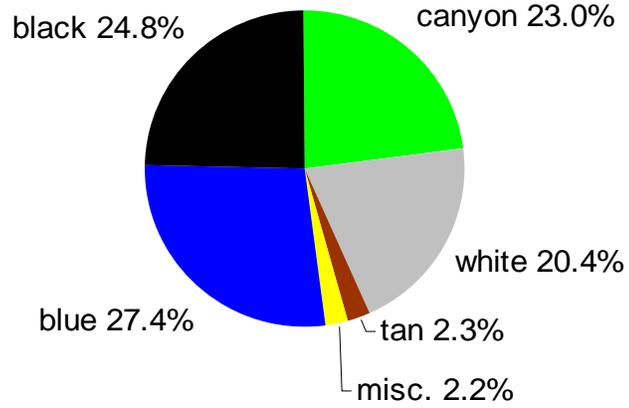
- These two oak species mix in with the local conifer species, including Douglas-fir, ponderosa pine, sugar pine, and madrone.
- In black oak forests, oaks comprise one-fifth of the basal area. One-third of the trees greater than 5" DBH are oaks.
- In canyon live oak forests, one-third of the tree basal area is oaks and less than half of the trees greater than 5" DBH are oaks.

Oak Forests

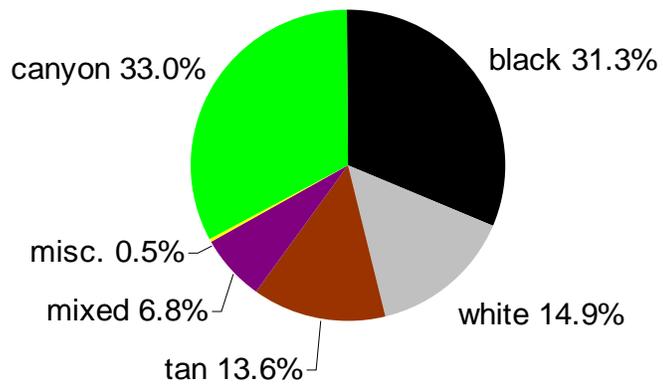
- Canyon live oak and black oak are prominent.



North Interior Oak Woodland Diversity



North Interior Oak Forest Diversity



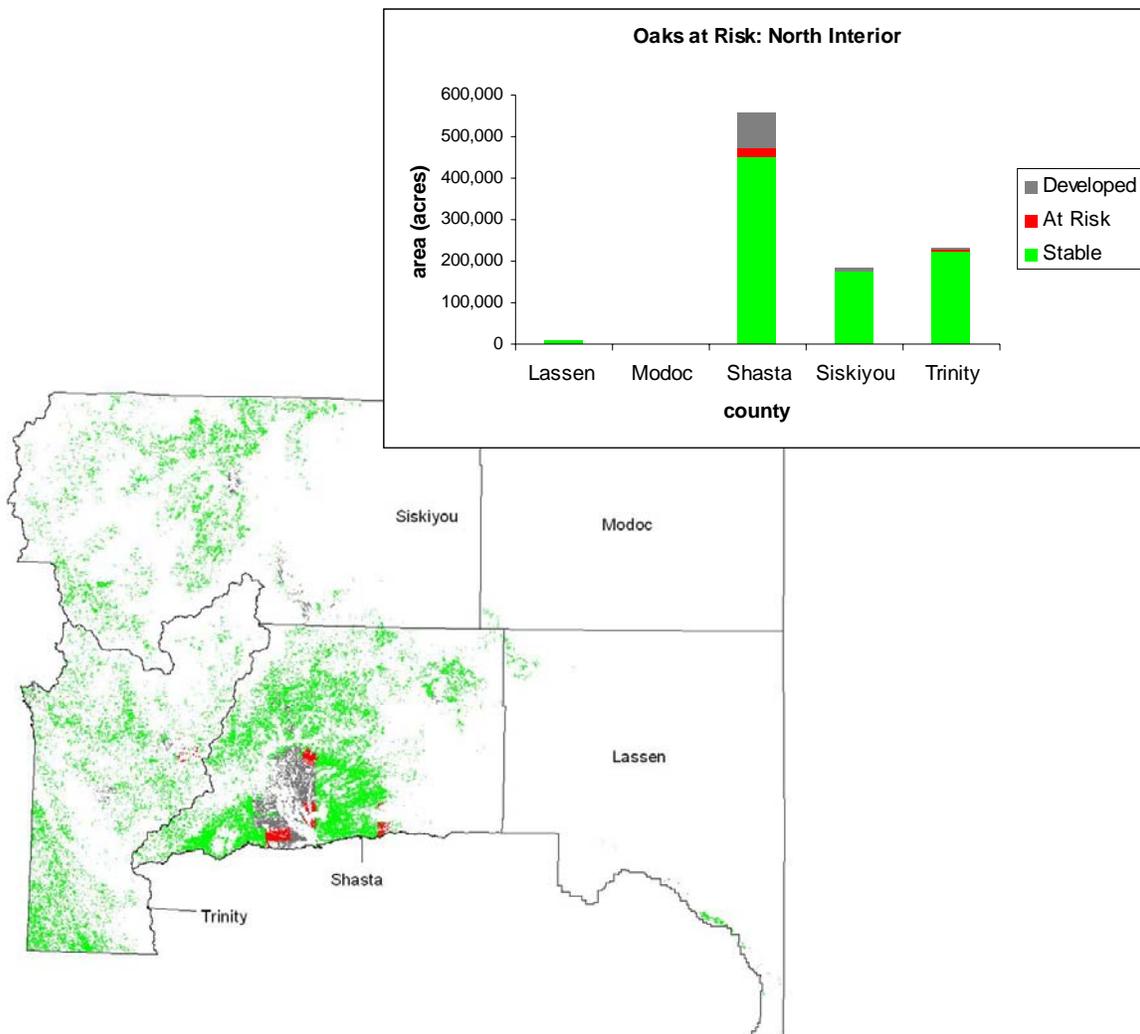
Oaks at Risk in the North Interior Region

Ownership

- Sixty percent of North Interior oak woodlands are privately owned. The USFS manages 33% and the Bureau of Land Management (BLM) manages six percent.
- Excluding Shasta County, oak woodland ownership is split roughly 50-50 between private and public; the USFS manages most of the public oak woodland.
- Shasta County's oak woodland ownership is 73% private, 20% USFS, and six percent BLM.

Development

- Ten percent of the region's oak woodland has already been developed. Three percent is at risk for development by 2040. Eighty-seven percent is unlikely to develop before 2040.
- Shasta County oak woodland is most at risk. Fifteen percent has been developed and five percent more may develop by 2040.
- Oak woodlands in Trinity, Siskiyou, Modoc and Lassen Counties are all less than five percent developed and less than one percent at risk.



Critical Oak Conservation Issues: North Interior

Although not typically regarded for its oak resources, the North Interior Region actually hosts a wealth of oaks. Fortunately, the oaks of this region are at relatively low risk for development in comparison to other regions. This is probably a result of relatively high rates of public ownership and relatively low population densities and expected developmental pressures in the near future. Nonetheless, this by no means implies that there is not still work to be done. Public policy, particularly as it relates to harvesting and grazing, is constantly being shaped and impacts how we manage oak woodlands and forests on USFS and BLM land. Development, particularly around the city of Redding, still is occurring and smart city and county planning is necessary to insure that development occurs in an ecologically-friendly manner. Additionally, conservation easements can help protect oak woodlands that do not face developmental pressures in the immediate future but might at some time down the road. Funds for this purpose are limited at this time.

Shasta County is clearly the most significant county in this region in terms of oak conservation. Shasta contains more than half of the region's oak woodlands. In addition to the greatest acreage (550,000) of Oak Woodlands in the region, it boasts regional highs with oak woodlands covering 23% and oaks present on 35% of its area. It also contains nearly all of the region's valley oak and blue oak woodlands. Finally, it has the highest percentage of private ownership (73%) in the region and, with greater than 25,000 acres, contains almost all of the region's oak woodland 'At Risk'. Once again, the area around Redding is a hotspot for oak conservation as this is where the majority of this region's development has and will continue to occur. Consequently, this area should be the focus of any oak woodland conservation efforts.

Trinity County is somewhat unique in terms of oak conservation in that more than half of the county's oak woodlands are managed by the USFS and only about 40% are privately owned. Although many of Trinity's oaks come in the form of oak forests, oaks are still present on over 500,000 acres throughout the county. Once again, low human population densities are found throughout the majority of the county and limited development is expected in the near future. This is a county where public land management should come under scrutiny and, wherever possible, preventative conservation measures may be utilized to insure oak woodland preservation in perpetuity.

Siskiyou County is another county where oak forests play a far more significant role than oak woodlands due to their greater numbers. Similar to Trinity County, roughly one-half of Siskiyou oak woodlands are publicly owned and low population densities result in low development pressure.

Lassen and Modoc Counties both contain relatively inconsequential acreages of oak woodlands (8,400 acres in Lassen and 1,100 acres in Modoc) and oak forests (2,400 acres in Lassen, none in Modoc) near the northeast corner of Shasta County.



