

Inventory of Tree Mortality in Southern California Mountains (2001-2004) due to Bark Beetle Impacts

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Abstract

Consecutive years of below-average precipitation from 1998 to 2003 resulted in large-scale insect outbreaks in the conifer and mixed conifer/hardwood forests of mountainous southern California. From 2001 through 2004, bark beetles of several species attacked drought-weakened trees in epidemic proportions, leading to millions of dead trees and large areas of dead and dying forests. The dead trees have presented numerous challenges to nearby residents and to government administrators at levels from local to national. Such trees greatly increase the risk of catastrophic wildfire, in addition to threats to structures and the electrical grid should they fall. Hazard tree removal and mitigation has thus been a top priority for a number of different government agencies.

In this study, we examine the forest mortality event from several sources of information, including vegetation change images from the Land Cover Mapping and Monitoring Program (LCMMP), updated vegetation maps, aerial survey maps and recently resampled Forest Inventory and Analysis (FIA) plot data. Using the spatial data in conjunction with the FIA vegetation plots, we calculated statistics on the magnitude of the event in terms of volume and area of dead wood, number of dead trees by size class and by species. We then discuss the current situation in the context of forest health and hazard mitigation, and look at possible risks to private property and plant species of special concern.

Keywords: Remote sensing; forest mortality; southern California

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Introduction

Several consecutive years of drought in the mountains of southern California precipitated a large outbreak of insects that attacked and killed large areas of conifer forest. The mountains most affected by the phytophagous insects include the San Bernardino, San Jacinto, Palomar and Cuyamaca/Laguna ranges. While these insects are a natural part of the forest ecosystem, the scale of the infestation and the magnitude of the impacts make this a highly unusual event. In response to the threats posed by the dead trees, Governor Gray Davis signed a Declaration of a State Emergency on March 7, 2003.

Several species of bark and engraver beetles are responsible for most of the damage to conifers in the region. Each tends to be tree host-specific. The main players which have attacked the pines include mountain pine beetle (*Dendroctonus ponderosae*), Jeffrey pine beetle (*Dendroctonus jeffreyi*) western pine beetle (*Dendroctonus brevicomis*), red turpentine beetle (*Dendroctonus valens*), and the pine engraver beetle (*Ips pini*). The fir engraver beetle (*Scolytus ventralis*) is the main culprit responsible for killing white fir, while cedar bark beetles (*Phloeosinus spp.*) have been damaging incense-cedars in the region¹.

In this study we inventory the areas of forest mortality using digital change detection techniques with remotely sensed data from Landsat Thematic Mapper (TM), newly resampled Forest Inventory and Analysis (FIA) plots, aerial survey and updated vegetation mapping. The dead and dying forests pose a potential hazard to lives, property, and ecosystem health in the region. Standing dead trees in close proximity to power lines can threaten the electrical distribution system, resulting in loss of power to nearby residents and possibly igniting catastrophic wildfires. If they fall on other structures or on roads they can pose other types of safety hazards. Large areas of dead trees away from development, where forest health has been significantly impacted, can increase the risk of catastrophic wildfire given the dry fuel they contain.

Mapping the extent of the dead trees and forests in the context of development and roads can help mitigation efforts focus on areas where hazards posed by them are particularly high. The maps and database can allow for prioritizing the removal and mitigation of the most risky of these hazards, while identifying areas away from development that are most in need of forest health improvement.

¹ Hagen, B. Personal Communication. 2005.

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Background

Physiographic setting

The South Coast Bioregion, covering about 2.86 million hectares of southwestern California, is well known for its remarkable natural diversity¹. The coastal plains, valleys, foothills and mountains support a wide range of native plant and animal life, from low-elevation coastal scrub and grasslands to alpine barrens. Several large mountain ranges bound the region, including the San Gabriel, San Bernardino, San Jacinto/Santa Rosa and Palomar/Laguna ranges. These mountains, with their highest elevations over 11,000 feet, divide the temperate coastal bioregion from the hot and dry interior desert bioregions to the east. With their strong climatic gradients, the mountains play an important role in supporting a variety of natural vegetation types, including conifer and mixed hardwood conifer forests.

The lower elevations of the South Coast bioregion are home to a very large number of people, approaching 20 million at the last census. The population of the “Inland Empire” region, in Riverside and San Bernardino counties, continues to grow rapidly. The heavily urbanized areas have both direct and indirect effects upon the natural vegetation, particularly in the surrounding mountains. Air pollution from urban areas flows into the mountains on a daily basis. A more direct effect comes from increasing commercial and residential development within the forests.

Conifer and mixed hardwood forests occupy a small but important proportion of the bioregion—the mid- to high-elevation mountains. Starting in the 1920s, residents of lower lying cities and suburbs have been building summer cottages and homes in the forests. Former summer residences are now often inhabited year-round, and sizable communities have spread through a number of areas. With regard to potential wildfires in particular, the condition of the surrounding and nearby forests has increasing bearing on the safety of residents and the level of threat to personal property.

Climate

The climate of southern California, termed “Mediterranean”, is characterized by mild wet winters and warm summers with little precipitation. This basic climatic pattern is modified by proximity to the coast and by elevation above sea level. Coastal areas, with their coastal breezes and fog, typically have milder temperatures in all seasons than those more inland.

Across all seasons, the mean temperature drops with increasing elevation. Rising elevation also generally increases annual precipitation. These hilly and mountainous areas thus have more favorable growing conditions for native vegetation, with increased

¹ Stephenson, J. R., and G. M. Calcarone. 1999. Southern California Mountains and Foothills Assessment: Habitat and Species Conservation Issues. General Technical Report GTR-PSW-175. Albany, CA. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 402 p.

water availability for plants (particularly in the growing season) and decreased plant transpiration requirements.

With the exception of localized Big-Cone Spruce (*Pseudotsuga macrocarpa*) stands in some lower elevation mesic canyons, the mixed conifer and conifer forests in southern California begin at about 5000 feet elevation (~2000 meters), with annual average maximum summer temperatures ranging from 65 to 75 degrees F, and mean winter maxima around 30 to 40 degrees F.

Rainfall/snowfall

Winter precipitation falls primarily as rain in the lower elevations of the bioregion, transitioning to snow from 6000 feet to 8000 feet. Snow accumulation is common in mountainous areas at and above these elevations, although the mean annual snowfall is highly variable in distribution. Overall, annual precipitation also increases with elevation. Within the Los Angeles Basin, mean annual precipitation is about 15-20 inches, and increases with elevation to around 35-45 inches at 6000 feet. The timing and form of precipitation strongly influences water availability to plants. Rainfall percolates into the soil and/or runs off in a timeframe close to the precipitation event. Snow remains unavailable to plants during the winter, but provides water to the soil as the weather warms as plants begin their growing cycle.

Natural vegetation types

With its highly diverse landscape, coastal southern California hosts a wide variety of plant species and vegetation types. Primary vegetation types in the bioregion include natural grasslands, oak savannah and woodlands, soft chaparral (coastal sage scrub), hard chaparral, hardwood (primarily oak) forests, mixed hardwood and conifer forests, mid-elevation conifer forests, sub-alpine conifer woodlands, and alpine dwarf scrub plant communities. Patterns of vegetation types are strongly influenced by seasonal temperature and water availability regimes—i.e. proximity to the coast and elevation.

Of primary concern for our purposes here are the mid and upper elevation forests of the interior mountains, which are comprised of hardwood forests, coniferous forests and mixed hardwood and conifer forests. Hardwood and conifer forests occupy almost 825,000 acres in San Bernardino, Riverside and San Diego counties (Figure 1). Coniferous forests occupy almost 550,000 acres, while hardwood forests occupy approximately 275,000 acres (See Table 1). Dominant forest species include several oaks (interior live oak, California black oak, canyon live oak), bigcone spruce, incense-cedar, white fir, ponderosa pine, sugar pine, Jeffrey pine and Coulter pine. The highest elevations have lodgepole and limber pine woodlands, and on the drier leeward mountainsides are extensive woodlands of single-leaf pinyon pine.

Table 1: Forestland Acres by County

County	Conifer Forest Acres	Hardwood Forest Acres	Total Acres
Riverside*	116,848	55,084	171,932
San Bernardino*	328,695	70,971	399,666
San Diego	100,670	149,629	250,299
Total	546,212	275,685	821,897

* excludes northern San Bernardino and eastern Riverside Counties

Post-1850 fire regime

With the rapid spread of European-American settlement in the region came important changes in the wildfire regimes. The removal of native peoples from the land resulted in fewer ignitions of wildfires in areas where they had been fairly frequent. The suppression not only ceased the ignitions, but also stopped fires from running what would have been their usual course. Those fires which did occur were in many cases actively suppressed.

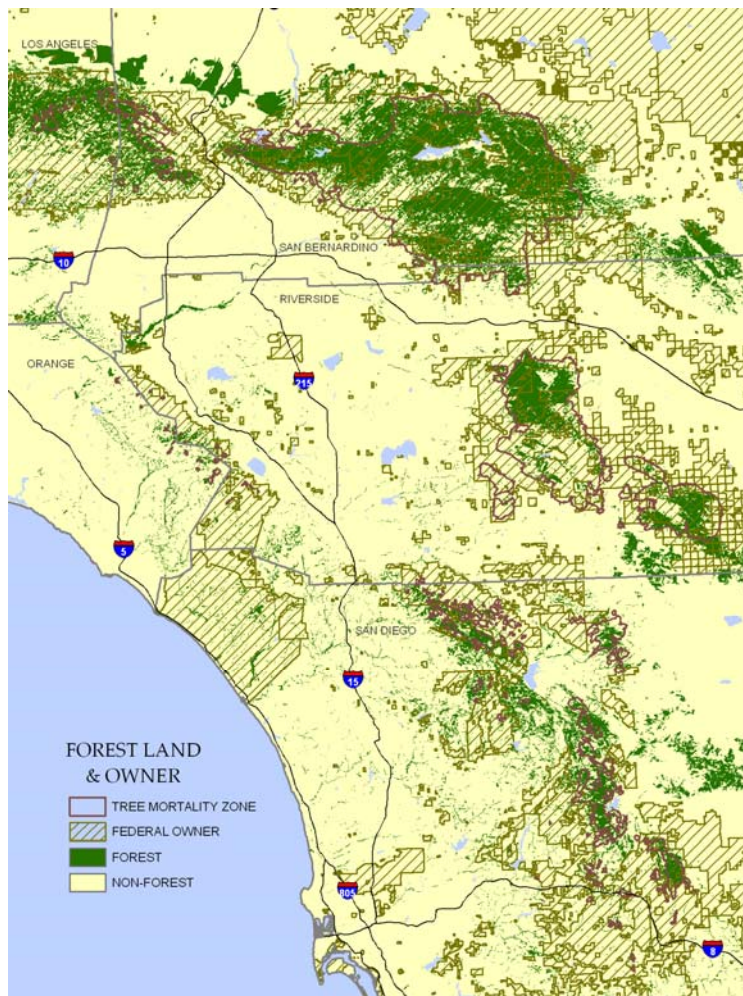


Figure 1. Forest Land and Owner by County

The effects of fire suppression, most effective since the 1930s, have created conditions in the conifer forests unlike those prior to 1850. Frequent, low-intensity burns used to remove understory vegetation and keep fires from climbing into the forest canopy. Now, however, due to the lack of frequent low-intensity ground fires for several decades, stand densities have increased, and the forest understory is often quite choked with shrubs and smaller trees. Ecologically, this has had several unfortunate effects on the forest. For example, higher stand densities and greater amounts of understory vegetation increases competition for water, leaving stands more vulnerable to prolonged periods of drought. When dry conditions exist, as it did during the 1998 - 2003 drought period, the denser understory increases the likelihood of a much hotter, more catastrophic fire. Also, understory vegetation competes for water with the dominant trees, thereby 'drying' the soil more quickly in the growing season, lengthening the period of low leaf moisture and thus the period of susceptibility to fire. Ultimately, the absence of frequent, low-intensity ground fires provides more fuel with favorable spatial distribution for fires, as its structure allows fires to easily climb into the canopy dominant trees, causing a much hotter and more devastating crown fire. The millions of dead and dying conifer trees killed by a combination of drought and overstocking, as occurred between 1998 and 2003, have additionally increased the risk of catastrophic crown fire over large areas of the region. Due to the imminent threat to lives, property and forest health in the region posed by the large number of dead trees, many agencies have worked to remove or mitigate the dead trees and the overgrown forest understory. Ideally, these mitigations over time are reducing the risk of catastrophic fires to lives and property.

Expanding development and increased risk of wildfire

With increased forest use from lowland urban dwellers has come expanding development in the nearby mountains. Throughout the 20th century development in the mountains of southern California has steadily increased. By the year 2000 there were an estimated 47,500 permanent residents in developed areas in the San Bernardino Mountains from Crestline to Big Bear to Forest Falls, and around 8000 in and around Idyllwild in the San Jacinto Mountains. Approximately 11,000 people live in and around the tree mortality zone in San Diego County. Development in these forests has greatly expanded what is known as the wildland-urban interface (WUI), a designation for areas of natural vegetation in close proximity to moderate densities of structures and roads. Due to increased exposure to fire, regions with larger WUI area usually have higher wildfire threats to lives and property.

The areas of mountain development in southern California are served by relatively few roads. This increases the risk to residents in the event of a large fire, due to increased likelihood that one or more of the few routes to safety may be cut off. Routes still in service are likely to be impacted by possibly life-threatening delays due to heavy traffic, as many residents seek to flee to safety at the same time, also increasing the risk to residents.

Wildfires of October 2003

Large wildfires swept through several areas of the southern California Mountains in the fall of 2003, burning over 700,000 acres during a 20 day period. However most of the fire was kept out of the bark beetle impacted areas, burning only about 8% of the mortality zone. Mortality estimates provided in this report exclude areas inside the October 2003 fires.