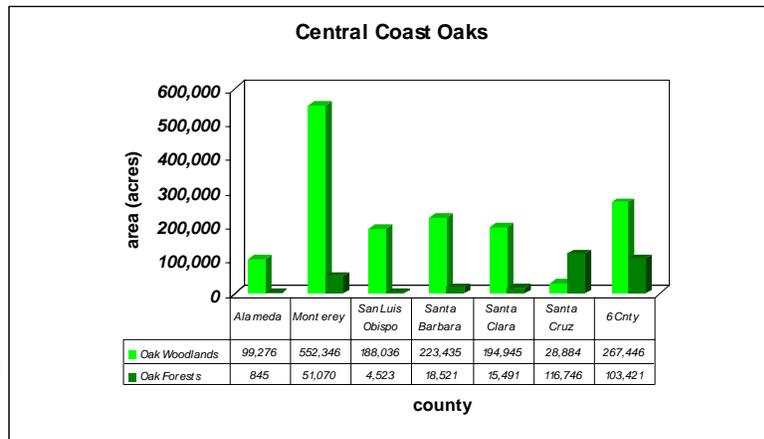
The Central Coast Region

Alameda, Contra Costa, Marin, Monterey, San Benito, San Francisco, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, and Ventura

Mapping Data Availability: The FRAP maps in conjunction with the USBR map leave three gaps; a small portion of northwest Santa Barbara County that has been mapped, but was not completed in time for inclusion in this study; much of San Luis Obispo County which is still unmapped; and a small section in San Benito County.

Oak Distribution

- The Central Coast is home to 1.6 million acres of oak woodlands and another 300,000 acres of oak forests.
- Overall, oaks are present on 17.5% of the region's area.
- Four counties provide 75% of the Central Coast oak woodlands: Monterey, Santa Barbara, Santa Clara, and San Luis Obispo.
- Oak woodlands comprise more than 20% of the area in Alameda, Monterey, and Santa Clara Counties.
- Santa Cruz has over 100,000 acres of forest oaks. Over 50% of land in that county has oaks present on it.



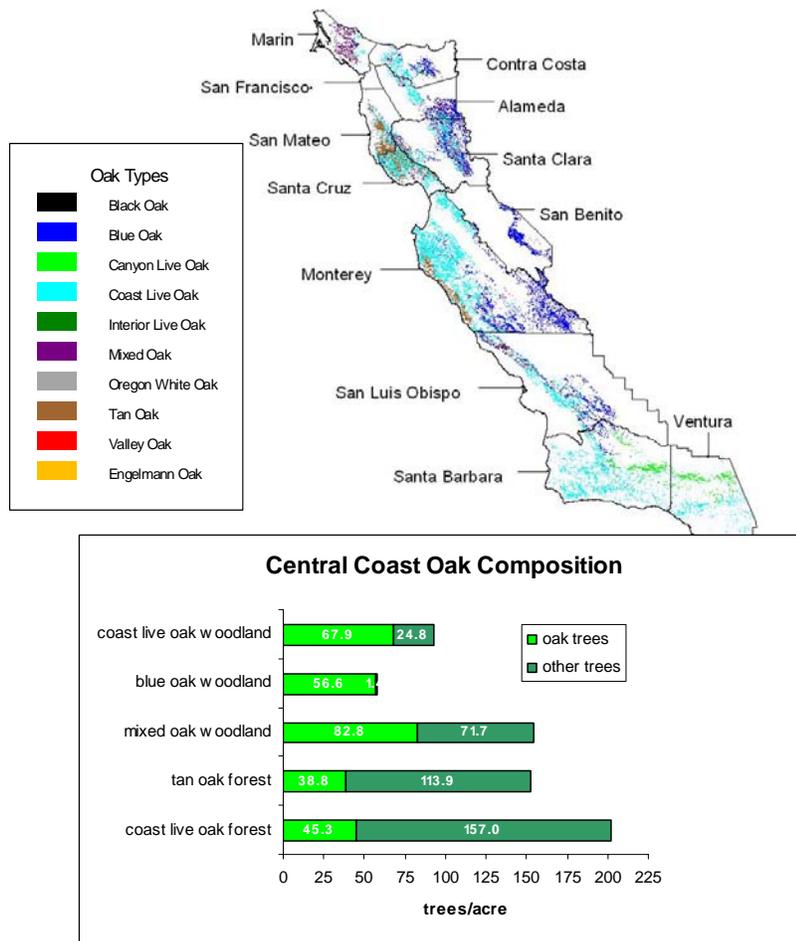
Central Coast Oak Diversity

Oak Woodlands

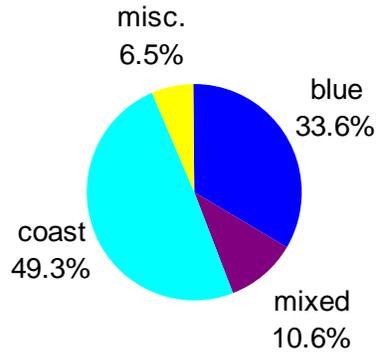
- One-half of the Central Coast’s oak woodland is coast live oak. One-third is blue oak.
- Eighty percent of California’s coast live oak woodland is in the Central Coast. Coast live oak woodland regularly includes bay trees, but oaks account for nearly 80% of the basal area in this oak type and over 90% of the trees greater than 10” in diameter.
- Blue oak woodland often includes coast live oaks. Overall, more than 95% of trees in all size classes are oaks.
- Mixed oak woodlands include coast live oak and bay mixing with black and/or blue oaks. Oaks account for more than 60% of the basal area and more than 50% of the trees greater than 5” DBH in these stands.
- Thirty percent of the state’s valley oak woodland is in the Central Coast, but there is not adequate inventory data to confidently describe this critical oak type.

Oak Forests

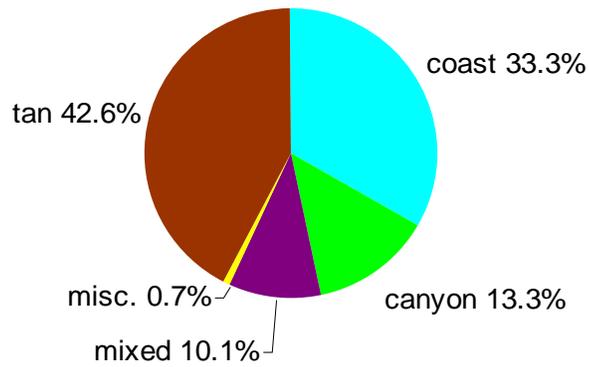
- Tanoak and coast live oak account for three-quarters of the region’s oak forests.
- Redwood and Douglas-fir are dominant in tanoak forests, but oaks comprise one quarter of the trees greater than 5” DBH and one eighth of the basal area.
- Coast live oak forests often include canyon and/or interior live oak, with bay and redwood or Douglas-fir.
- Overall, oaks account for 10% of the basal area of these stands and provide more than 20% of the trees greater than 5” DBH.



Central Coast Oak Woodland Diversity



Central Coast Oak Forest Diversity



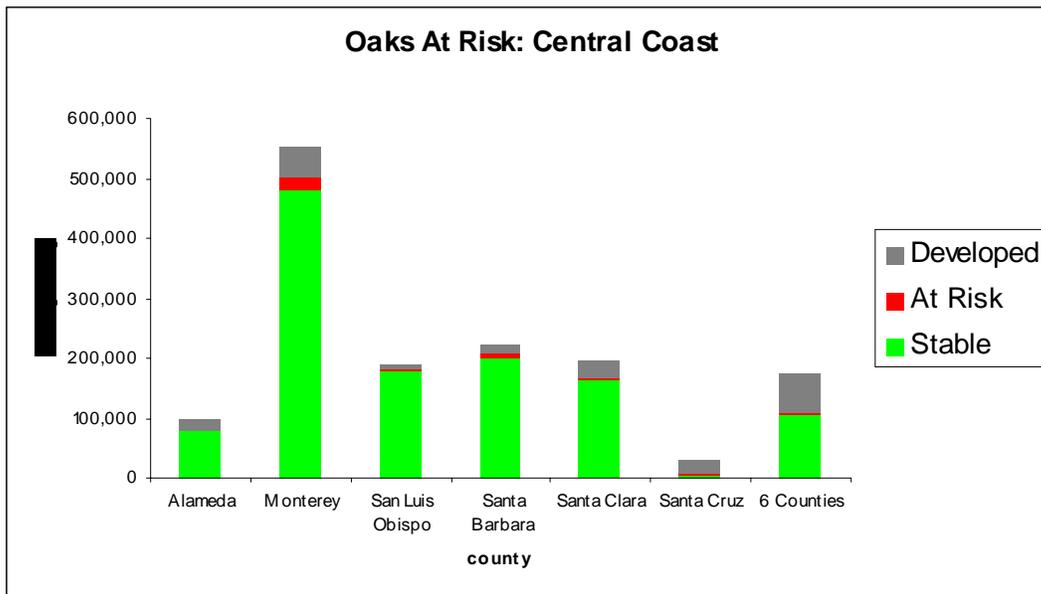
Oaks at Risk in the Central Coast Region

Ownership

- A complex land ownership matrix covers the oak woodlands of the Central Coast.
- Private ownership of oak woodlands predominates, averaging 75% throughout the region and ranging from 65% in Santa Barbara to 95% in Alameda.
- Another 15% is managed by the Los Padres National Forest, five percent by the US Military, and five percent by state and local governments. The Los Padres National Forest covers much of the oak woodlands in Ventura, Santa Barbara, San Luis Obispo, and Monterey.
- Additionally, the BLM manages 20% of San Benito's oak woodlands and Fort Hunter-Liggett holds 12% of Monterey's oak woodlands.
- The state owns approximately 10% of oak woodland in Santa Clara, Contra Costa, and Santa Cruz. Local ownership covers nearly 20% of oak woodland in Marin and Contra Costa.

Development

- Almost 85% of the Central Coast oak woodlands are unlikely to be developed before 2040.
- Most of the remaining areas have already been developed.
- Less than three percent is still at risk for development.
- Monterey once again leads the way with 24,000 acres of oak woodland 'At Risk', more than half of the region's total. Santa Clara, Santa Barbara, and San Luis Obispo are next on the list.
- Four percent of Monterey's oak woodlands are 'At Risk', topped in the region only by Santa Cruz at eight percent.
- In fact, more than three-quarters of Santa Cruz's oak woodlands have already been developed and less than 16% are currently in the stable category. Both of these figures are records for the state.



Critical Oak Conservation Issues: Central Coast

The Central Coast is one of the more complex regions in the state in terms of oak conservation. The northern half of the region includes a number of relatively small counties that possess a variety of oak resources interspersed with major population centers. The oak woodland ownership matrix includes significant landholdings by the National Park Service, the USFS, the Bureau of Land Management, the US Military, State Parks, and local governmental agencies. Private property fills in the gaps, covering just less than 75% of the oak woodlands. This region has significant oak mapping gaps, a major threat posed by Sudden Oak Death, the state's biggest collection of large oaks, and major oak regeneration problems. Interestingly, while high levels of oak woodland development have already occurred in this region, development in the near future is expected to be somewhat limited. Therefore, the main challenge becomes trying to maintain open spaces and restore ecosystem functioning in the wildland-urban interface. Naturally, a diversity of owners and problems necessitates a diversity of approaches and solutions. This is definitely a region where using all of the tools in the conservation toolbox is essential.

Monterey County stands out as the Central Coast's county most at risk. With over 550,000 acres of oak woodlands, Monterey doubles any other county in the region and maintains one-third of the region's oak woodland. More than one-quarter of the county is covered by oak woodland (also a regional high). More than half the region's oak woodlands at risk are in Monterey County and only Santa Cruz is more threatened by development. Monterey also contains more coast live oak than any other county in the state and nearly half of the Central Coast's blue oak woodlands with over 250,000 acres of each. The largest military holding of oak woodlands lies within Fort Hunter-Liggett in Monterey County. Development is the main issue in Monterey County, so conservation-minded county and city planning is necessary to limit urbanization and promote woodland health. Additionally, Fort Hunter-Liggett needs to manage its' oaks to ensure their sustainability .

Santa Cruz County possesses a unique situation in terms of oaks. Despite having less than 30,000 acres of oak woodlands, Santa Cruz has over 100,000 acres of oak forests. Santa Cruz joins Mendocino as the only two counties that have oaks present on over half the land. Santa Cruz also has a higher concentration of oak forests than any other county in the state. Moreover, Santa Cruz has the highest percentage of oak woodlands at risk in the county. In fact, Santa Cruz's oaks may have undergone more intense development over the past 50 years than any other county's oaks. Over three-quarters of Santa Cruz's oak woodlands have been developed and only 15% are reasonably stable for the time being. In a place like this, conservation efforts should focus on smart growth and retaining natural ecosystem functioning to the best extent possible, even in people's backyards.

San Luis Obispo County is an interesting county in terms of oak mapping. Significant portions of the county are unmapped and large populations of oak woodlands likely exist in these unmapped areas. Nonetheless, San Luis Obispo has nearly 200,000 acres of mapped oak woodlands. It has nearly 9,000 acres of known valley oak woodlands, topped only by Tehama. There is little risk for development amongst the mapped oak woodlands in San Luis Obispo. However, the unmapped areas are more likely to be developed, as they are further from USFS land. Mapping the unmapped portions of this county should be a top priority, as should be trying to protect large tracts of undeveloped, unprotected oak woodland.

Critical Oak Conservation Issues: Central Coast (continued)

Santa Barbara County ranks second in the county to Monterey in terms of oak woodland acreage. It also has a high proportion of public land. Fortunately, future development of oak woodland should be relatively slow. In general, Santa Barbara faces similar problems to San Luis Obispo. The oaks in and around rural development need to be protected through governmental planning and the opportunity exists for the protection of large tracts of private oak woodlands.

Ventura County does not have the large acreages of oak woodlands and forests found in Santa Barbara and San Luis Obispo, but it does face similar problems. Past development is even more pronounced here as we get closer to Los Angeles, but the issues are mostly the same: high levels of public land and large populations living in and around oak woodlands.

Santa Clara County comes in second to Monterey in terms of oak woodland concentration. Henry Coe State Park provides a nice refuge for oak woodlands and, for the most part, development around it is occurring slowly.

Contra Costa and **Marin Counties** are unlike most other counties in that nearly 20% of their oak woodlands are owned by county and municipal governments. This provides an excellent opportunity for smart public planning to protect critical natural treasures. On the other hand, high levels of oak woodland development have already occurred, thereby making the management of the remaining areas even more important.

San Mateo and **Alameda Counties** have experienced very high levels of oak woodland development in the past. The goals in these counties should be to mitigate damage caused by new housing developments and to maintain open spaces and ecosystem functioning in suburban areas.

San Francisco County does not host any significant acreage of natural oak woodlands.

San Benito County is unique due to the oak woodlands near the Carrizo Plain National Monument. San Benito also has a small gap in its vegetation map and may be home to some oaks residing at low densities in grasslands. Development risk is currently low.



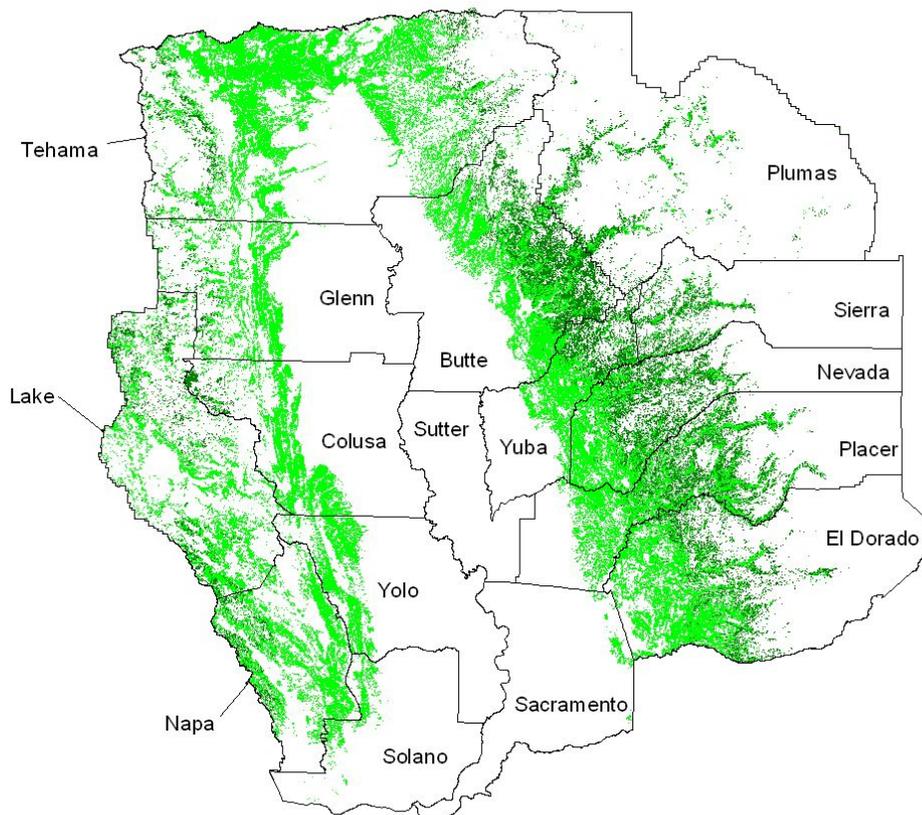
The Sacramento Region

Butte, Colusa, El Dorado, Glenn, Lake, Napa, Nevada, Placer, Plumas, Sacramento, Sierra, Solano, Sutter, Tehama, Yolo, and Yuba

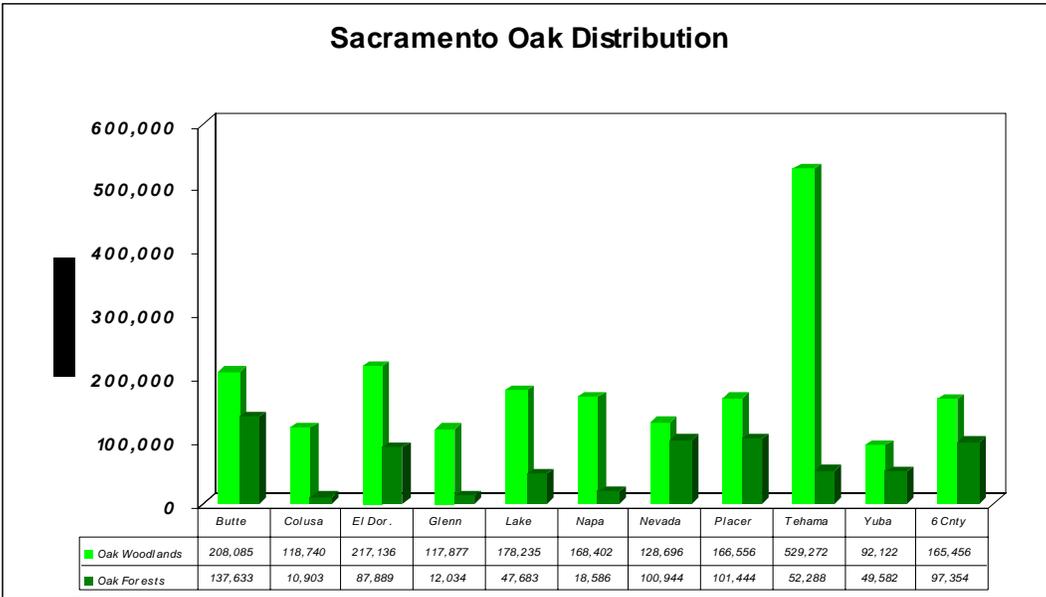
The FRAP maps in conjunction with the USBR map adequately cover this entire region.