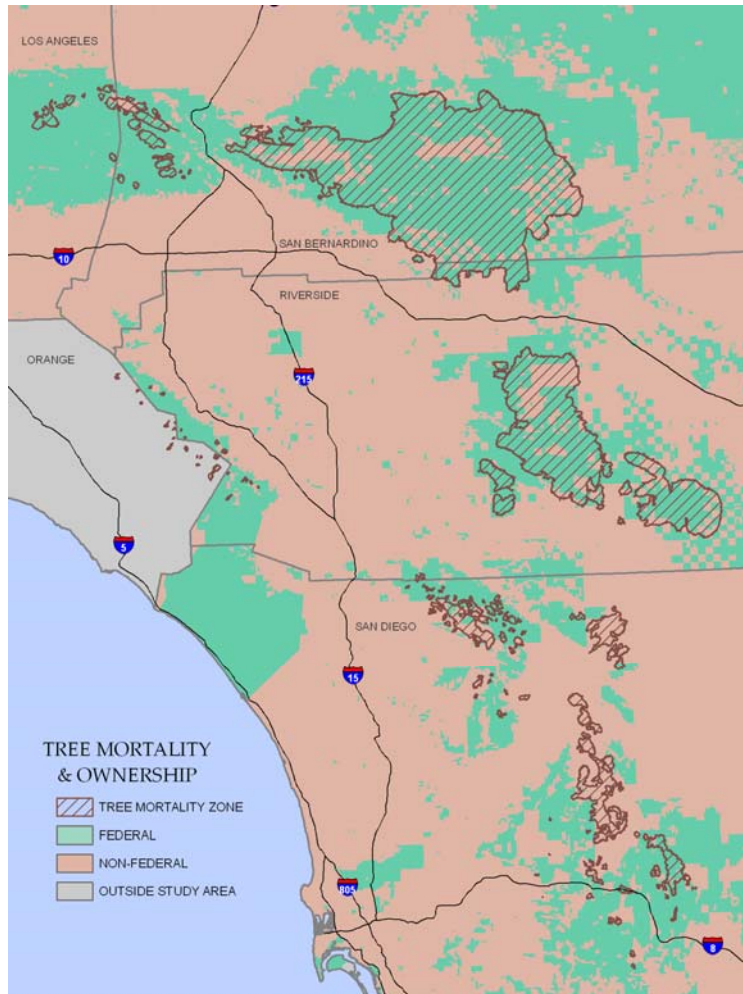


Figure 2. Mortality Zone and Ownership

Public Agency Jurisdiction of Lands

Several federal, state and local agencies play some role in the jurisdiction of the mountains of southern California. The region in question has three national forests administered at the federal level by the USDA Forest Service (USFS): the San Bernardino National Forest (665,000 acres); the Cleveland National Forest (420,000 acres); and the Angeles National Forest (660,000 acres). By far the largest area of dead

trees occurred in the San Bernardino NF. The Cleveland NF had some areas of mortality, while only a small section of the Angeles NF (in the extreme east) appeared so affected. Except in localized zones, there is little to no development on lands in the region administered by the USFS. However there are many communities directly adjacent to these areas and both roads and power lines cross USFS lands.

On mountain lands outside of the three national forests, jurisdiction for dealing with hazardous dead trees falls to several agencies. The California Department of Forestry and Fire Protection (CDF) has an overall responsibility for dealing with wildfire outbreaks as well as timber management on private unincorporated lands. Structure protection in unincorporated areas is generally the responsibility of a range of county establishments, ranging from fire protection districts in San Bernardino and San Diego, to county fire departments, as in Riverside County. Private entities such as Southern California Edison (SCE) and San Diego Gas and Electric have the responsibility of mitigating hazards along their rights-of-way for power lines, substations and other related areas.

Mountain Area Safety Taskforce (MAST)

California's Congressional representatives Jerry Lewis and Dianne Feinstein helped secure funding to address the severe mortality outbreak in southern California. In early 2003 Lewis secured \$3.3 million and reallocated it to FEMA to remove dead and dying trees in southern California. In September 2003 Feinstein and Lewis helped secure \$30 million in emergency supplemental funding, with \$20 million allocated to the USDA Forest Service State and Private Forestry branch. In 2004 Congress appropriated \$120 million for the Natural Resource Conservation Service's (NRCS) Emergency Watershed Protection (EWP) program. Also in 2004, Congress provided earmarks totaling \$90 million to the USFS, with \$50 million for removal of dead and dying trees and \$40 million for fuels reduction on USFS lands.

To facilitate the coordination of dead tree removal between the various agencies involved, a Mountain Area Safety Taskforce (MAST) was established in each of Riverside and San Bernardino counties, and the Forest Area Safety Taskforce (FAST) was established in San Diego. The primary role of MAST/FAST organizations has been to coordinate dead tree removal through inter-agency communication and decision making.

Results

Forest Mortality by subregion and jurisdiction

In order to determine the magnitude of the mortality, we measured recent tree mortality using several data sources including recent aerial photography, Landsat Thematic Mapper satellite image data, aerial survey data, newly sampled Forest Inventory and Analysis (FIA) inventory plots and post outbreak updated vegetation maps. The plot information on its own provided statistics on the number of trees that died during the

event, as well as those trees that survived, according to species, size class and other factors. Using remote sensing and aerial survey data, the plot information was divided into strata based upon mortality and vegetation. These were then converted to per-acre estimates and extrapolated across the landscape using Geographic Information Systems (GIS). We then developed tree mortality and related estimates (e.g. basal area, cubic foot volume, board feet, etc.) by aerial units such as county, land ownership and land (wildfire) jurisdiction. We also compared the patterns of recent tree mortality with spatial models of mortality risk recently developed by the USFS Region 5 Forest Health Protection (FHP) staff.

Tree Mortality by County

Although tree mortality is dispersed across more than 640,000 acres, approximately 250,000 acres of this area is dominated by non-forest land cover types such as chaparral or grass, and another 17,500 acres of the mortality area burned during the October 2003 fires. Excluding non-forest land cover types and fire related mortality, we estimate that approximately 375,000 acres of forestland in San Bernardino, Riverside, San Diego and Los Angeles counties had elevated levels of tree mortality between 1997 and 2003 (See Figure 3). The distribution of forest mortality was not even throughout the affected mountains of southern California. Overall, forests in the San Gabriel Mountains (mostly in Angeles National Forest) had negligible mortality compared with those in the San Bernardino and San Jacinto mountains (Riverside County), and those to the south in San Diego County. Recent estimates of this mortality event indicate approximately 4.6 million trees died, totaling about 2.8 million Bone Dry Tons (BDT) and 137 million cubic feet of material (See Table 2). Tree mortality was not evenly distributed across the counties. San Bernardino County experienced the largest proportion of mortality with 68% of the insect and drought related tree mortality between 1997 and 2003, while Riverside had about 21%, San Diego about 10% and Los Angeles had about 1% of the mortality during this event. The distribution of mortality by county is disproportionate with respect to the distribution of forest land in these counties. Excluding the northern part of the county, which was outside of the immediate study area, San Bernardino County has about 49% of the forest land, while San Diego has about 31% and Riverside about 18% (See Table 1).

Table 2. Tree Mortality by County

County	Acres	Cubic feet	Trees	Tons
San Bernardino	254,192	90,260,543	3,021,387	1,844,313
Riverside	80,422	33,037,809	1,079,716	662,532
San Diego	37,183	11,914,342	483,745	257,939
Los Angeles	2,909	1,636,470	39,599	32,875
Grand Total	374,705	136,849,164	4,624,446	2,797,658

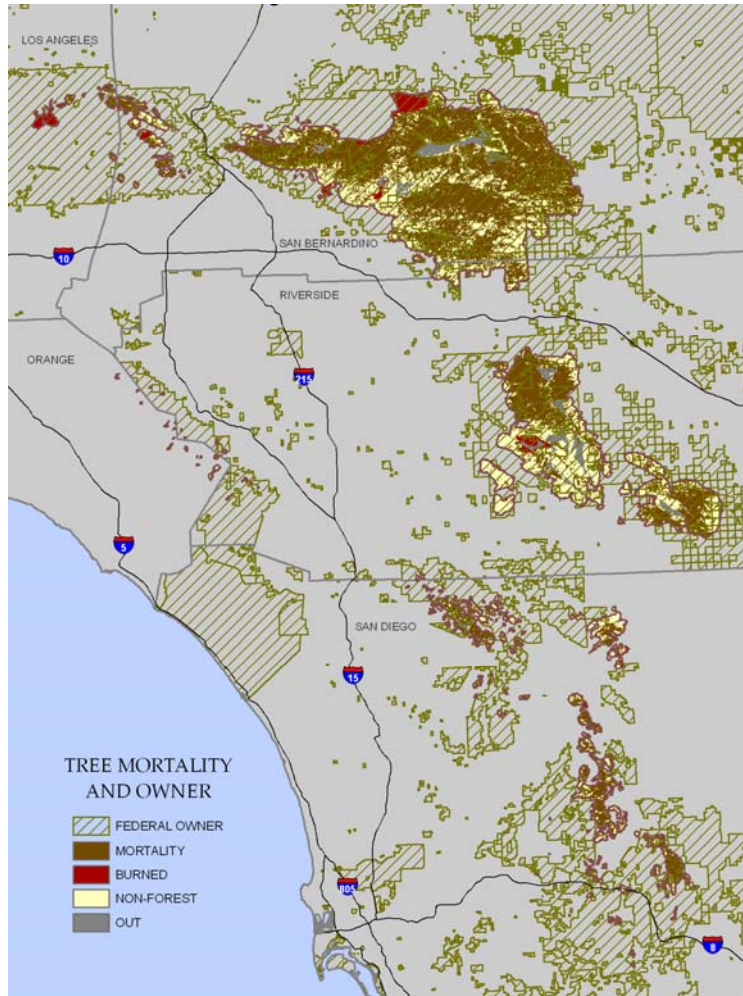


Figure 3. Tree Mortality and Ownership

Tree Mortality by Ownership

Excluding Los Angeles County, which experienced only about 1% of the total mortality during this event, about 74% of forest land in the impacted area is managed by the federal government and 26% is owned by state, local or private parties. The level of forest mortality was proportional to the number of acres managed by agency—approximately 29% of the tree mortality was on local, state or privately owned lands, while about 71% was on federal land (See Table 3). Most of the federal land in the impacted area is on the San Bernardino National Forest or the Cleveland National Forest, which are managed by the USDA Forest Service. In every county except San Diego, the rate of mortality was slightly higher on federal land than on non-federal land (See Appendix A-5). In San Bernardino County 79% of tree mortality is on federal lands, which is not unexpected, given that federal lands comprise about 75% of the forested area in the mountain communities of San Bernardino County impacted by this event. Over 68% of the tree mortality in Riverside County was on federal land. San Diego County had a disproportionate amount of mortality on federal land, as compared to non-federal land. Almost 80% of the forest land in San Diego County is on non-federal

ownership, yet only 59% of tree mortality in San Diego County was on non-federal land (See Figure 1).

Table 3. Acres, cubic feet, trees and tons of dead trees by owner in San Bernardino, San Diego, Riverside and Los Angeles counties

Owner	Acres	Cubic feet	Trees	Tons
Federal	267,148	95,028,164	3,199,277	1,939,247
Non Federal	107,557	41,821,000	1,425,170	858,411
Grand Total	374,705	136,849,164	4,624,446	2,797,658

For this assessment, mortality is categorized into “High” ($\geq 20\%$), “Moderate” (8 – 19%) and “Low” (0-8%) categories based on the amount of mortality estimated from inventory and remote sensing. The percentage indicates the proportion of trees which died in the 1997–2003 event. Across all counties and ownership, the distribution of mortality levels indicate that approximately 5% of the total area impacted experienced “High” levels of mortality, 12% of the area experienced “Moderate” levels of mortality, and 83% of the area experienced “Low” levels of mortality (See Table 4). This pattern was reasonably consistent over all counties in the study, however, mortality levels varied by ownership.

Table 4. Acres of dead trees by owner and mortality level in San Bernardino, San Diego, Riverside and Los Angeles counties

Owner	High mortality $\geq 20\%$	Moderate mortality $\geq 8-19\%$	Low mortality 0-8 %	Grand Total
Federal	11,265	30,092	225,791	267,148
Non Federal	8,549	14,185	84,823	107,557
Grand Total	19,814	44,277	310,614	374,705

When viewed across the entire study area, the distribution of mortality levels on federal lands indicates that about 4% of the total area of mortality on federal land is considered “High”, 11% is “Moderate” and 85% is “Low” (See Appendix A-5). We estimate that the distribution of mortality level on non-federal lands is 8% in “High”, 13% in “Moderate” and 79% in “Low.” A similar pattern of mortality level among management/ownership classes emerges when viewed in San Bernardino County, where approximately 10% of the non-federal land mortality is in the highest category while only about 14% experienced “Moderate” mortality and about 76% is “Low” (See Appendix A-5). Mortality levels in Riverside County were proportionately about the same on federal and non-federal lands, with about 4% of the mortality in the “High” category, 11% in the “Moderate” category and 85% in the “Low” category (See Appendix A-5). Mortality levels in San Diego County also varied by federal and non-federal ownership status. In San Diego County, mortality levels on federal lands are approximately 3% in “High”, 10% in “Moderate” and 87% in “Low”. Mortality levels on non-federal lands in San Diego County are estimated at 7% “High”, 15% “Moderate” and 78% in “Low” (See Figure 4 & Appendix A-5).

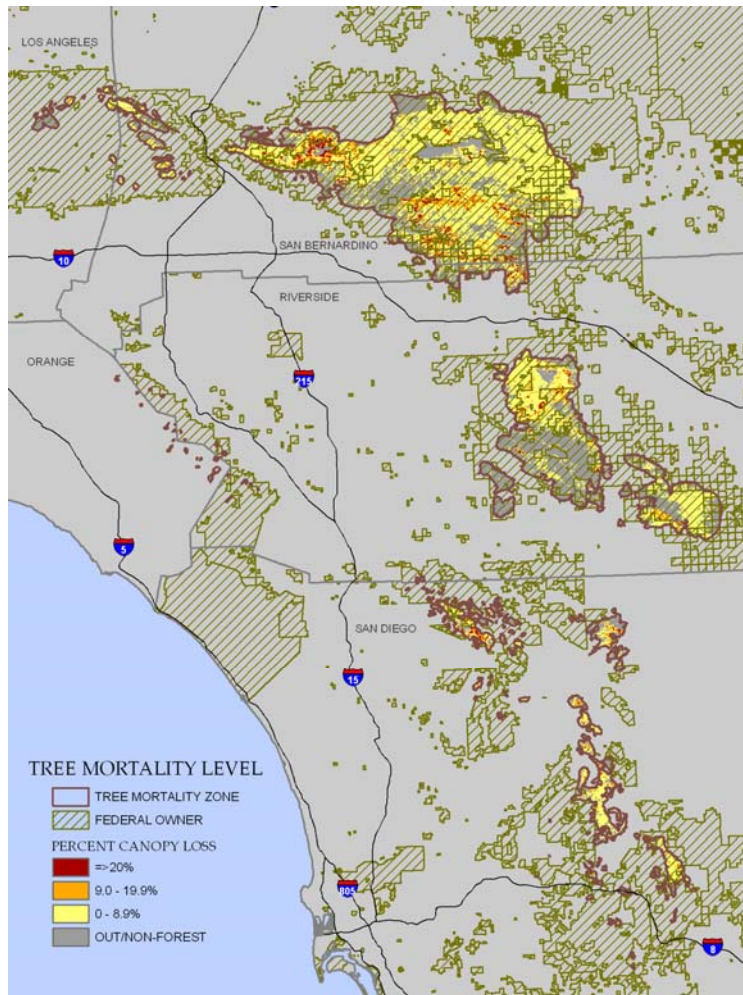


Figure 4. Tree Mortality Level

Tree Mortality by Major Forest Type

For this assessment, tree mortality is stratified into major forest type categories including Hardwood, Pine, Fir, Sub-alpine Mixed Conifer, and Pinyon-Juniper (See Figure 6). Fir experienced the largest amount of mortality with 39% of the insect and drought related tree mortality between 1997 and 2003. Fir was followed by Pine, with 23%, Pinyon-Juniper with 22%, Hardwood with 13% and Subalpine Mixed Conifer with 3% of tree mortality across the four county area (See Table 5 & Figure 5).