Oak Mapping

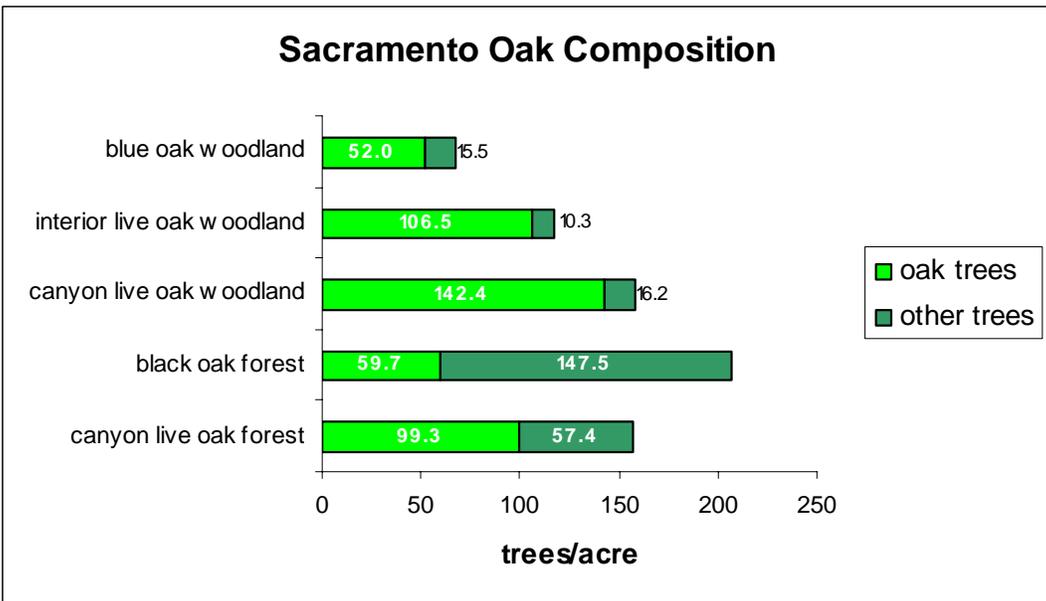
- The Sacramento region's 2.1 million acres of oak woodlands provide nearly one-quarter of the state's total.
- Including approximately 700,000 acres of oak forests, oaks are present on 20% of the region's land.
- Tehama County has more oak woodlands than any other county in the region, but large oak populations are found in many counties throughout the region.
- Thirty three percent (33%) of Napa County is covered by oak woodlands, giving it the greatest density of oak woodlands in the state.
- Tehama, Yuba, Lake, and Nevada Counties are each at least 20% covered by oak woodlands.



Sacramento Oak Distribution



Sacramento Oak Composition



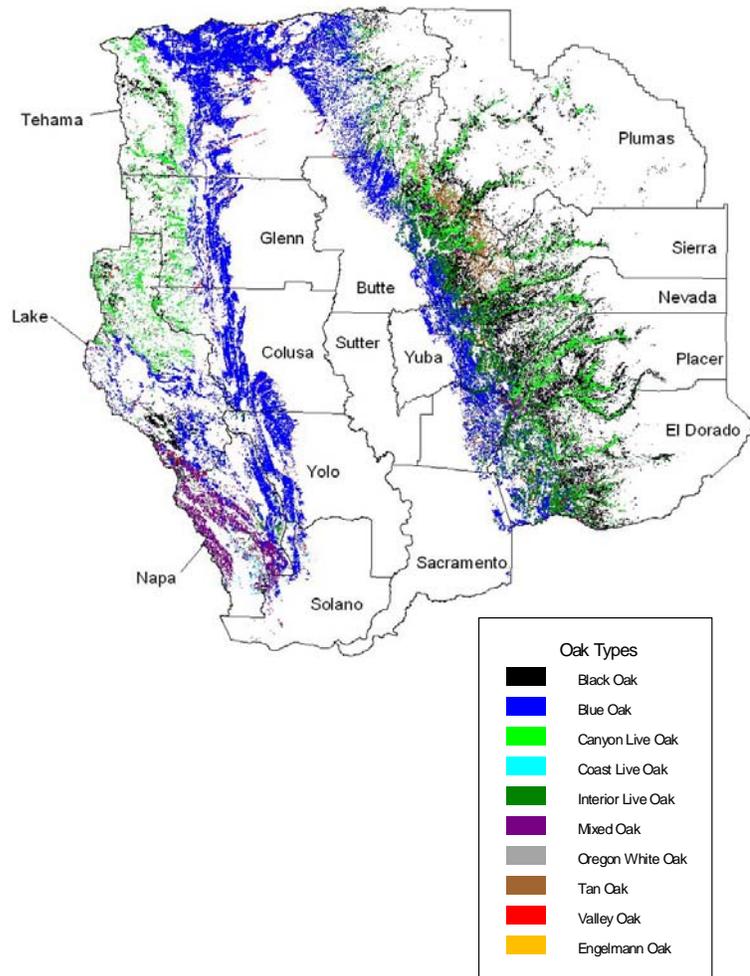
Sacramento Oak Diversity

Oak Woodlands

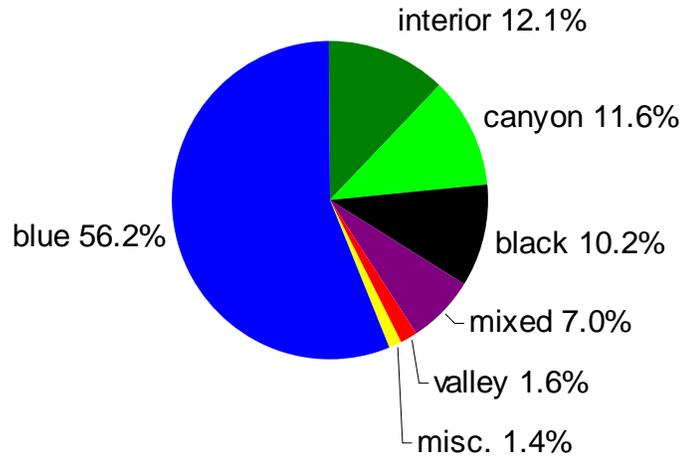
- More than half of Sacramento's oak woodlands are blue oak. Gray pines mix in, but oaks comprise 70% of the basal area and 80% of the trees greater than 5" DBH.
- Interior live oak woodland contains blue oak, valley oak, black oak, gray pine, and ponderosa pine.
- Canyon live oak and black oak woodlands include Douglas-fir, ponderosa pine, and incense cedar.
- In canyon and interior live oak woodland, oaks make up 80% of the basal area and 90% of the trees.
- The Sacramento region has more than one-third of California's valley oak woodland and more than one-third of California's blue oak woodland.
- Tehama has the most blue oak, valley oak and canyon live oak woodland. El Dorado has the most interior live oak and black oak woodland.

Oak Forests

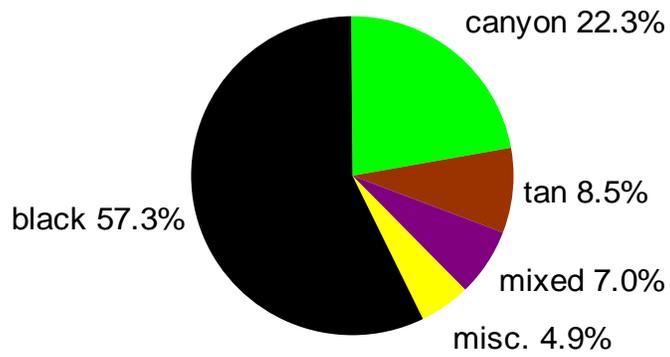
- Black oak and canyon live oak dominate the region's oak forests.
- Canyon live oak forests are 60% oaks, mixing with ponderosa pines and Douglas-firs.
- Black oak forests are 25% oaks, along with Douglas-fir, ponderosa pine, white fir and incense cedar.



Sacramento Oak Woodland Diversity



Sacramento Oak Forest Diversity



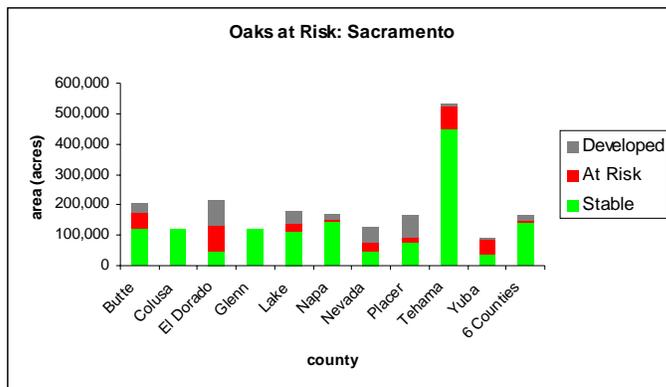
Oaks at Risk in the Sacramento Region

Ownership

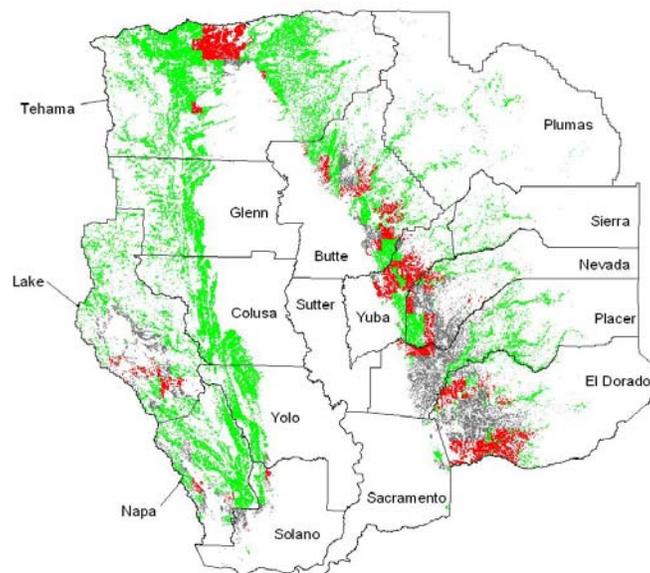
- More than 80% of the Sacramento region's oak woodland is private.
- The USFS owns about 60% of the remaining public lands, including large portions of the oak woodlands in Plumas (81%), Sierra (74%), Glenn (28%), Placer (20%), and Lake (19%) Counties.
- Private ownership of oak woodlands surpasses 80% in all other counties, topped off by Solano (98%), Yolo (97%), Sacramento (96%), Colusa (94%), and Napa (93%) Counties.