Fir is also the dominant forest type affected by recent tree mortality in San Bernardino, Riverside and Los Angeles Counties. Pine is the dominant mortality strata in San Diego County, where almost 20,000 acres of pine experienced elevated levels of mortality. For a detailed breakdown of major forest type and mortality level, see Appendix A-6.

Table 5. Acres of Dead Trees by Forest Type and Mortality Level in San Bernardino, Riverside, San Diego and Los Angeles counties

Major Forest type	High mortality ≥ 20 %	Moderate mortality ≥ 8-19 %	Low mortality 0-8 %	Total
Fir	15,198	33,095	102,637	150,930
Pine	4,616	11,182	69,087	84,885
Hardwood			47,904	47,904
Pinyon juniper			81,271	81,271
Subalpine mixed			9,715	9,715
Total	19,814	44,277	310,614	374,705

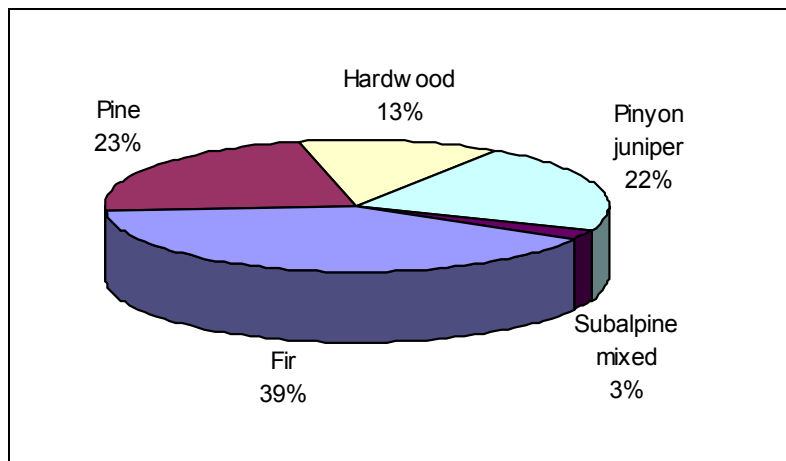


Figure 5. Acres of dead trees by forest type in San Bernardino, San Diego, Riverside and Los Angeles counties

Forest Land Cover Changes

In areas hit hardest by tree mortality, some forest land cover and composition changed from forest dominated land covers to non-forest cover types, while other stands changed from conifer or mixed conifer and hardwood dominated forests to pure hardwood forest stands. Table 6 identifies forest land cover changes for federal and non-federal ownership in each county. Across all counties inside the study area, over 14,000 acres of federal and non-federally owned forest land experienced significant shifts in forest land cover and composition, with almost 11,000 acres identified on federally managed lands. In every county, the Mixed Conifer and Hardwood Forest (MIX) type suffered the greatest impact. In San Bernardino County, over 7,000 acres changed from mixed conifer and hardwood stands to nearly pure hardwood. Approximately 1,500 acres previously dominated by Conifer forest are now dominated by shrub in San Bernardino County. In Riverside County the major impacted forest type is also the MIX category, which lost almost 3,500 acres to shrub dominated land cover types. San Diego County, which had the lowest overall amount of mortality, also had the lowest overall amount of forest land cover changes with only about 600 acres.

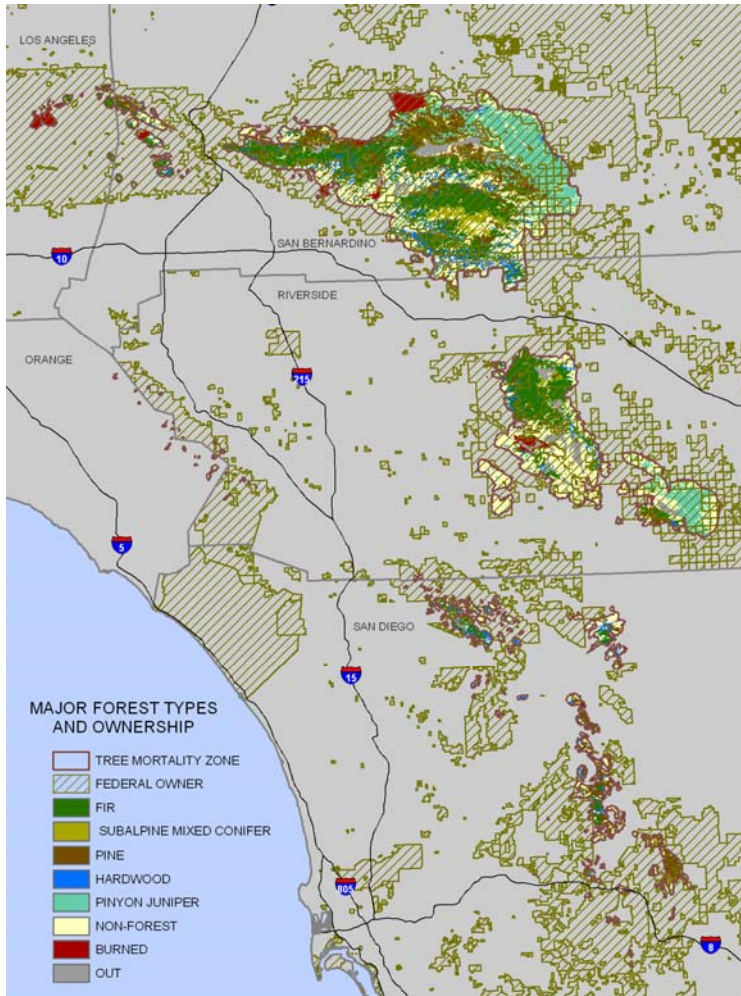


Figure 6. Major Forest Types and Ownership

Table 6. Forest Land Cover Change in Acres by County and Owner (acres)

County	Forest Land Changes	Federal	Non-Federal	Grand Total
Los Angeles	From MIX to SHB	32.35	3.85	36.19
	Los Angeles Total Acres Changed	32.35	3.85	36.19
Riverside	From CON to SHB	8.82		8.82
	From MIX to HDW	674.61	19.66	694.26
	From MIX to SHB	2,516.25	900.12	3,416.37
	Riverside Total Acres Changed	3,199.68	919.78	4,119.46
San Bernardino	From CON to SHB	1,291.16	362.92	1,654.08
	From MIX to HDW	5,695.81	1,450.49	7,146.30
	From MIX to SHB	513.62	53.11	566.73
	San Bernardino Total Acres Changed	7,500.59	1,866.52	9,367.11
San Diego	From CON to SHB	69.69	59.82	129.52
	From MIX to HDW	109.79	239.86	349.65
	From MIX to SHB	36.15	71.43	107.58
	San Diego Total Acres Changed	215.63	371.12	586.75
Grand Total for All Counties		10,948.25	3,161.27	14,109.51

“CON” stands for Conifer forest, “HDW” stands for Hardwood forest, “MIX” stands for Mixed Conifer and Hardwood forest, and “SHB” stands for Shrub dominated land cover

Forest Land at Risk

The USDA Forest Service Region 5 Forest Health Protection (FHP) staff recently developed maps of forests currently at-risk from insect and disease outbreaks. Their methods are based on those developed by the national FHP program office. An area is defined to be at risk if 25% or more of standing live volume greater than 1" DBH will die over the next 15 years (<http://www.fs.fed.us/r5/spf/fhp/index.shtml>). An updated 2004 risk map was developed by FHP for the recent tree mortality in southern California. Based upon their criteria, and taking into account the recent fires and mortality event, the 2004 map identifies approximately 10 million living trees (conifer and hardwood) on over 100,000 acres that are still at risk from insect and disease outbreaks in southern California. The acres at risk cover approximately 27% of the study area. More than 73% of the project area is not thought to be at risk from severe insect and disease outbreaks in the next 15 years.

Table 7. Acres and cubic feet of living trees by owner at risk in 2004 in San Bernardino, San Diego, Riverside and Los Angeles counties

Owner	Acres			Number of Living Trees		
	At risk	Not at risk	Total	At risk	Not at risk	Total
Federal	79,834	187,315	267,148	8,061,663	20,623,942	28,685,605
Non Federal	20,527	87,030	107,557	2,067,468	9,841,742	11,909,210
Grand Total	100,360	274,345	374,705	10,129,131	30,465,684	40,594,815

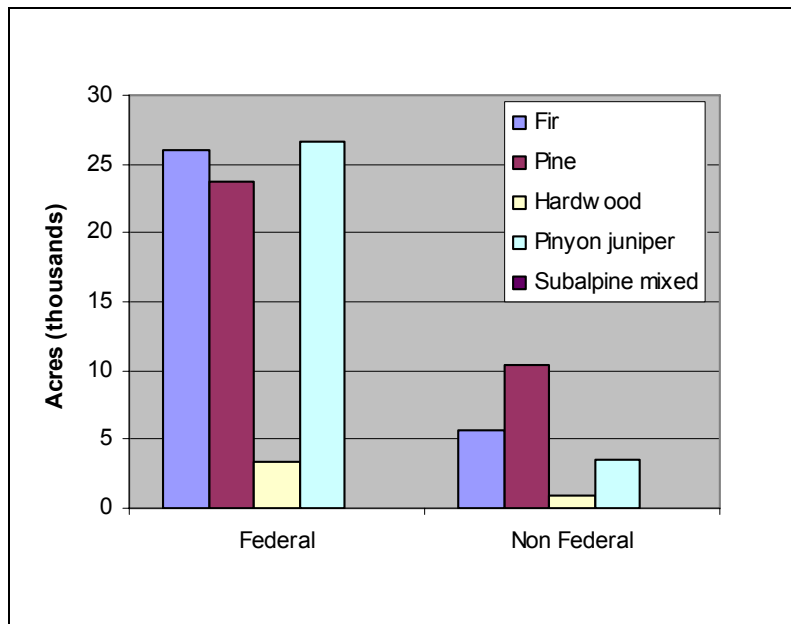


Figure 7. Acres of living trees by owner and forest type at risk in 2004 in San Bernardino, Riverside, San Diego and Los Angeles counties.

The largest remaining risks for future insect and disease outbreaks on federal lands inside the mortality zone are to fir and pinyon-juniper forest types. Current risk maps of

these areas indicate there are approximately 53,000 acres of fir and pinyon-juniper types that are currently at risk from future severe mortality. On non-federal lands inside the mortality zone, the largest remaining risks for future outbreaks are to pine, with about 10,000 acres at risk.

There are some questions regarding stand densities (and water demand) and their role in the susceptibility of forests to future drought-induced insect outbreaks. Answering these questions for key forest types will aid treatment planning efforts as well as forest health restoration efforts.

Conifer Mortality

Recently sampled inventory plot data were tabulated to show the impacts of the mortality event by conifer tree species and diameter classes. Estimates of live standing versus recent dead standing were used to determine those impacts. Metrics used for this purpose were number of trees, wood volume (cu ft), and wood weight (bone dry tons).

The most abundant conifer species in the inventory sample are white fir, single-leaf pinyon and Jeffrey pine. Thirty percent of the conifer trees in the study area are white fir. Twenty-five percent of the trees are single-leaf pinyon and 22% are Jeffrey pine. Other species included incense-cedar (7%), western juniper (4%), sugar pine (4%), Coulter pine (3%) and lodgepole pine (2.5%). Rare species in the sample area included ponderosa pine, limber pine, gray pine and bigcone Douglas-fir which together comprised about 1% of the trees. Table 8 has an overview of the breakdown by number of conifer trees by species.

Table 8. Number of Trees on Forest Land by Conifer Species (trees at least 5" in diameter)

Conifer Species	Number of Trees	% of Conifer trees	Alive	Dead	% Change
Bigcone Douglas-fir	90,797	0.33%	41,554	49,243	54.23%
Coulter pine	840,473	3.04%	464,927	375,546	44.68%
Grey pine	4,167	0.02%	-	4,167	100.00%
Incense cedar	1,920,557	6.95%	1,917,722	2,835	0.15%
Jeffrey pine	6,059,420	21.94%	5,405,386	654,034	10.79%
Limber pine	38,846	0.14%	36,852	1,994	5.13%
Lodgepole pine	702,573	2.54%	691,433	11,139	1.59%
Ponderosa pine	447,086	1.62%	200,127	246,959	55.24%
Singleleaf pinyon	6,811,631	24.66%	6,315,752	495,879	7.28%
Sugar pine	1,045,522	3.79%	830,322	215,200	20.58%
Western juniper	1,214,356	4.40%	1,204,993	9,363	0.77%
White fir	8,444,104	30.57%	7,003,507	1,440,597	17.06%
Total	27,619,532	100.00%	24,112,577	3,506,955	12.70%

Overall impact of mortality event

In the southern California Mountains about 12.7% of conifer trees died among all size classes between 2001 and 2004, in large part due to drought conditions and insect attacks. Our overall estimate is that approximately 3.5 million conifer trees died in the region during this period, out of a total of about 27.6 million conifer trees.

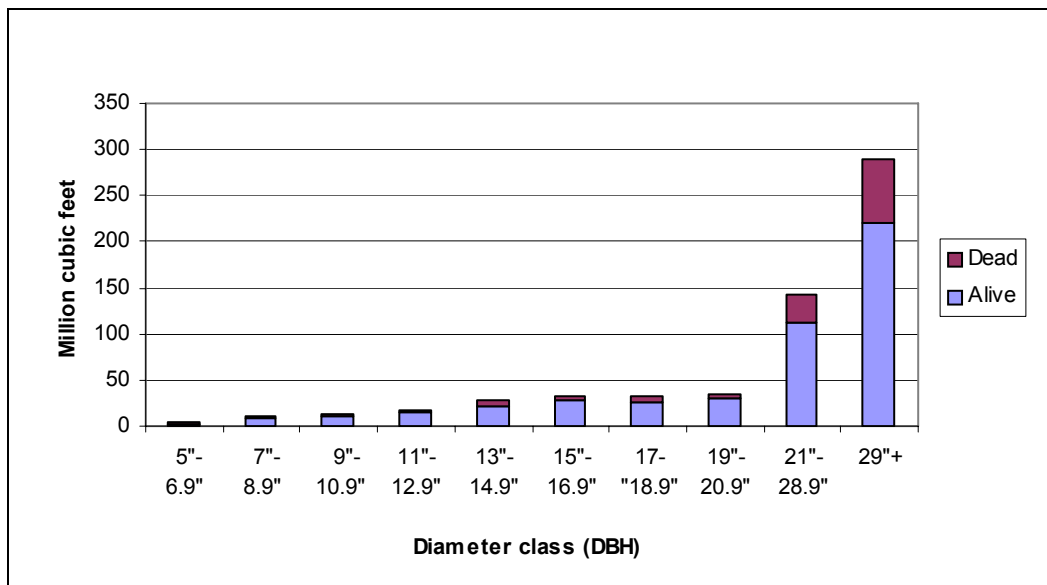


Figure 8. Conifer Tree Volume (CuFt) by Diameter Class (DBH) measured to a 4 Inch Top for trees at least 5 inches in diameter

Large conifers, defined as those with a diameter at breast height (DBH) of 17 inches or greater, had about twice the mortality rate (19.2%) as smaller conifers – those with DBH of 5 inches to 16.9 inches (10.8%) (See Figure 9). Measured by volume (cu ft) and weight (bone dry tons), about 21% of the conifer forest biomass in the region was in dead trees by 2004. This represents about 127 million of 603 million total cubic ft in conifer volume and about 2.47 million bone dry tons out of a total (live + dead) of 11.72 million bone dry tons (BDT). As may be expected, the biomass contributed by standing dead conifers in the larger size classes far exceeded that from the smaller size classes. The largest tree size class (≥ 29 " DBH) alone comprised about 55% of total dead biomass, with the top two size classes (DBH ≥ 21 "") having nearly 80% of the total (Figure 9).

The inventory plot data show that the event impacted on some conifer species more than others. Two of the most impacted species were pines which grow in moderately mesic conditions in the region. Coulter pine suffered the largest percentage mortality by volume of the conifers in the region. More than 44% of the trees died in the event, comprising nearly 69% of the species' total volume. Percentage mortality among Coulter pines increased with the larger size classes. Trees in the smallest size class

suffered some of the least percentage mortality (21%), and by contrast more than 78% of Coulter pines in the largest size class died.

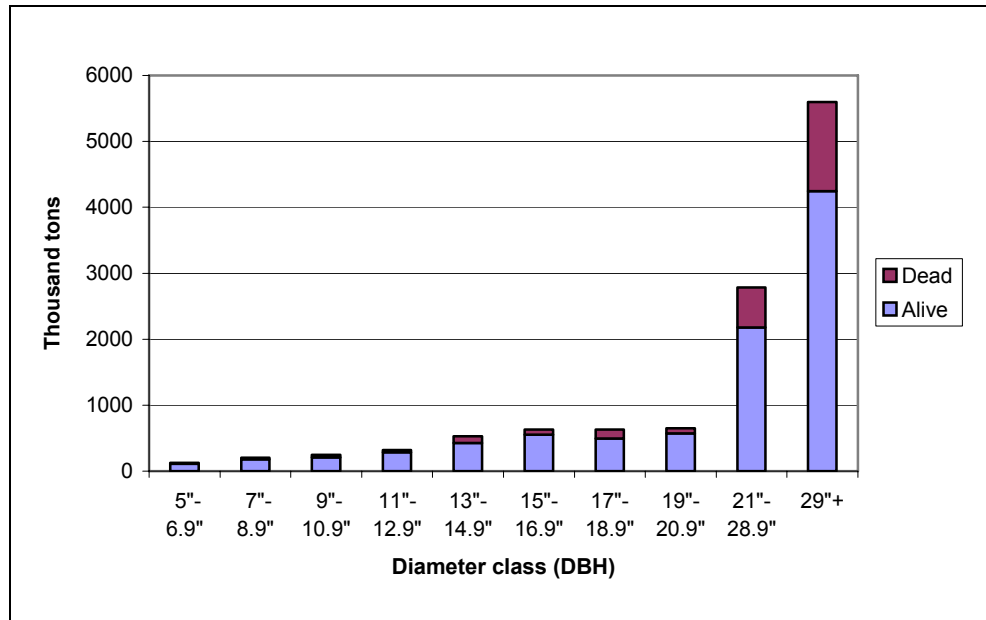


Figure 9. Conifer Tree Biomass by Diameter Class (DBH) measured to a 4 Inch Top for trees at least 5 inches in diameter

Ponderosa pine lost about 66% of its total live volume and incurred about 55% mortality in terms of the number of trees. The same pattern of mortality among size classes has been observed for Coulter pine – larger trees were much more likely to die than smaller ones. The smallest two size classes had negligible mortality whereas all size classes of 17" DBH or greater showed on average a 73.5% death rate.

At the other end of the mortality spectrum, incense-cedar, western juniper, lodgepole pine and single-leaf pinyon pine, all moderately to strongly drought-tolerant species, appeared to have been little impacted by the drought/insect event. Incense-cedar mortality accounted for less than 2% of its total pre-event volume – less than 1% of its total living trees – and western juniper had less than 1% mortality as a result of the drought event.

Of the most common species in the inventory sample, single-leaf pinyon lost about 7% in terms of both the number of trees and live standing volume. Jeffrey pine lost 11% of the trees and 16% of the volume in the period 2001-2004. The same figures for white fir were 17% and 22% respectively. Bigcone Douglas-fir and limber pine occurred in so few samples that little can be inferred by our inventory data. The limited data on the Bigcone Douglas-fir might suggest that it is a fairly rare type, and not easily estimated with our limited sample.

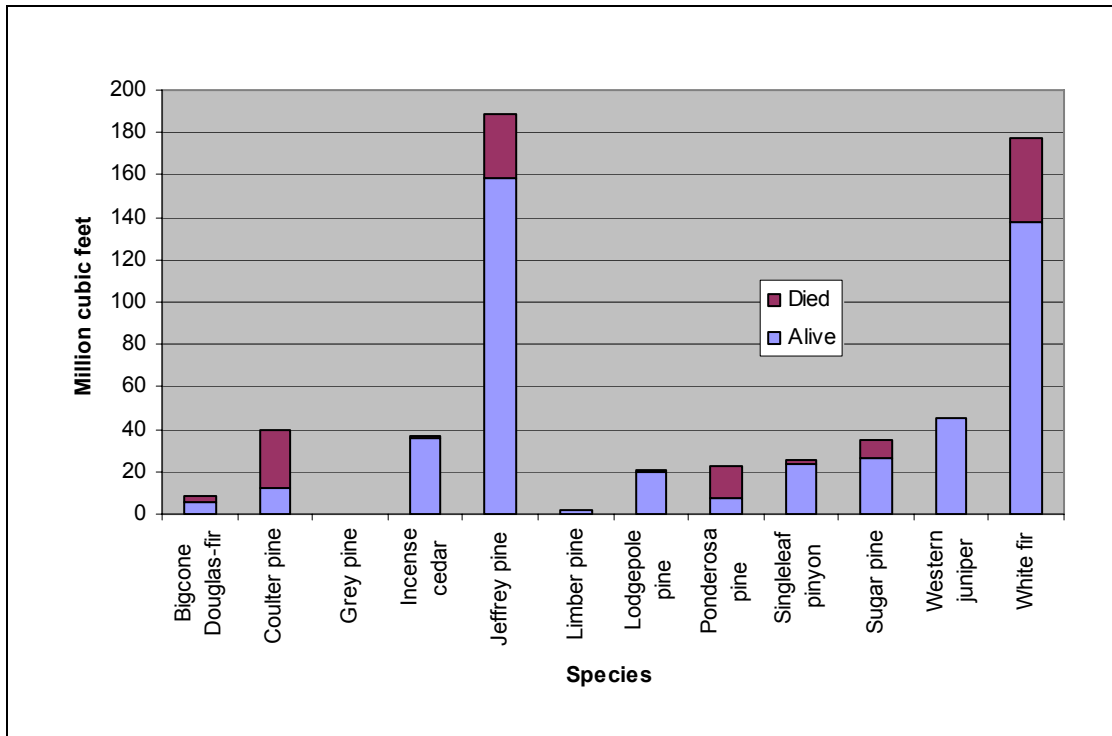


Figure 10. Conifer Tree Volume (CuFt) by Species

Tree Mortality Removals and Hazard Mitigation

The millions of recently dead conifers in the three Southern California counties have created locally increased hazards related to wildfire and potential tree falls and have greatly impacted public safety and forest health. Tracking and mitigating the increased hazards posed by the dead trees has been a challenge, due to the multi-jurisdictional boundaries, the large geographic extent, vegetation management complexities and limited federal and state funding. In response, various government agencies and regional utilities came together as early as 2002 to form several ad hoc organizations to be the primary bodies for coordination of local mitigation efforts. They include the Mountain Area Safety Taskforces (MASTs) in San Bernardino and Riverside counties and the Forest Area Safety Taskforce (FAST) in San Diego County. The MASTs/FAST organizations are comprised of the following major governmental agencies and non-governmental groups:

- Federal government agencies such as the USDA Forest Service and Natural Resource Conservation Service (NRCS)
- State government agencies, such as the California Department of Forestry and Fire Protection (CDF), California Governor's Office of Emergency Services (OES), the California Highway Patrol (CHP) and the California Department of Transportation (CALTRANS)
- Local government organizations, such as county fire, law enforcement, emergency management and transportation departments

- Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E)
- Volunteer organizations such as local Fire Safe Councils
- Private companies providing technical support services, as the Environmental Systems Research Institute (ESRI)

Local MAST and FAST groups identified and prioritized, within their respective counties, the need to develop and implement forest stand prescriptions for hazard reduction. Their activities and objectives have included improving public safety through evacuation planning and fire safe evacuation centers, reducing internal community vegetative fuel risks, (especially dead trees) and creating new fuel breaks. Hazard treatments have been targeted to bring affected areas within prescribed lower-risk tree stocking conditions, while coordinating the removal of other vegetation that may interfere with emergency responses and evacuation needs. Further efforts of the MASTs and FAST have involved the identification of remaining hazards, public education and outreach, developing wood waste disposal and utilization options and planning for long-term forest sustainability.

Hazardous Tree Removal Efforts

A primary focus of the MAST and FAST coordination groups is Hazard tree removal, which is critical to improve public safety and protect lives and property. Public safety hazards posed by dead, dying and diseased trees include “falling hazards”, when dead trees fall and hit occupied structures or block roads, and increased fuel loading, which can produce extreme fire behavior. Falling trees are a public safety concern because they can block critical evacuation routes, damage occupied structures and destroy emergency communications equipment and other critical infrastructure. Increased fuel loading contributes to extreme fire behavior, including faster rates of spread and increased temperatures, both of which can increase the damage potential and make fires more difficult to control.

Approximately 21% of the mortality area has been identified as a high priority for hazard tree removal, mostly in and around communities (i.e. in WUI areas), due to public safety concerns (See Figure 12). Across the four counties it is expected that almost 80,000 acres of forestland will be treated, with almost 35,000 acres of that on non-federal, mostly privately owned lands (See Table 9). This is consistent with the overarching objective to protect public safety by prioritizing and implementing treatments in and around communities, evacuation routes, power lines and other critical infrastructure. Areas away from communities may also warrant fuel reduction treatment activities to protect forest health and, to a slightly lesser degree to protect the public. (However, at the time of this report the primary emphasis is still on protecting people and property). Areas away from communities offer the best opportunity for forest health improvements partially because these areas have fewer impacts from people, and are more likely to function as healthy ecosystems. Also, these areas don’t pose as much threat to public safety as areas right next to communities, which allows land managers greater leeway in their treatment options for these areas.

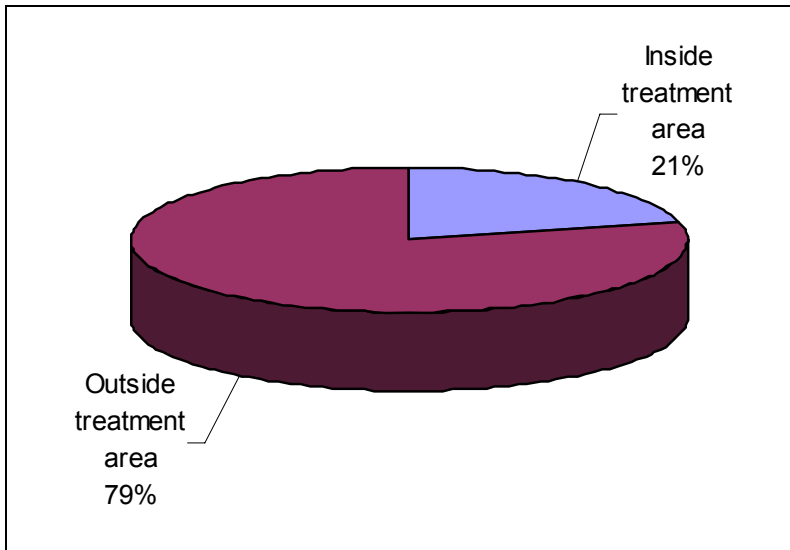


Figure 12. Mortality and Treatment Area in San Bernardino, San Diego, Riverside and Los Angeles counties

Table 9. Hazard Tree Removal Treatment Areas by Owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	43,793	242,813	286,606
Non Federal	34,305	53,794	88,099
Grand Total	78,098	296,607	374,705

Overall, about one third of the areas (almost 6500 acres) that experienced the highest levels of mortality ($\geq 20\%$) have been treated or are slated for treatment, representing about 5.5 million cubic feet of material. Over 4.2 million cubic feet of this is from Fir, and about 1.3 million from Pine forest types. On federally owned lands, about 18% of the hardest hit areas are scheduled for tree removal, while over half of the highest level mortality areas on non-federally owned lands are slated for hazard reduction treatments (See Table 10).

Table 10: Acres of dead trees by ownership, treatment status and mortality level in San Bernardino, Riverside, San Diego and Los Angeles Counties

Owner	Status	$\geq 20\%$ mortality	$> 8-19\%$ mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	2,276	6,071	35,446	43,793
	Outside treatment area	9,729	25,729	207,354	242,813
	Federal Total	12,005	31,800	242,801	286,606
Non Federal	Inside treatment area	4,209	6,510	23,586	34,305
	Outside treatment area	3,600	5,967	44,227	53,794
	Non Federal Total	7,809	12,477	67,813	88,099
Grand Total		19,814	44,277	310,614	374,705

Table 11. Treatment Status by Major Forest Type

Treatment Status	Major Forest type	Total Acres
Inside treatment area	Fir	41,051
	Pine	26,253
	Hardwood	10,227
	Pinyon juniper	568
	Total	78,098
Outside treatment area	Fir	109,879
	Pine	58,632
	Hardwood	37,677
	Pinyon juniper	80,702
	Subalpine mixed	9,715
	Total	296,607
Total	Fir	150,930
	Pine	84,885
	Hardwood	47,904
	Pinyon juniper	81,271
	Subalpine mixed	9,715
	Total	374,705

Methods

Thematic Mapper data processing

In a collaborative effort, the USDA Forest Service Region 5 Remote Sensing Lab (RSL) and Forest Health Protection (FHP) staff have been working with the California Department of Forestry and Fire Protection (CDF) on the Land Cover Mapping and Monitoring Program (LCMMP), which maps vegetation and updates maps for landscape changes in forest and rangeland areas on a 5-year rotation. (The techniques developed for this program are explained in detail <http://www.fs.fed.us/r5/rsl/projects/>.) In short, the monitoring techniques use brightness, greenness and wetness transformations of Thematic Mapper multi-spectral image data taken from two dates 5 years apart. After some preprocessing to remove unwanted data (cloud cover, haze etc.) and to co-register the two image dates, the differences derived can be attributed to changes on the ground. Vegetation removal generally shows up as a significant decrease in greenness and corresponding increase in brightness, while vegetation cover regeneration has the opposite effect. Areas showing significant vegetation changes are systematically compared with aerial photographs of the same period to determine the amount of canopy cover change in relation to the multi-spectral pixel clusters produced by the change images. For the purposes of this study, areas were classified into four categories of forest canopy loss: large decrease (>70%), moderate decrease (41-70%), small decrease (16-40%) and little or no change (0-15%) in vegetative cover).