Development

- Sacramento is more at risk for development than any other region. Only two-thirds of Sacramento's oak woodlands are considered 'Stable'. One-sixth is 'Developed' and one-sixth is 'At Risk'.
- Over 300,000 acres of oak woodland could be developed in the Sacramento Region by 2040.
- El Dorado has more oak woodlands at risk than any other county in the state, but Tehama, Butte, and Yuba are not far behind.



- By 2040, 80% of El Dorado County's oak woodlands may be developed and more than half of the oak woodlands in Nevada, Yuba, and Placer Counties may be developed.



Critical Oak Conservation Issues: Sacramento Region

More than any other region, the Sacramento region is literally paving the way in terms of oak woodland development. One-sixth of Sacramento's oak woodland has already been developed and another one-sixth is likely to experience the same fate by 2040. Overall, nearly half of California's oak woodlands at risk are found in this region. Suburban sprawl and rural growth in the foothills outside of the city of Sacramento account for most of this, but development around Red Bluff poses a major threat in the near future. Blue oak woodland comprises more than half the region's oak woodlands, complemented by the state's largest collection of valley oak woodland. Interior live, canyon live, and black oak woodlands and forests fill in at higher elevations. Over 80% of the Sacramento region's oak woodlands are privately owned. The oak conservation focus in this region must deal with development and private lands. The pace of development is staggering in the region, so managing this development in a sustainable manner is essential. Effective county planning is a must for approaching this problem. Securing easements and setting up oak reserves is essential for long-term conservation. Smart growth policy applications can help protect sensitive areas and mitigate environmental consequences of development.

El Dorado County has more acres of oak woodlands at risk for development than any other county in the state. In fact, with nearly 90,000 acres of oak woodlands at risk, El Dorado County alone tops the entire North Coast, North Interior, Central Coast, and Southern Regions. Forty percent of the county's oak woodlands have already been developed and another 40% may soon experience the same fate as the Highway 50 corridor expands. In the region, only Tehama has more oak woodland and no county has more interior live oak woodland than El Dorado.

Placer County's oak woodland has experienced comparable urbanization along the Highway 80 corridor in the past. In the future, while densification will continue, new sprawl will occur more slowly than in El Dorado. This is due in part to the fact that one-third of Placer's oak woodlands are publicly owned. In both Placer and El Dorado Counties, development threatens to encompass nearly all private oak woodland within 35 years. Immediate action is critical to protecting the oak woodlands in these two counties.

Yuba County is relatively small with less than 500,000 total acres. However, oaks are present on more than one-third of that acreage. Additionally, more than half of Yuba's oak woodlands are at risk for development. Without effective action, more than fifty thousand acres of Yuba's oak woodlands may be developed by 2040. The major wave of oak woodland urbanization is just starting to hit Yuba and now is the time to guide Yuba's oak woodland development towards sustainability. Yuba County represents a unique opportunity to proactively address a new and emerging threat to California's oaks.

Nevada County is undergoing similar development to Yuba County, but it is much further along in the process. Fifty thousand acres of oak woodland have already been developed and another 30,000 acres could follow before 2040. The population explosion experienced by the city of Sacramento is being felt in Yuba and Nevada Counties as well.

Critical Oak Conservation Issues: Sacramento Region (continued)

Tehama County is one of four counties in the state with more than 500,000 acres of oak woodlands (Mendocino, Shasta, and Monterey are the others). Tehama has more valley oak woodland (12,000 acres) and more blue oak woodland (450,000 acres) than any other county in the state. Twenty-eight percent of the county is covered by oak woodlands. Development has been slow in this county's oak woodlands, but it is poised to take off around Red Bluff. Tehama ranks second in the state with over 70,000 acres of oak woodland threatened by development before 2040.

Butte County has another 50,000 acres of oak woodland at risk. Chico and Oroville are the epicenters of growth in this county. In both Butte and Tehama, large tracts of oak woodland are at risk for development and very little has been protected in perpetuity. Smart growth and public planning around population centers should be coupled with conservation easements on privately-owned lands.

Sierra and Plumas Counties both contain relatively small oak woodland populations that are predominantly owned by the USFS. Oak woodland development is limited. Management of public oak woodlands is most important here.

One-third of **Napa County** is made up of oak woodlands. No other county in the state has greater oak woodland density than Napa. With 170,000 acres of oak woodland, 93% of which are privately owned, it ranks fifth in the region. Development pressures in the form of major population densification and urban expansion into oak woodlands are lighter than in other parts of the region. Nonetheless, other pressures like grazing and vineyards do persist. This is a perfect example of a county where smart public planning can encourage landowners to manage their private oak woodlands in ways that are sustainable.

In **Lake County**, oak woodland development pressures are actually a little higher than in Napa County and public ownership is much higher. Nonetheless, similar oak woodland conservation challenges are present in Lake and Napa Counties.

In **Sacramento, Solano, and Sutter Counties**, relatively little oak woodland has been mapped by FRAP. Most of what has been mapped is either developed or in some way protected from development. The US Bureau of Reclamation map reveals some additional oak woodland in the valley. In general, the key issues in these counties involve managing oaks in urban, suburban, and agricultural environments.

Colusa, Glenn, and Yolo Counties each have on the order of 100,000 acres of oak woodland according to the FRAP map. In Glenn County, the USFS has significant oak woodland holdings, but most oak woodlands are privately owned as usual. Development of these oak woodlands is unlikely in the near future. Additional oak woodlands are seen in the USBR map at lower elevations, many in agricultural environments and low density residential zones. Conservation strategies include easements, county planning and landowner involvement.



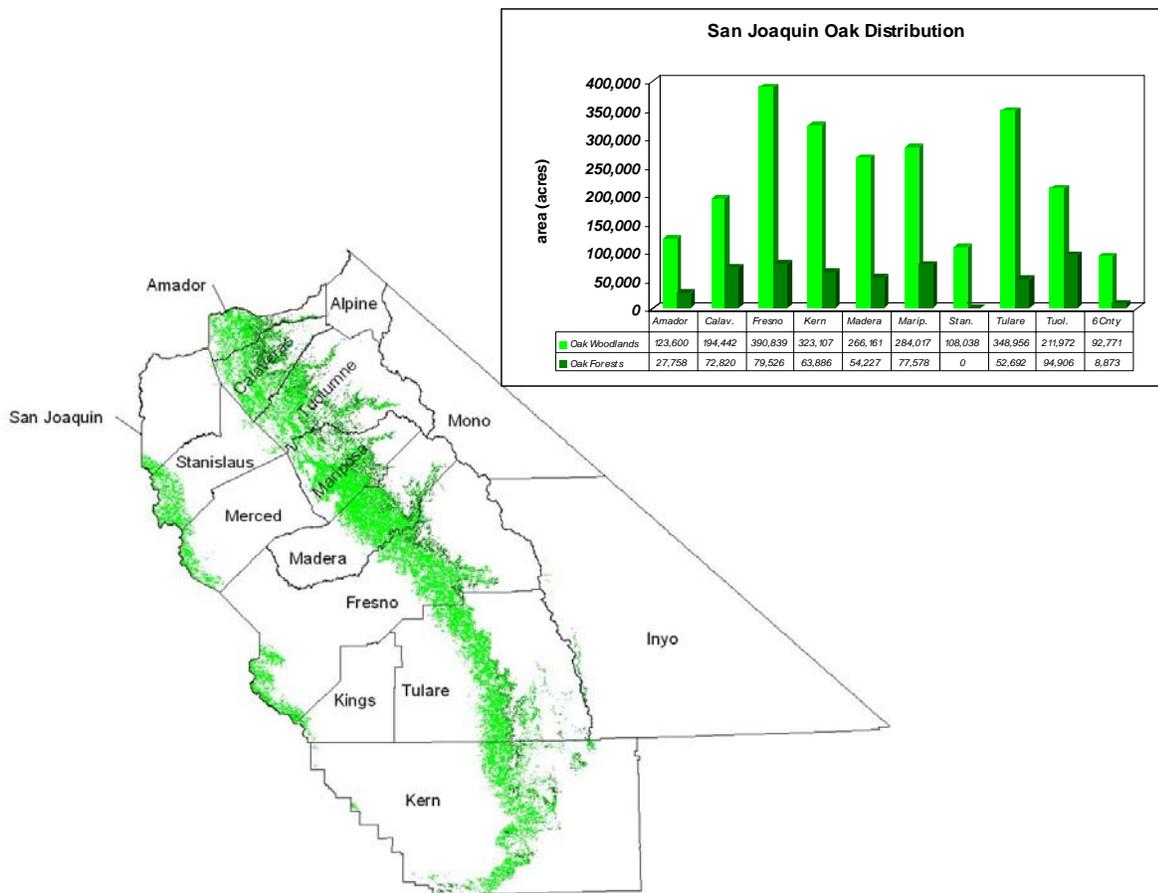
The San Joaquin Region

Alpine, Amador, Calaveras, Fresno, Inyo, Kern, Kings, Madera, Mariposa, Merced, Mono, San Joaquin, Stanislaus, Tulare, Tuolumne

Data Availability: The FRAP maps combined with the US Bureau of Reclamation map covers most of this region. The Sequoia-Kings Canyon National Park map covers the gaps in Tulare and Fresno Counties. The only other data gap is in the desert, where little or no oak woodland is present.