For this study we used the LCMMP data produced for the region showing vegetation changes from 1997–2002. The TM scenes used are from late spring/early summer to maximize vegetation spectral response. In addition, we used very similar techniques to

process a change image using TM data from the late summers of 2001 and 2003 respectively. This second change image contained additional new forest mortality that occurred during the summers of 2002 and 2003.

Table 12. Landsat Thematic Mapper dates and scenes used for the two periods of vegetation change detection

TM sensor	Path/Row	Date	Processing
Landsat-7	40/36 & 40/37	11-jun-97	Date 1 for 1997-2002 veg changes
Landsat-7	40/36 & 40/37	01-Jun-02	Date 2 for 1997-2002 veg changes
Landsat-5	40/36 & 40/37	21-Sep-01	Date 1 for 2001-2003 veg changes
Landsat-5	40/36 & 40/37	16-Sep-03	Date 2 for 2001-2003 veg changes

Aerial survey mapping

The USDA Forest Service, Forest Health Monitoring (FHM) is a national program designed to determine the status, changes, and trends in indicators of forest condition on an annual basis. The FHM program in Region 5 uses data from ground plots and surveys, aerial surveys, satellite imagery and other biotic and abiotic data sources and develops analytical approaches to address forest health issues that affect the sustainability of forest ecosystems. Information collected during aerial surveys and associated on-the-ground field work is a key component in short and long term monitoring, reporting and protection of all forest lands in California. Annual surveys are part of a national program to detect, map and monitor current year mortality and other forest damage. Special surveys occur when mortality outbreaks are beyond the scope of the annual program, as is the case in the recent tree mortality in southern California.

The primary purpose of the aerial survey program is to create sketch maps of areas containing current year conifer and hardwood mortality, defoliation, and other damage. Sketch maps are captured digitally for input to the USFS Region 5 GIS. The number of trees and acres with damage are calculated for areas surveyed and then reported annually.

Current-year tree mortality and other damage is sketch mapped by an aerial observer and is defined by yellow to reddish brown trees. Examples of paper map bases used for sketch mapping include 1:100,000 scale maps, 7.5 minute series quad maps, and various other digital map bases. Map labels are categorized by damage type, number of trees affected, and affected tree species.

Damage type is labeled either as mortality or one of several non-lethal damage types (top-kill, defoliation, etc.). Multiple damage types are often listed for each polygon. Surveyors also note the probable damage-causing agent (fire, bark beetles, etc.). This information can also be supplied post-flight by the area entomologists and pathologists.

The number of trees affected is expressed as either the number of affected trees within the polygon or the estimated number of trees per acre within the polygon. Generally, areas with <1 tree per acre of mortality are considered to have "background" or "normal" levels of mortality and were not mapped.

Affected tree species is recorded to species level if it was possible (Sugar Pine and White Fir), otherwise they are identified to the genus level (pine, fir). In areas where two or more tree species are affected, the surveyor will designate the proportion of damage affecting each species (25% Sugar Pine, 75% White Fir), or provide an estimate of the number of trees per acre affected for each species.¹

Mortality Layer Development

A single continuous layer (computer file) depicting mortality within existing vegetation conditions was developed from several sources. This process combined mortality assessment layers from three different sources with a 2003 existing vegetation layer. The layers used to collectively define the analysis extent and magnitude of mortality were a) the September, 2003 aerial sketch mapping polygons of forest mortality from FHP; b) the 1997-2002 Landsat TM based change detection layer, and; c) a 2001-2003 Landsat TM based mortality detection layer (see above discussion). The sketch mapping polygons primarily defined the study area while the change detection layers provided information about the relative magnitude of mortality. These separate layers along with a 1997-2003 fire history layer were combined into a single mortality grid. The fire history data allowed for the discrimination of pest and drought associated mortality from fire related mortality. Mortality estimates from the 2003 fires are not assessed in this report.

The 2003 existing vegetation layer was used to provide information about vegetation type within mortality areas. This layer was also used as the spatial base to determine vegetation type for the final mortality maps for forested types. The relatively fine scale delineations of vegetation composition and structure in the vegetation layer were used to create a larger stand-based spatial definition of the change detection mortality pixels. This also had the effect of standardizing the spatial variability between the change detection pixels and the coarser sketch mapping polygons.

¹ <http://www.fs.fed.us/r5/spf/fhp/fhm/index.shtml>
<http://www.fs.fed.us/r5/spf/fhp/fhm/aerial/index.shtml>

Polygons of forest mortality were derived from grouping pixels indicating mortality levels. This process, referred to as regionalization, was the result of a spatial overlay of the vegetation layer polygons and a grid of the mortality classes. The change detection pixels originally classified mortality into four classes: little or no change, low, medium and high classes, which were redefined into ranges of canopy cover loss. For regionalization purposes in the combined mortality layer, the midpoint value of each range was used to assign a loss value to the remotely sensed change data. Mortality delineated by the sketch mapping polygons, but not classified in the change detection layers, was categorized as very low mortality. Table 13 shows the canopy cover loss values that were assigned to each mortality class.

Table 13. Forest mortality classes and their corresponding canopy losses.

Mortality Class	Canopy Loss Range	Mid-point value
Very Low mortality	0-15%	8%
Low mortality	16-40%	28%
Medium mortality	41-70%	56%
High mortality	>70%	86%

Polygons from the vegetation layer were labeled with a canopy loss value based on a generalization of the mortality pixels, using a zonal mean function in ARC/GRID. The polygon labels were thus assigned a canopy loss in the range from 8 and 86 percent. The vegetation type labels were re-assigned to polygons labeled with canopy loss. Vegetation type labels from the 2003 layer were used unless mortality was identified as an update cause in the vegetation layer. In these cases, the previous version 1997 vegetation labels were used to ensure that pre-mortality forested conditions (and type) were included. The final mortality map containing regionalized canopy loss values and vegetation type labels formed the basis for the development of mortality strata.

Plot Inventory Data

The estimates of mortality were mostly derived from USFS National Forest inventory data. The majority of the FIA inventory plots were established on the Angeles, San Bernardino and Cleveland National Forests in 1995-1996 with some additions in 2000. The 1993-1994 periodic inventory plots were available on lands outside National Forests. Thus, the established inventory data provided estimates of numbers of trees and volume by species and diameter class in the mapped area *prior* to the mortality event. Forestland plots that fell in non-mortality areas or in wildfire areas that occurred between 1997 and 2003 fires were excluded from the analysis for the mapped project area.

The 124 sample plots within the mapped area were reviewed for mortality on 1:15,840 scale color aerial photography flown on Sept. 5-6, 2003. If any tree mortality was observed on the photography for a plot location, the plot was subsequently visited on

the ground by field crews in spring of 2004. Each tree over 5 inches in DBH that had been tallied live at the previous inventory was checked to see if it was still alive. There were 92 sample plots measured in the field (88 on National Forest lands and 4 on lands outside National Forests). The 32 additional sample plots (30 National Forest and 2 outside National Forests) where no mortality had occurred, as determined on the aerial photography, were also included in our sample. The inventory sample of 124 plots allowed us to derive estimates of the number of trees, biomass and volume by species and diameter class within the mapped area that had recently died, as well as determine the remaining live trees.

Forest Mortality Stratification

In order to have enough sample plots in population strata and reduce the variance in the estimates of mortality in terms of numbers of trees, volume and biomass derived from the plots, we stratified the assessment area into forest type groups and canopy cover loss groups. The features of our original map consisted of Pacific Southwest Region (USFS Region 5) defined major forest types and canopy cover loss in percent. First, we looked at how many plots there were available for each major forest type. Plots collected with Region 5 type codes (R5 type) were reclassified into fewer strata (Type Group) as the first step for use with the remotely sensed change detection data.

To have a reasonable number of plots in each forest type/canopy cover loss stratum, Region 5 major forest types were collapsed into more general type groups. The productive and non-productive hardwoods types were collapsed into one hardwood group. The pinyon juniper (N) and subalpine mixed conifer (A) types were distinct enough from the other forest types that these types were left as their own groups. Westside mixed conifer, eastside mixed conifer, white fir and Bigcone Douglas-fir were lumped into a Fir (F) group; and Coulter pine, eastside pine, Jeffrey pine and Ponderosa pine into a Pine (P) group.

Table 14. Plot Distribution by Major Forest Types

R5 Major Forest Type	R5 TypeCode	# of plots	Type Groups
Productive hardwood	H	2	H
Nonproductive Hardwood	I	14	H
Subalpine mixed conifer	A	8	A
Pinyon Juniper	N	8	N
Coulter pine	C	6	P
Bigcone Douglas-fir	D	4	F
Eastside Pine	E	9	P
Eastside Mixed Conifer	F	33	F
Jeffrey pine	J	17	P
Westside Mixed Conifer	M	20	F
Ponderosa Pine	P	2	P
White Fir	W	1	F
		124	

Each combined “Type Group” was then divided into canopy loss categories of low (L), medium (M) and high (H) canopy loss based on the trends in the average basal area mortality from inventory plots, when there were enough sample plots to maintain statistical validity. The low group (L) consisted of areas with $\leq 8\%$ canopy loss. Eighty six of the one hundred and twenty four plots fell into these areas. Medium and high canopy loss, given the distribution and number of plots by type and the standard errors of estimates, was $\geq 9-19\%$ loss for medium (M) and $\geq 20\%$ loss for high (H). However, we did not have enough sample plots to subdivide all the forest type groups into low-medium-high categories. The pinyon juniper (N) and subalpine mixed types (A) did not have enough plots for subdividing into mortality groups. Although the hardwood forest type had 16 plots, there was no trend in the average basal area mortality between the low, medium and high plots. Therefore, we did not stratify the hardwood area into mortality groups. Our final stratification is shown in the table below along with the numbers of sample inventory plots in each stratum and the average basal area mortality.

Table 15. Basal Area Mortality by Strata from FIA plots

Stratum	Name	# of plots	Basal Area Mortality (sq ft per acre)
FL	Low mortality-FIR	36	28.6
FM	Medium mortality-FIR	17	29.8
FH	High mortality-FIR	5	43.7
PL	Low mortality-PINE	27	11.7
PM	Medium mortality-PINE	4	13.1
PH	High mortality-PINE	3	36.4
HX	Hardwood – all	16	7.5
NX	Pinyon juniper – all	8	4.9
AX	Subalpine mixed conifer –all	8	5.5

Mortality Risk Mapping

Region 5 Forest Health Protection (FHP) staff has recently developed maps of forests currently at risk from insect and disease outbreaks. Their methods are based on direction from the national FHP program office. The FHP considers forests as “at risk” if those areas are likely to experience 25% or more volume loss from insect and disease within the next 15 years (<http://www.fs.fed.us/r5/spf/fhp/fhm/risk/index.shtml>). Scientific literature, professional expertise, and existing statistical data were used to develop empirical models for modeling pest risk. Region 5 developed these models collaboratively to characterize landscapes at risk statewide based on information in 2002 and then again in 2004.

The mortality risk data is based upon rules and statistics developed by eco-region and sub-sections. Rule structures for most forests are based primarily upon stand density index (SDI) but also include precipitation, plantation history, elevation, campground

proximity, and canopy cover by host type. SDI is calculated based on averaged FIA plot data and linked to the statewide vegetation data via strata layers. CALVEG vegetation strata data are updated synchronous with inventory, vegetation maps, and strata map labels and are used to assign a location, major forest type and canopy cover category. The final maps of at-risk vegetation are validated by USFS field personnel. The risk data are binary—either an area is considered at risk or it is not.

GIS Database development to support MASTs and FAST

The complexity of the MAST and FAST organizations necessitated coordination of efforts, given the interactions between all levels of government and the allocation of federal funds. The dispersed, dynamic nature of the problem has made success dependent on accurate, up-to-date, and fully accessible GIS information. Both federal and state agencies have been concerned that available funds are effectively used for hazard mitigation. Geographic Information System (GIS) analysis has come to play an important role in supporting these activities. CDF, as a partner in the MAST and FAST efforts at all levels, recognized this need early on in the process and has developed a GIS database to integrate organization resources in a planned and coordinated manner. Additionally, CDF has been attentive to the potential duplication of effort and conflicting policy issues that need to be quickly identified and resolved. The GIS-produced maps and data have helped to address many of these issues.

The challenges to the creation of GIS database to assist the MASTs and FAST coordination of the hazard mitigation have included:

- the rapidly changing forest mortality situation in Southern California forests;
- the increased risk of extreme fire events;
- the many diverse assets at risk (homes, community centers, power lines, watersheds, water quality, and major roads);
- the high and variable risks and costs for removing dead trees; highly variable costs to transport the biomass waste stream;
- the high and variable costs and pollution associated with permanent biomass disposal;
- the many different entities with responsibilities and liabilities,
- the many different GIS data providers and more potential clients and very limited budgets.

GIS Master Plan Development

The GIS Master Plan (GMP) developed for the MASTs and FAST by CDF uses a decentralized model to deliver necessary components. As such, the GMP is actually a set of similar plans, adapted to the needs of each member organization, which guides the collection of GIS based data and facilitates the production of maps and reports to support dead tree removal. The complete set of GIS Master Plans is presented as a “Tree Cutting Information Flow Diagram” (Figure 13). The basic design recognizes that

work gets done by key agency representatives at the local level and information flows out from there.

While each agency developed a unique process, they deviated only slightly from the general pattern represented in Figure 14.

The key steps in the process (from left to right in the figure) include:

1. *Parcel Assessment Plan*: Each agency must first identify where their responsibility area may be impacted by tree mortality and develop a plan to assess specific locations to review on the ground.
2. *Assessment*: Each specific location is reviewed for presence/absence of mortality. Information on ownership, location, number of dead trees, potential cost of tree removal etc. may be collected.
3. *Schedule*: Once projects are determined, project work is prioritized and scheduled.
4. *Assessment Data*: Once a project location is determined additional data may be gathered. Information may include environmental data, land status information, archeological information or others. At this point the project is considered “planned” and is sent to the MAST database and shared with other agencies and the public.
5. *GIS generated MAP and information for contractor*: Maps, tree counts and other project related information are provided to the group (agency or contractor) tasked with removing dead trees. While a given activity is being conducted, the project is generally considered “in progress” and is sent to the MAST regional GIS database.
6. *Inspection*: Once tree cutting has been completed and an inspection is done, final tree counts, acres, costs or other information is provided and the MAST regional GIS database is updated. The status of the project is then amended to “completed”.
7. *Local Database*: With the completion of the project, the local and MAST regional GIS databases are updated. Status maps, tables and charts can be generated and reported to management, elected officials and the public.

There are several ongoing planning and implementation efforts committed to minimizing community fire threat. For example, Southern California Edison, Bear Valley Electric and San Diego Gas & Electric have been removing dead and dying trees from power-line rights-of-way; with the assistance of CDF, the California Department of Transportation (CalTrans) has been removing trees along state highways; and San Bernardino, Riverside and San Diego Counties have been organizing tree removal efforts using various funding sources. Each of these organizations has identified their own GIS needs and has arranged for the necessary support.

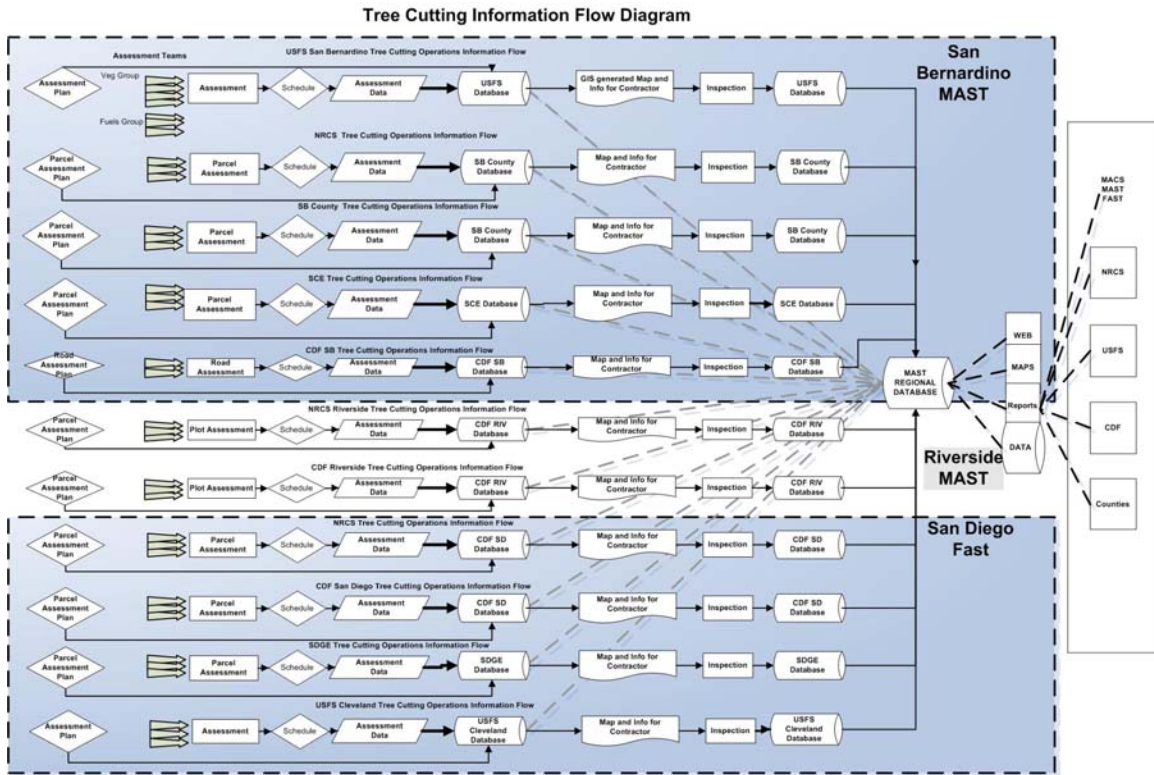


Figure 13.

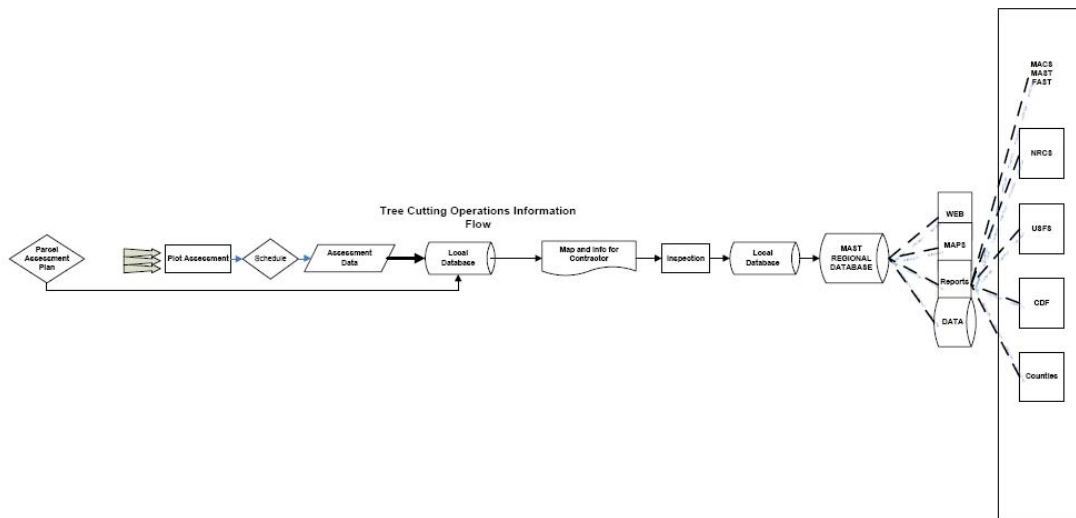


Figure 14.

Conclusion

Consecutive years of below-average precipitation from 1998 to 2003 resulted in large-scale insect outbreaks which caused moderate to severe tree mortality on almost 375,000 acres of forest land in Southern California. Estimates of mortality developed for this report indicate approximately 4.6 million trees died, totaling about 2.8 million BDT and 137 million cubic feet of material. Tree mortality impacted both public and privately owned lands in San Bernardino, Riverside, San Diego and Los Angeles counties. Fir species is the most common forest type and also the most impacted species, although certain species of Pine are also greatly impacted. Recent analysis by the USFS Forest Health Protection staff indicates that over 25% of the area is still at risk from insect and disease outbreaks in the next 15 years.

Tree mortality and hazard mitigation activities have thus far focused primarily on Wildland Urban Interface (WUI) areas, where public safety and property is at risk. Treatments in the WUI cover approximately 21% of the impacted area and are primarily focused on dead tree removal. Agencies have also been removing ladder and surface fuels to reduce the risk of catastrophic fire events in the urban interface, but on a more limited basis. These efforts will likely mitigate the most serious of the life threatening hazards posed by falling trees and increased build-up of fuels next to communities. Continued investments are needed to maintain these treatment areas as they re-grow, to ensure they do not become a problem once again. Some treatments may need to be directed outside of WUI to enhance and fortify treatments implemented inside WUI. Treatments away from WUI also offer the best opportunities to improve forest health.

The current bark beetle outbreak affecting the three Southern California counties has created a growing public awareness of local forest health issues and an increased demand for more frequent, timely information. Continued monitoring of tree mortality is needed to maintain public safety and improve forest health as these areas recover from this event. Monitoring inside and outside of treatments will be important to alert us when fuels build up to potentially dangerous levels again, as reforestation occurs. Ultimately, the increased interest and public awareness resulting from this high-profile forest mortality could lead to a better community understanding and management of local forests.

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A-1. Forestland Acres by County

Table A-1 Forestland Acres by County

County	Conifer Forest Acres	Hardwood Forest Acres	Total Acres
Riverside*	116,848	55,084	171,932
San Bernardino*	328,695	70,971	399,666
San Diego	100,670	149,629	250,299
Total	546,212	275,685	821,897

* excludes northern San Bernardino and eastern Riverside Counties

A-2. Tree Mortality by County

Table A-2 Tree Mortality by County

County	Acres	Cubic feet	Trees	Tons
San Bernardino	254,192	90,260,543	3,021,387	1,844,313
Riverside	80,422	33,037,809	1,079,716	662,532
San Diego	37,183	11,914,342	483,745	257,939
Los Angeles	2,909	1,636,470	39,599	32,875
Grand Total	374,705	136,849,164	4,624,446	2,797,658

A-3. Owner

A-3.1 Number of Dead Trees

Table A-3.1a San Bernardino county number of dead trees by owner

Owner	Trees
Federal	2,321,922
Non Federal	699,465
Grand Total	3,021,387

Table A-3.1b Riverside county number of dead trees by owner

Owner	Trees
Federal	746,846
Non Federal	332,869
Grand Total	1,079,716

Table A-3.1c San Diego county number of dead trees by owner

Owner	Trees
Federal	97,018
Non Federal	386,727
Grand Total	483,745

Table A-3.1d Los Angeles county number of dead trees by owner

Owner	Trees
Federal	33,490
Non Federal	6,109
Grand Total	39,599

Table A-3.1e Number of dead trees by owner in the four county area*

Owner	Trees
Federal	3,199,277
Non Federal	1,425,170
Grand Total	4,624,446

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-3.2 Tons of Dead Trees

Table A-3.2a San Bernardino county tons of dead trees by owner

Owner	Tons
Federal	1,429,202
Non Federal	415,111
Grand Total	1,844,313

Table A-3.2b Riverside county tons of dead trees by owner

Owner	Tons
Federal	424,787
Non Federal	237,744
Grand Total	662,532

Table A-3.2c San Diego county tons of dead trees by owner

Owner	Tons
Federal	57,569
Non Federal	200,370
Grand Total	257,939

Table A-3.2d Los Angeles county tons of dead trees by owner

Owner	Tons
Federal	27,689
Non Federal	5,186
Grand Total	32,875

Table A-3.2e Tons of dead trees by owner in the four county area*

Owner	Tons
Federal	1,939,247
Non Federal	858,411
Grand Total	2,797,658

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-3.2a San Bernardino county tons of dead trees by owner

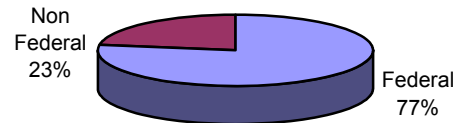


Chart A-3.2b Riverside county tons of dead trees by owner

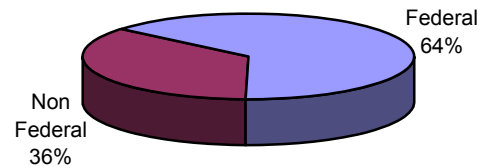


Chart A-3.2c San Diego county tons of dead trees by owner

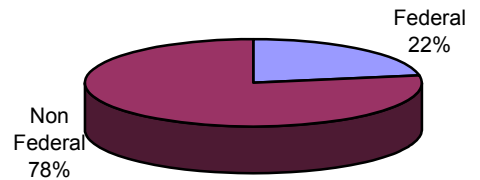


Chart A-3.2d Los Angeles county tons of dead trees by owner

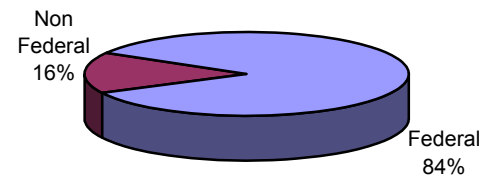
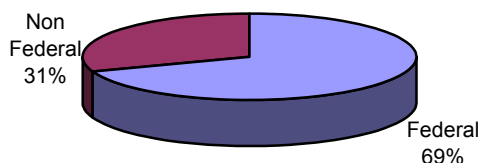


Chart A-3.2e Tons of dead trees by owner in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

A-3.3 Acres of Dead Trees

Table A-3.3a San Bernardino county acres of dead trees by owner

Owner	Acres
Federal	201,353
Non Federal	52,838
Grand Total	254,192

Table A-3.3b Riverside county acres of dead trees by owner

Owner	Acres
Federal	54,551
Non Federal	25,871
Grand Total	80,422

Table A-3.3c San Diego county acres of dead trees by owner

Owner	Acres
Federal	8,781
Non Federal	28,402
Grand Total	37,183

Table A-3.3d Los Angeles county acres of dead trees by owner

Owner	Acres
Federal	2,463
Non Federal	446
Grand Total	2,909

Table A-3.3e Acres of dead trees by owner in the four county area

Owner	Acres
Federal	267,148
Non Federal	107,557
Grand Total	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-3.4 Cubic Feet of Dead Trees

Table A-3.4a San Bernardino county cubic feet of dead trees by owner

Owner	Cubic feet
Federal	69,904,199
Non Federal	20,356,344
Grand Total	90,260,543

Table A-3.4b Riverside county cubic feet of dead trees by owner

Owner	Cubic feet
Federal	21,152,520
Non Federal	11,885,289
Grand Total	33,037,809

Table A-3.4c San Diego county cubic feet of dead trees by owner

Owner	Cubic feet
Federal	2,594,026
Non Federal	9,320,316
Grand Total	11,914,342

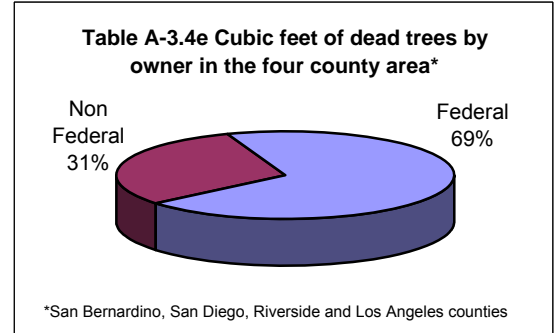
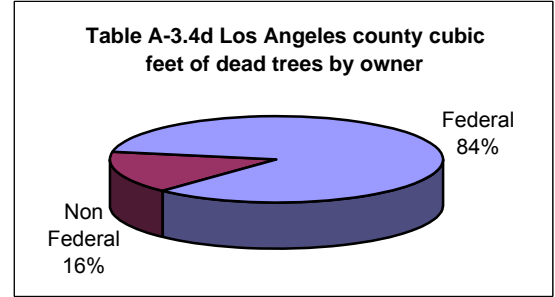
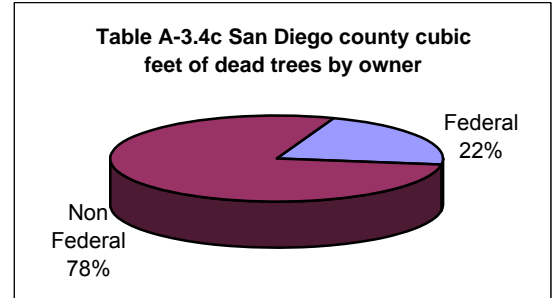
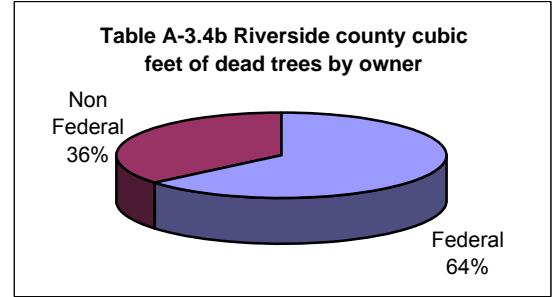
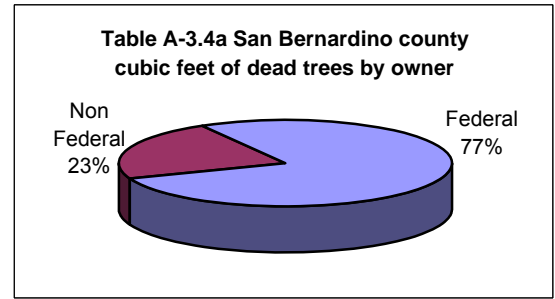
Table A-3.4d Los Angeles county cubic feet of dead trees by owner