Oak Mapping

- The San Joaquin region has more than 2.3 million acres of oak woodlands and 500,000 acres of oak forests.
- Oaks are present on only 10% of the region’s land. However, certain portions of the region have far greater oak woodland density than others.
- Overall, 27% of the state’s oak woodland falls within these 15 counties.
- The San Joaquin region currently has more than 450 million oak trees. More than one-third of these oaks are larger than 5” DBH.



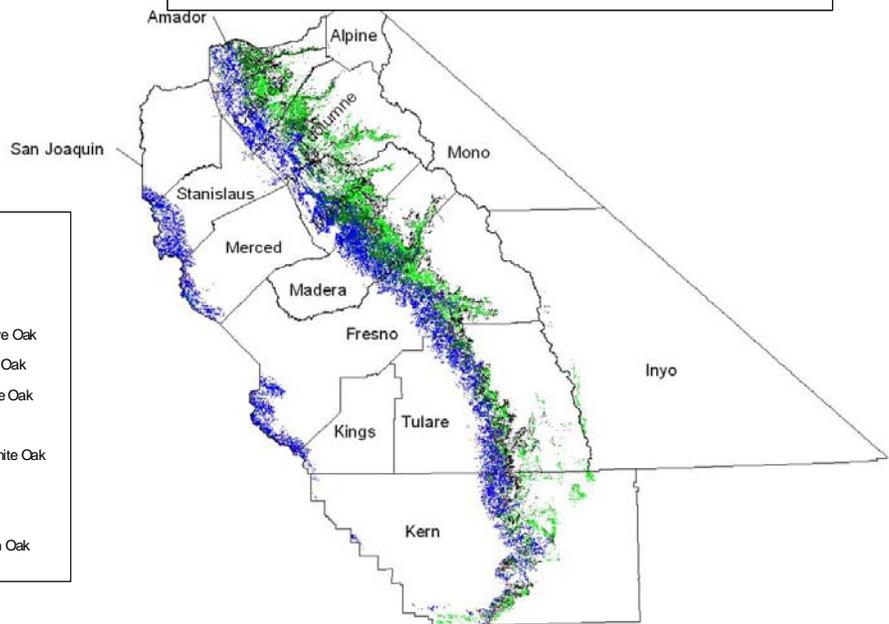
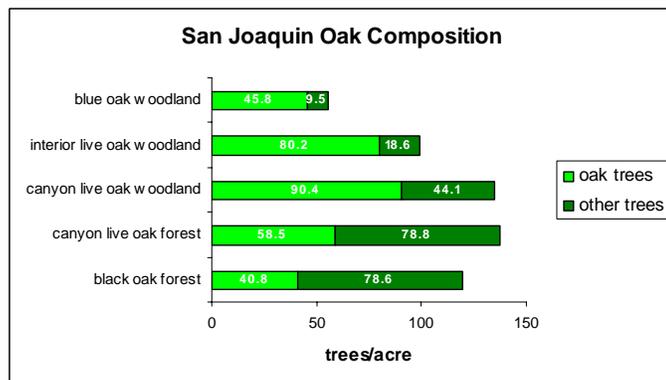
San Joaquin Oak Diversity

Oak Woodlands

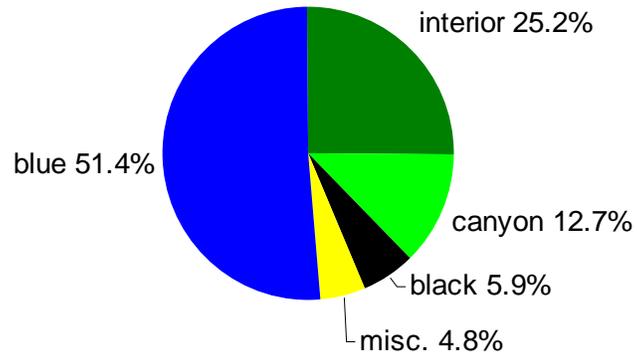
- More than half of the region's oak woodlands are blue oak and another 25% are interior live oak.
- Associated species include gray pine and buckeye, as well as valley oak, blue oak and canyon and interior live oaks.
- The San Joaquin region has more blue oak woodlands and interior live oak woodlands than any other region.
- In blue oak woodlands, oaks account for 70% of the trees and 80% of the basal area and trees greater than 5" DBH.
- In interior live oak woodlands, oaks provide 70% of the tree basal area and more than 80% of the trees.
- In canyon live oak woodlands, oaks comprise 55% of the basal area, 62% of all trees, and 67% of trees greater than 5" DBH.

Oak Forests

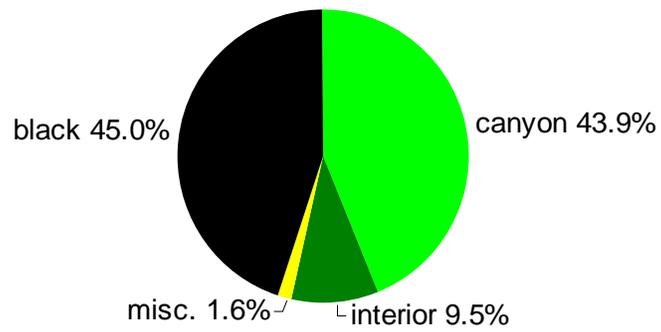
- Canyon live oak and black oak comprise almost 90% of the oak forests.
- Associated species in San Joaquin oak forests include incense cedar, ponderosa pine, sugar pine and white fir.
- In canyon live oak forests, oaks provide one-third of the basal area and nearly one-half of the trees.
- In black oak forest, oaks comprise more than half of the trees, but only one-third of the trees greater than 5" DBH and only one-quarter of the tree basal area.



San Joaquin Oak Woodland Diversity



San Joaquin Oak Forest Diversity



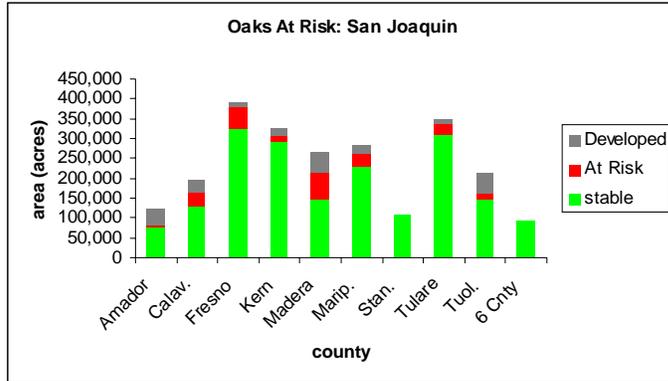
Oaks at Risk in the San Joaquin Region

Ownership

- Seventy-three percent of the San Joaquin region's oak woodlands are privately owned.
- The USFS owns 18% and the BLM owns five percent.

Development

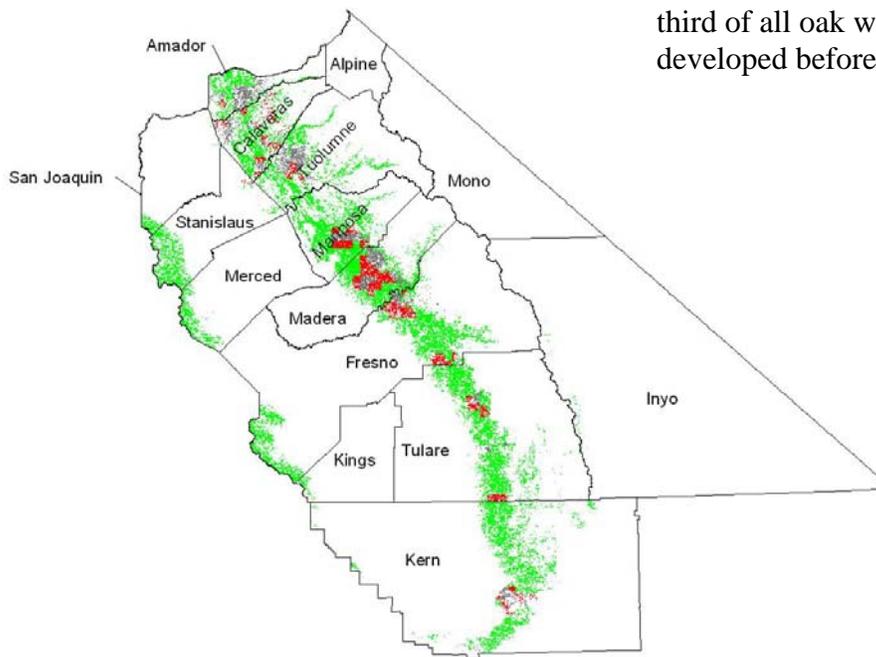
- Ten percent of the oak woodlands in the region have already been developed. Ten percent are at high risk of development by 2040. Eighty percent are currently stable, however targeted planning could ensure that a greater number of acres are conserved for the long-term.



- Nearly 250,000 acres of oak woodlands in the San Joaquin region are at risk of development by 2040. Only the Sacramento region contains more oak woodlands at risk.

- In Madera, Amador, and Calaveras Counties combined, more than one-third of all oak woodland may be developed before 2040.

- In Madera, Amador, and Calaveras Counties combined, more than one-third of all oak woodland may be developed before 2040.