Owner	Cubic feet
Federal	1,377,420
Non Federal	259,051
Grand Total	1,636,470

Table A-3.4e Cubic feet of dead trees by owner in the four county area*

Owner	Cubic feet
Federal	95,028,164
Non Federal	41,821,000
Grand Total	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties



A-4. Mortality Level

A-4.1 Number of Dead Trees

Table A-4.1a San Bernardino county number of dead trees by mortality level

Mortality level	Trees
≥ 20 % mortality	395,184
> 8-19 % mortality	481,435
0-8 % mortality	2,144,768
Grand total	3,021,387

Table A-4.1b Riverside county number of dead trees by mortality level

Mortality level	Trees
≥ 20 % mortality	97,599
> 8-19 % mortality	133,265
0-8 % mortality	848,852
Grand total	1,079,716

Table A-4.1c San Diego county number of dead trees by mortality level

Mortality level	Trees
≥ 20 % mortality	61,764
> 8-19 % mortality	91,138
0-8 % mortality	330,843
Grand total	483,745

Table A-4.1d Los Angeles county number of dead trees by mortality level

Mortality level	Trees
≥ 20 % mortality	1,581
> 8-19 % mortality	3,531
0-8 % mortality	34,487
Grand total	39,599

Table A-4.1e Number of dead trees by mortality level in the four county area*

Mortality level	Trees
≥ 20 % mortality	556,127
> 8-19 % mortality	709,369
0-8 % mortality	3,358,950
Grand total	4,624,446

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-4.2 Tons of Dead Trees

Table A-4.2a San Bernardino county tons of dead trees by mortality level

Mortality level	Tons
≥ 20 % mortality	248,205
> 8-19 % mortality	344,082
0-8 % mortality	1,252,026
Grand total	1,844,313

Table A-4.2b Riverside county tons of dead trees by mortality level

Mortality level	Tons
≥ 20 % mortality	63,850
> 8-19 % mortality	107,172
0-8 % mortality	491,510
Grand total	662,532

Table A-4.2c San Diego county tons of dead trees by mortality level

Mortality level	Tons
≥ 20 % mortality	35,982
> 8-19 % mortality	39,076
0-8 % mortality	182,880
Grand total	257,939

Table A-4.2d Los Angeles county tons of dead trees by mortality level

Mortality level	Tons
≥ 20 % mortality	1,010
> 8-19 % mortality	2,702
0-8 % mortality	29,163
Grand total	32,875

Table A-4.2e Tons of dead trees by mortality level in the four county area*

Mortality level	Tons
≥ 20 % mortality	349,048
> 8-19 % mortality	493,031
0-8 % mortality	1,955,578
Grand total	2,797,658

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-4.2a San Bernardino county tons of dead trees by mortality level

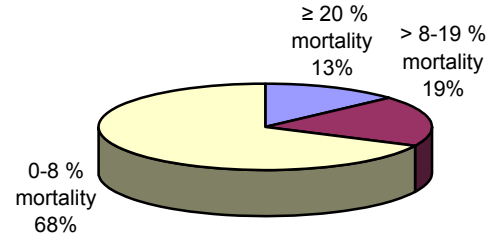


Chart A-4.2b Riverside county tons of dead trees by mortality level

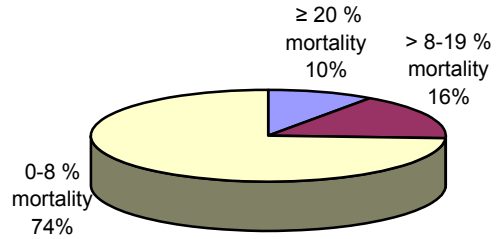
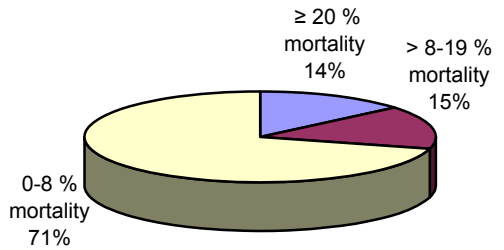
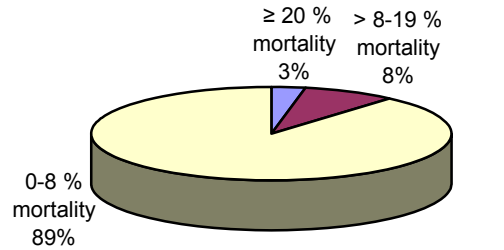


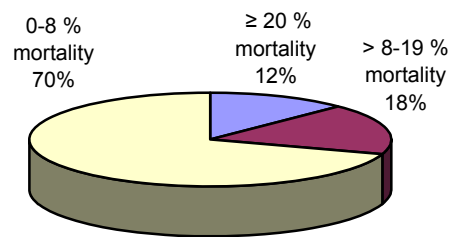
Chart A-4.2c San Diego county tons of dead trees by mortality level



Los Angeles county tons of dead trees by mortality level



Tons of dead trees by mortality level in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

A-4.3 Acres of Dead Trees

Table A-4.3a San Bernardino county acres of dead trees by mortality level

Mortality level	Acres
≥ 20 % mortality	14,081
> 8-19 % mortality	30,249
0-8 % mortality	209,861
Grand total	254,192

Table A-4.3b Riverside county acres of dead trees by mortality level

Mortality level	Acres
≥ 20 % mortality	3,498
> 8-19 % mortality	8,624
0-8 % mortality	68,300
Grand total	80,422

Table A-4.3c San Diego county acres of dead trees by mortality level

Mortality level	Acres
≥ 20 % mortality	2,178
> 8-19 % mortality	5,178
0-8 % mortality	29,827
Grand total	37,183

Table A-4.3d Los Angeles county acres of dead trees by mortality level

Mortality level	Acres
≥ 20 % mortality	56
> 8-19 % mortality	226
0-8 % mortality	2,627
Grand total	2,909

Table A-4.4e Acres of dead trees by mortality level in the four county area*

Mortality level	Acres
≥ 20 % mortality	19,814
> 8-19 % mortality	44,277
0-8 % mortality	310,614
Grand total	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-4.4 Cubic Feet of Dead Trees

Table A-4.4a San Bernardino county cubic feet of dead trees by mortality level

Mortality level	Cubic feet
≥ 20 % mortality	12,312,533
> 8-19 % mortality	17,645,452
0-8 % mortality	60,302,558
Grand total	90,260,543

Table A-4.4b Riverside county cubic feet of dead trees by mortality level

Mortality level	Cubic feet
≥ 20 % mortality	3,173,819
> 8-19 % mortality	5,527,316
0-8 % mortality	24,336,674
Grand total	33,037,809

Table A-4.4c San Diego county cubic feet of dead trees by mortality level

Mortality level	Cubic feet
≥ 20 % mortality	1,777,850
> 8-19 % mortality	1,935,622
0-8 % mortality	8,200,870
Grand total	11,914,342

Table A-4.4d Los Angeles county cubic feet of dead trees by mortality level

Mortality level	Cubic feet
≥ 20 % mortality	50,168
> 8-19 % mortality	139,032
0-8 % mortality	1,447,270
Grand total	1,636,470

Table A-4.4e Cubic feet of dead trees by mortality level in the four county area*

Mortality level	Cubic feet
≥ 20 % mortality	17,314,371
> 8-19 % mortality	25,247,422
0-8 % mortality	94,287,371
Grand total	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-4.4a San Bernardino county cubic feet of dead trees by mortality level

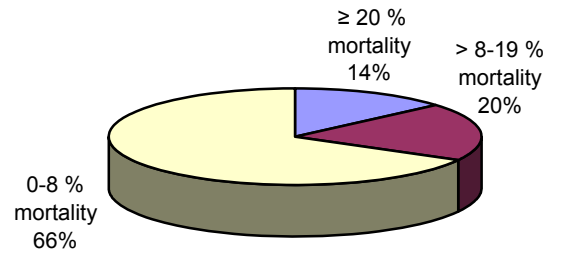


Chart A-4.4b Riverside county cubic feet of dead trees by mortality level

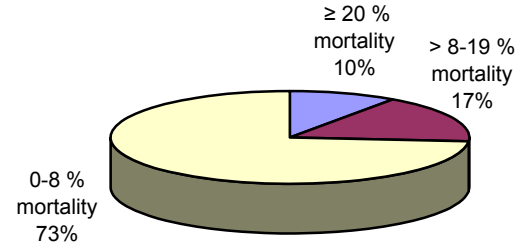


Chart A-4.4c San Diego county cubic feet of dead trees by mortality level

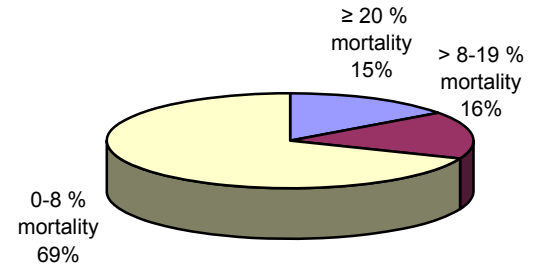


Chart A-4.4d Los Angeles county cubic feet of dead trees by mortality level

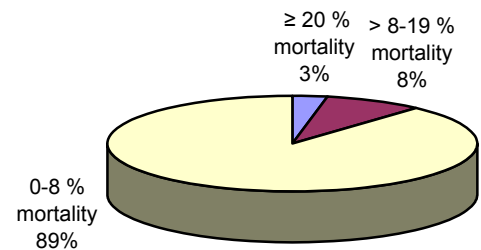
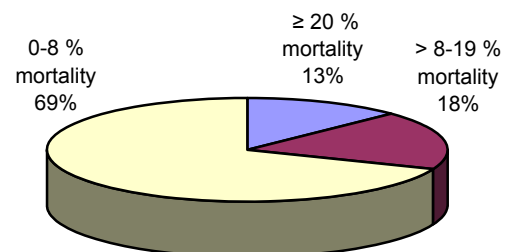


Chart A-4.4e Cubic feet of dead trees by mortality level in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

A-5. Owner and Mortality Level

A-5.1 Number of Dead Trees

Table A-5.1a San Bernardino county number of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	239,271	367,925	1,714,726	2,321,922
Non Federal	155,913	113,510	430,042	699,465
Grand Total	395,184	481,435	2,144,768	3,021,387

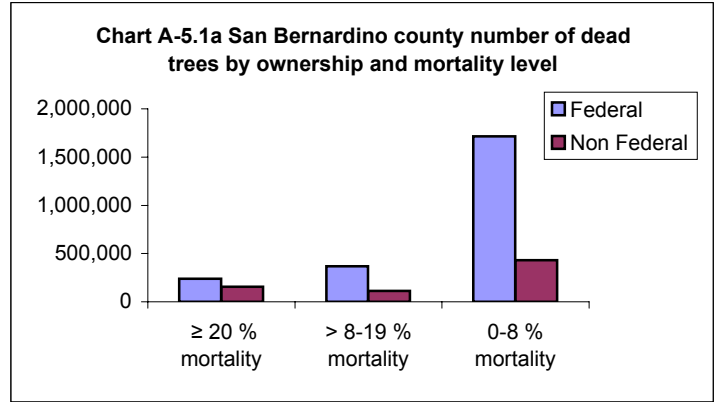


Table A-5.1b Riverside county number of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	67,914	91,010	587,923	746,846
Non Federal	29,685	42,255	260,930	332,869
Grand Total	97,599	133,265	848,852	1,079,716

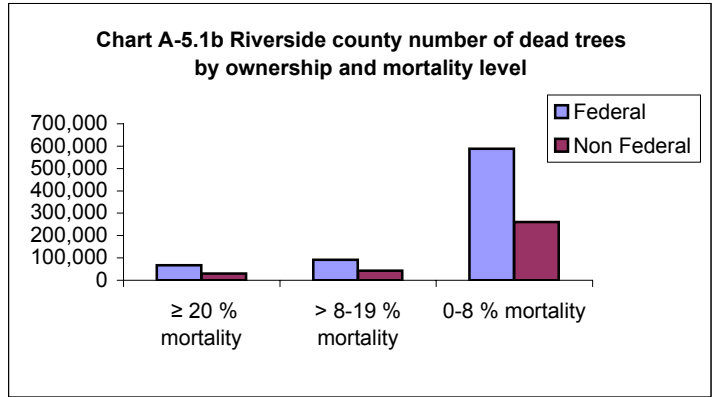


Table A-5.1c San Diego county number of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	6,938	16,419	73,661	97,018
Non Federal	54,826	74,719	257,182	386,727
Grand Total	61,764	91,138	330,843	483,745

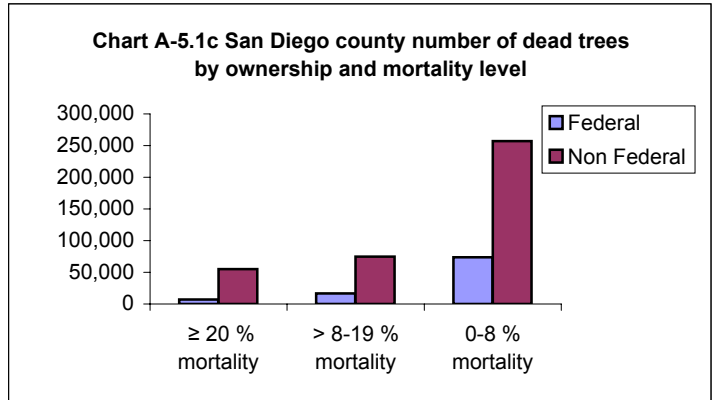


Table A-5.1d Los Angeles county number of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	1,581	3,388	28,522	33,490
Non Federal		143	5,966	6,109
Grand Total	1,581	3,531	34,487	39,599