Critical Oak Conservation Issues: San Joaquin Region

The **San Joaquin** region has more than one-quarter of California's oak woodlands, more than one-third of California's blue oak woodlands and more than two-thirds of California's interior live oak woodlands. While oaks are present on only 10% of the acreage region-wide, oak woodlands are densely distributed throughout the Southern Sierra Nevada Foothills. More than 70% of this critical and sizeable chunk of oak woodlands is privately owned, but the USFS, BLM, and the National Park Service have major holdings as well. Nearly a quarter million oak woodland acres in this region have already been developed and another quarter million acres are at risk by 2040. One third of the state's oak woodland at risk is found within the San Joaquin Region. The South Yosemite areas around Oakhurst and Mariposa are most at risk, but the development axis spreads up Highway 49 through Sonora, Angel's Camp and Jackson. Additional pockets are found further south by the entrances to Sequoia-Kings Canyon National Park and by Tehachapi. Vast oak woodland resources are found within the San Joaquin region. In an area so vast and with so much diversity, a variety of conservation tools are necessary. Management of public oak woodlands is a crucial issue. Development also needs to be managed to provide sustainability. Perhaps most importantly, efforts must be made to legally protect huge acreages of private land through easements and/or in fee acquisitions.

Twenty-five percent of **Madera County's** quarter million oak woodland acres are at risk of development by 2040. Only El Dorado and Tehama counties have more acres at risk. The foothill bands of blue and interior live oak woodland pass through Madera where they face developmental pressures radiating out from Oakhurst and Yosemite's South Entrance. Recreation and tourism are key factors here, as well as the typical expansion outward from Fresno and the other valley cities.

Mariposa County has more oak woodlands than Madera County. In fact, oaks cover more than a third of the county. Mariposa's oak woodlands face less immediate threat of development than those in Madera. Nonetheless, 30,000 acres of oak woodland are at risk by 2040. In both Madera and Mariposa, public land management is a crucial issue. Smart growth is essential to manage development but still retain natural oak woodland resources.

Tuolumne County has the highest rate of oak woodland development in the region. Management of significant public land holdings, protection of the remaining private oak woodlands and application of smart growth principles around Sonora and Standard are essential in order to avoid degradation of scenic and wildlife values. Oaks are present on 40% of Calaveras County land, of which thirty-thousand acres are developed. Another 35,000 of oak woodlands are at risk around San Andreas and Angel's Camp. Almost 90% of Calaveras' oak woodland is privately owned. Steps must be taken to mitigate development in the short term and provide easements for the long term.

In Amador County, more than one-third of the oak woodlands have already been developed and over 90% of remaining oak woodlands are privately owned. Conservation and management of oak woodlands around Amador City, Ione, Jackson, Plymouth and Sutter Creek is critical. Additionally, steps should be taken to provide more long-term protections for oak woodlands in this county.

Critical Oak Conservation Issues: San Joaquin Region (continued)

Fresno County tops the San Joaquin region with nearly 400,000 acres of oak woodland. Fresno is one of four counties in the state with more than 200,000 acres of blue oak woodland (Tehama, Shasta, and Monterey are the other three). Despite high public ownership by the USFS and the BLM, more than 50,000 acres of oak woodland in Fresno are at risk of development before 2040. The most vulnerable areas are those that are commutable to the City of Fresno. The southern portion of the county near the National Park is also at high risk. Fresno has oak woodlands on its western side, much like Stanislaus and Merced. Fresno also has some oaks in the Central Valley, which are typically scattered around existing developed and agricultural areas. These areas are often covered by the USBR map, but not by the FRAP map. Nonetheless, the majority of the region's oak woodlands and oak forests are found in the Sierra Foothills to the east. With the great diversity of environments found in Fresno County comes a diversity of problems and solution options. Development must be managed towards sustainability. Oak woodlands in residential areas must be protected through education and public incentives and regulations. Protections must be put in place in order to conserve rural private oak woodlands in perpetuity. Public lands must be appropriately managed.

Tulare County's situation is similar to Fresno County, but with a less severe threat. Tulare has over 300,000 acres of oak woodland, nearly 30,000 of which are at risk for development by 2040. Tulare maintains more than half of the region's valley oak woodlands and considerable acreage of blue oak woodland as well. Development pressures include valley towns expanding into the foothills and pressures from recreation and tourism. One-third of Tulare's oak woodlands are owned by the government, so proper management of public oak woodlands is important. Additionally, growth and development should be carefully monitored and limited where possible. Finally, long term protections are needed for wild private woodlands.

Kern County also has over 300,000 acres of oak woodland. Roughly five percent has already been developed and another five percent are at risk of development before 2040. As in many other parts of the San Joaquin region, blue oak woodlands and interior live oak woodlands abound. Oak woodland development is concentrated around the City of Tehachapi. Kern is experiencing problems similar to those faced in Fresno and Tulare. In particular, the issue of private land stewardship is critical to protect vast acreages of oak woodlands.

Stanislaus, Merced, San Joaquin, and Kings Counties have a total of 200,000 acres of mapped oak woodland. The majority of these oak woodlands are found in Stanislaus and Merced Counties. Most of this is in the western portions of the counties and while most of it is privately owned, very little is expected to be developed before 2040. The U. S. Bureau of Reclamation map shows some additional acreage in the county, but mostly in agricultural or developed areas. Permanent protection should be sought for oak woodlands before large-scale development eliminates this option.

Alpine, Mono, and Inyo Counties combined have less than 5,000 acres of oak woodland, owned and managed almost entirely by USFS.



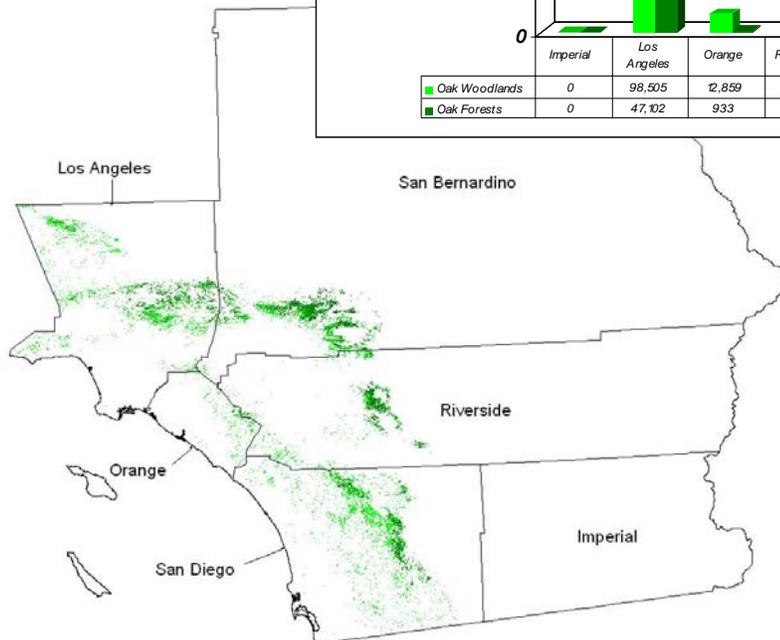
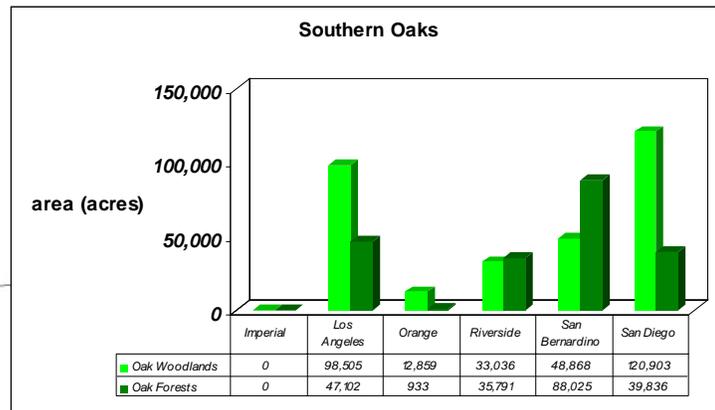
The Southern Region

Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego

Data Availability: This entire region is adequately covered by the FRAP maps. The areas that are not covered by FRAP maps are predominantly desert with few oaks.

Oak Mapping/Inventory

- The Southern region is home to more than 300,000 acres of oak woodlands and more than 200,000 acres of oak forests.
- Combined, these 500,000 acres comprise only two percent of the region. However, discounting urban areas and the desert, the oak woodland concentration is much higher.
- San Diego and Los Angeles Counties collectively contain more than two-thirds of the Southern region's oak woodlands.
- San Bernardino County has the largest quantity (90,000 acres) of oak forests in the region.



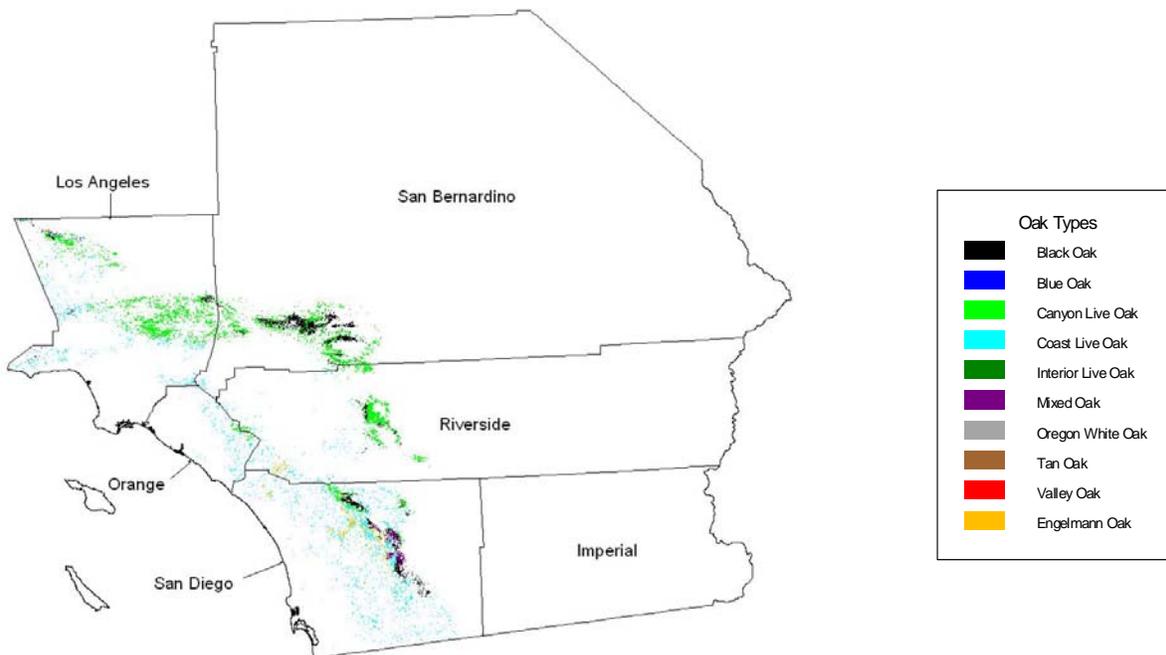
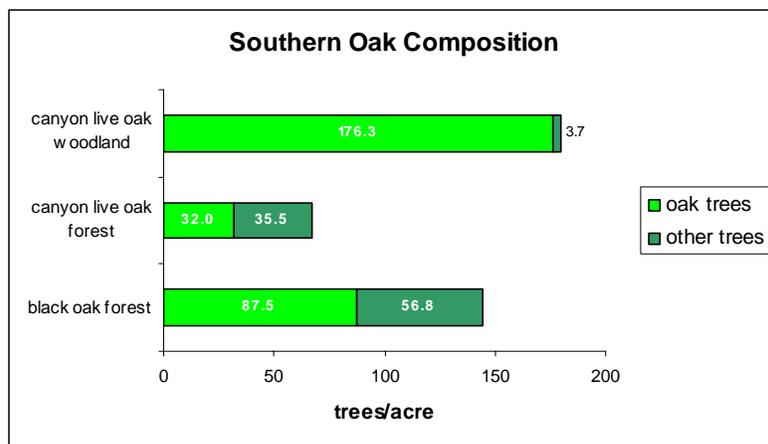
Southern Oak Diversity

Oak Woodlands

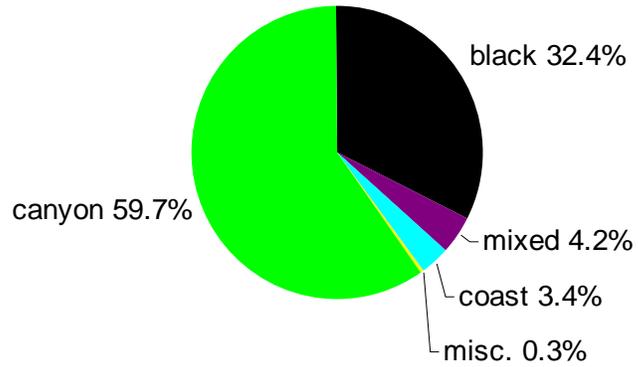
- Coast live oak and canyon live oak are most prevalent, but black oak and Engelmann oak populations are also significant.
- Eighty-five percent of the basal area is comprised of oaks. Ninety-two percent of the trees greater than 5” DBH are oaks and 96% of the trees greater than 1” DBH are oaks.
- The rare Engelmann oak is found only within this region, mostly in San Diego County.
- Los Angeles County is home to the majority of the region’s blue oak and valley oak woodlands.

Oak Forests

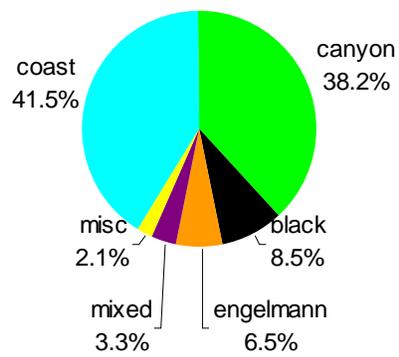
- Canyon live oak and black oak dominate in the Southern region’s oak forests. They mix with Coulter pine, Jeffrey pine, incense cedar and white fir.
- Oaks comprise less than 50% of the basal area, but more than 80% of the trees and 65% of the trees greater than 5” DBH.



Southern Oak Forest Diversity



Southern Oak Woodland Diversity



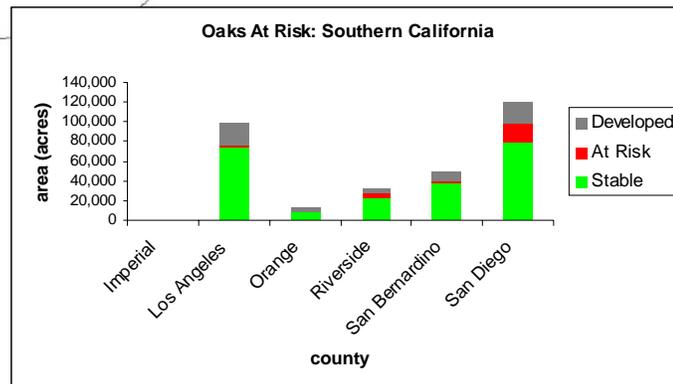
Oaks at Risk in the Southern Region

Ownership

- The oak woodlands of the Southern region have the highest levels of public ownership found in the state.
- USFS owns 44% of the region’s oak woodlands, 11% are owned by other government agencies, and 45% are privately owned.
- The land ownership patterns within this region are variable. The oak woodlands in San Diego and Orange Counties are predominantly privately-owned, but the USFS owns most of the oak woodlands in San Bernardino, Riverside and Los Angeles Counties.

Development

- Twenty percent of the Southern region’s oak woodlands have already been developed. Ten percent are at risk of development by 2040. Development of the remaining 70% is not anticipated in the near future.
- Oak woodland development percentages are higher than in any other region in the state. Only the Sacramento region has a lower percentage of oak woodlands that are considered stable.
- Riverside and San Diego Counties lead the region with almost 20% of their oak woodlands at risk. Both Orange and Los Angeles Counties have already had over 20% of their oak woodlands developed.
- San Diego and Orange Counties have the lowest percentages of stable oak woodland with 65% in each county. San Bernardino tops the list with 78% stable.



Critical Oak Conservation Issues: Southern California

The Southern region is home to a relatively small portion of California's oak woodlands and oak forests. In fact, these six counties have often been grouped with the San Joaquin region in various regional oak studies (Bolsinger 1988, Waddell & Barrett 2005). However, for this study, a decision was made to separate this Southern region in order to address some of the unique challenges to oak conservation being faced in this portion of the state. The oak woodland ownership patterns differ here compared with the rest of the state; less than half of the oak woodlands are privately owned. There are also different species of oaks present, most notably the rare Engelmann oak found in San Diego and, to a lesser extent, Riverside and Los Angeles Counties. Recent droughts in the area have sparked a major conifer die-off which may, in certain areas, convert oak forests to oak woodlands.

San Diego County has the most acres of oak woodlands in the region. These acres are also the most likely to be developed in the near future. It possesses the highest total acreage (120,000) of oak woodlands in the region, the highest percentage (4.5%) of oak woodlands in the region, the highest total acreage (160,000) of oaks present in the region, and the highest percentage (six percent) of oaks present in the region. It also contains nearly all of the state's Engelmann Oak. Riverside is the only other county with significant acreage of Engelmann Oak and San Diego has 7.5% times more Engelmann oak woodland than Riverside. San Diego also has the highest percentage of private ownership (65%) in the region. With more than 20,000 acres at risk, San Diego contains more than two-thirds of the region's oak woodlands at risk.

Riverside County has roughly 35,000 acres each of oak woodland and oak forest. Five thousand acres of oak woodland are at risk, topped only by San Diego. And much like San Diego, the Riverside development push has come later than it did in Los Angeles, Orange and San Bernardino Counties. Therefore, the challenge is to manage the development of Riverside's oak woodlands as judiciously as possible. This requires urban and county planning that will protect critical oak woodlands (including Riverside's Engelmann Oak) from being removed for development, and to mitigate the negative impacts of the development that does occur.

Los Angeles County has nearly 100,000 acres of oak woodland, topped in the region only by San Diego County. One-third of Los Angeles County's oak woodlands have been developed. Almost everything left is controlled by the government, in particular the Angeles National Forest. There are a few thousand acres of undeveloped private oak woodland, but most of them are likely to be developed by 2040. The priority here involves protecting the oaks on public lands and taking steps to protect the remaining oak trees in suburban areas with ordinances, such as one recently passed in Los Angeles (Reference Page/Ordinances of 41 Counties... at www.californiaoaks.org).

Critical Oak Conservation Issues: Southern California (continued)

San Bernardino County is similar to Los Angeles County. Roughly 75% of the county's oak woodlands are publicly owned, primarily by the San Bernardino National Forest. The majority of what is left either has or will soon become developed. Public land management and the urban-wildland interface are the critical issues in San Bernardino County.

Orange County has much the same story as Los Angeles and San Bernardino Counties. However, in Orange County, only one-third of the county's oak woodlands are publicly owned and the other two-thirds have already been developed.

Summary

This project presents an updated map and inventories of oak forests and woodlands. These data should be useful for conservation planning at the regional, county and local levels. The FIA plots are also valuable for ongoing monitoring of thousands of individual trees and populations on a landscape scale over a long period of time.

We found that large oak trees are deceptively rare in California. Valley Oak and Engelmann oaks types need more intensive inventories. Blue oak woodland species have unsustainable rates of regeneration.

Oak woodlands in the Sacramento and San Joaquin Regions are most at risk of development. California should plan for protection of its "stable" oak ecosystems now before these ecosystems are fragmented beyond repair.

A more-detailed version of this report, including regional inventories, is presented online at the website of the California Oak Foundation <http://www.californiaoaks.org/Oaks2040>

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