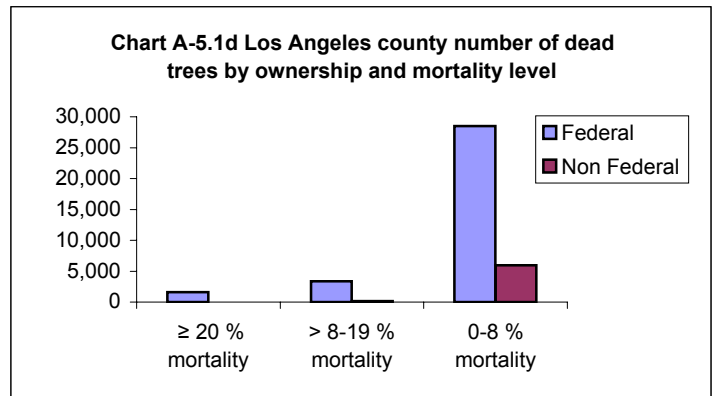
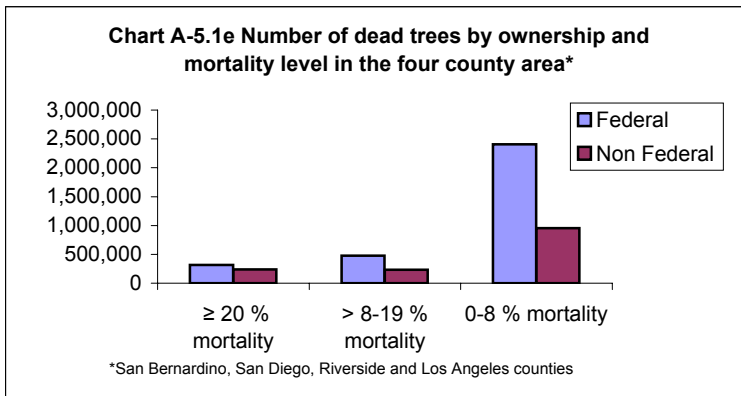


Table A-5.1e Number of dead trees by owner and mortality level in the four county area*

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	315,704	478,742	2,404,831	3,199,277
Non Federal	240,424	230,627	954,119	1,425,170
Grand Total	556,127	709,369	3,358,950	4,624,446

*San Bernardino, San Diego, Riverside and Los Angeles counties



A-5.2 Tons of Dead Trees

Table A-5.2a San Bernardino county tons of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	151,298	261,739	1,016,165	1,429,202
Non Federal	96,907	82,343	235,861	415,111
Grand Total	248,205	344,082	1,252,026	1,844,313

Table A-5.2b Riverside county tons of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	44,141	72,588	308,058	424,787
Non Federal	19,709	34,584	183,452	237,744
Grand Total	63,850	107,172	491,510	662,532

Table A-5.2c San Diego county tons of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	3,809	5,832	47,928	57,569
Non Federal	32,173	33,244	134,953	200,370
Grand Total	35,982	39,076	182,880	257,939

Table A-5.2d Los Angeles county tons of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	1,010	2,572	24,107	27,689
Non Federal		130	5,056	5,186
Grand Total	1,010	2,702	29,163	32,875

Table A-5.2e Tons of dead trees by owner and mortality level in the four county area*

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	200,259	342,731	1,396,257	1,939,247
Non Federal	148,789	150,301	559,321	858,411
Grand Total	349,048	493,031	1,955,578	2,797,658

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-5.3 Acres of Dead Trees

Table A-5.3a San Bernardino county acres of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	8,534	23,092	169,728	201,353
Non Federal	5,547	7,158	40,133	52,838
Grand Total	14,081	30,249	209,861	254,192

Table A-5.3b Riverside county acres of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	2,432	5,877	46,242	54,551
Non Federal	1,066	2,747	22,058	25,871
Grand Total	3,498	8,624	68,300	80,422

Table A-5.3c San Diego county acres of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	243	907	7,631	8,781
Non Federal	1,936	4,270	22,196	28,402
Grand Total	2,178	5,178	29,827	37,183

Table A-5.3d Los Angeles county acres of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	56	216	2,191	2,463
Non Federal		10	436	446
Grand Total	56	226	2,627	2,909

Table A-5.3e Acres of dead trees by owner and mortality level in the four county area*

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	11,265	30,092	225,791	267,148
Non Federal	8,549	14,185	84,823	107,557
Grand Total	19,814	44,277	310,614	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-5.3a San Bernardino county acres of dead trees by ownership and mortality level

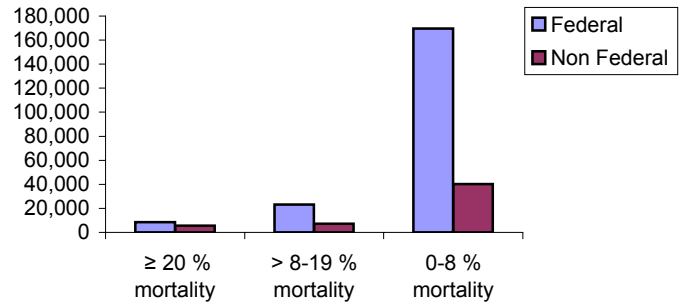


Chart A-5.3b Riverside county acres of dead trees by ownership and mortality level

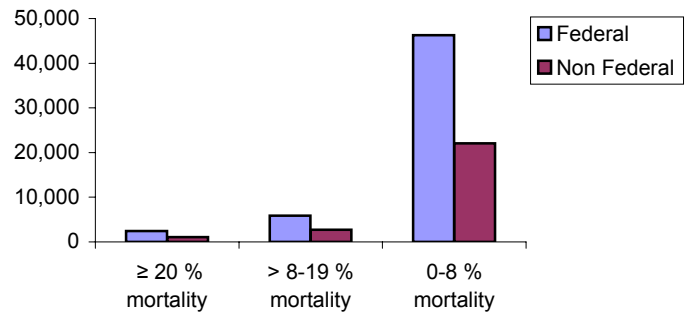


Chart A-5.3c San Diego county acres of dead trees by ownership and mortality level

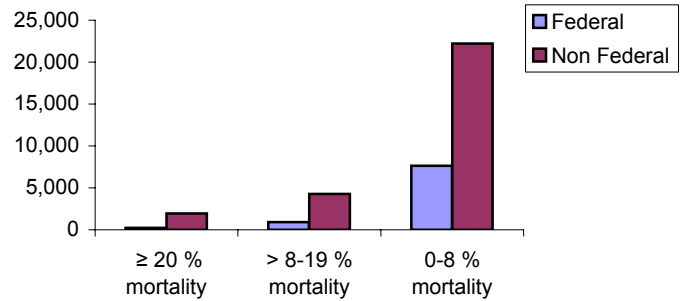
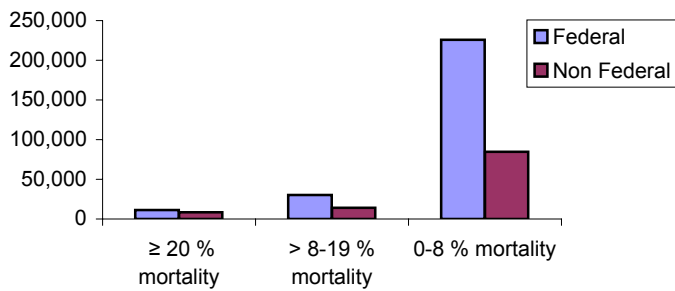
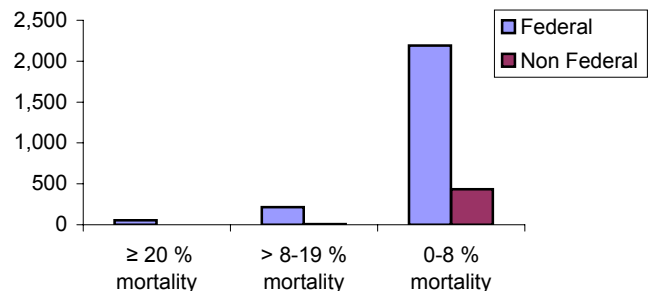


Chart A-5.3e Acres of dead trees by ownership and mortality level in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-5.3d Los Angeles county acres of dead trees by ownership and mortality level



A-5.4 Cubic Feet of Dead Trees

Table A-5.4a San Bernardino county cubic feet of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	7,507,899	13,419,497	48,976,803	69,904,199
Non Federal	4,804,634	4,225,954	11,325,755	20,356,344
Grand Total	12,312,533	17,645,452	60,302,558	90,260,543

Table 5.4b Riverside county cubic feet of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	2,193,439	3,742,273	15,216,808	21,152,520
Non Federal	980,380	1,785,043	9,119,866	11,885,289
Grand Total	3,173,819	5,527,316	24,336,674	33,037,809

Table 5.4c San Diego county cubic feet of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	187,582	283,603	2,122,841	2,594,026
Non Federal	1,590,268	1,652,019	6,078,029	9,320,316
Grand Total	1,777,850	1,935,622	8,200,870	11,914,342

Table 5.4d Los Angeles county cubic feet of dead trees by owner and mortality level

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	50,168	132,302	1,194,949	1,377,420
Non Federal		6,730	252,320	259,051
Grand Total	50,168	139,032	1,447,270	1,636,470

Table 5.4e Cubic feet of dead trees by owner and mortality level in the four county area*

Owner	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	9,939,088	17,577,675	67,511,401	95,028,164
Non Federal	7,375,283	7,669,747	26,775,970	41,821,000
Grand Total	17,314,371	25,247,422	94,287,371	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-6. Forest Type and Mortality Level

A-6.1 Number of Dead Trees

Table A-6.1a San Bernardino county number of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	300,942	349,143	975,289	1,625,375
Pine	94,242	132,292	222,169	448,703
Hardwood			533,421	533,421
Pinyon juniper			408,259	408,259
Subalpine mixed			5,629	5,629
Total	395,184	481,435	2,144,768	3,021,387

Table A-6.1b San Diego county number of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	32,305	29,111	71,347	132,763
Pine	29,459	62,027	73,916	165,403
Hardwood			185,579	185,579
Total	61,764	91,138	330,843	483,745

Table A-6.1c Riverside county number of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	87,695	113,572	497,229	698,496
Pine	9,904	19,692	29,445	59,041
Hardwood			205,471	205,471
Pinyon juniper			116,001	116,001
Subalpine mixed			706	706
Total	97,599	133,265	848,852	1,079,716

Table A-6.1d Los Angeles county number of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	1,296	2,814	31,316	35,426
Pine	285	717	2,532	3,533
Hardwood			447	447
Pinyon juniper			192	192
Total	1,581	3,531	34,487	39,599

Table A-6.1e Number of dead trees by forest type and mortality level in the four county area*

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	422,238	494,640	1,575,181	2,492,060
Pine	133,889	214,728	328,063	676,680
Hardwood			924,919	924,919
Pinyon juniper			524,453	524,453
Subalpine mixed			6,335	6,335
Total	556,127	709,369	3,358,950	4,624,446

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-6.1a San Bernardino county number of dead trees by forest type

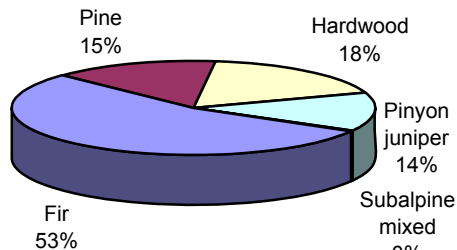


Chart A-6.1b San Diego county number of dead trees by forest type

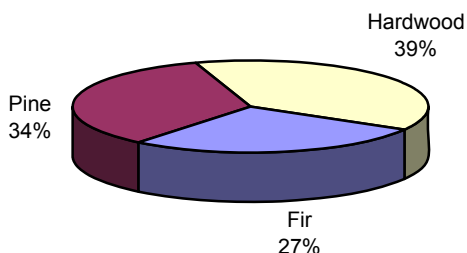


Chart A-6.1c Riverside county number of dead trees by forest type

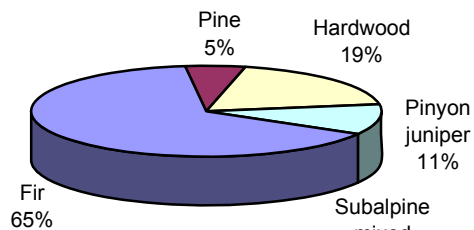


Chart A-6.1d Los Angeles county number of dead trees by forest type

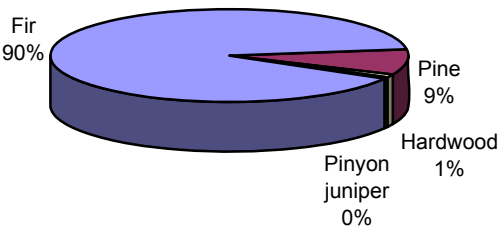
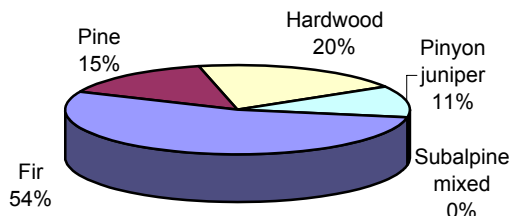


Chart A-6.1e Number of dead trees by forest type in the four county area*



A-6.2 Tons of Dead Trees

Table A-6.2a San Bernardino county tons of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	202,706	317,136	795,962	1,315,805
Pine	45,499	26,946	309,109	381,553
Hardwood			62,691	62,691
Pinyon juniper			63,155	63,155
Subalpine mixed			21,109	21,109
Total	248,205	344,082	1,252,026	1,844,313

Table A-6.2b San Diego county tons of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	21,760	26,442	58,229	106,431
Pine	14,223	12,634	102,841	129,698
Hardwood			21,810	21,810
Total	35,982	39,076	182,880	257,939

Table A-6.2c Riverside county tons of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	59,069	103,161	405,803	568,033
Pine	4,781	4,011	40,968	49,760
Hardwood			24,148	24,148
Pinyon juniper			17,945	17,945
Subalpine mixed			2,646	2,646
Total	63,850	107,172	491,510	662,532

Table A-6.2d Los Angeles county tons of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	873	2,556	25,558	28,987
Pine	137	146	3,522	3,806
Hardwood			53	53
Pinyon juniper			30	30
Total	1,010	2,702	29,163	32,875

Table A-6.2e Tons of dead trees by forest type and mortality level in the four county area*

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	284,408	449,295	1,285,552	2,019,255
Pine	64,640	43,737	456,440	564,817
Hardwood			108,702	108,702
Pinyon juniper			81,129	81,129
Subalpine mixed			23,755	23,755
Total	349,048	493,031	1,955,578	2,797,658

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-6.2a San Bernardino county tons of dead trees by forest type

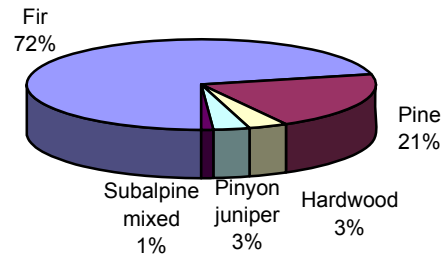


Chart A-6.2b San Diego county tons of dead trees by forest type

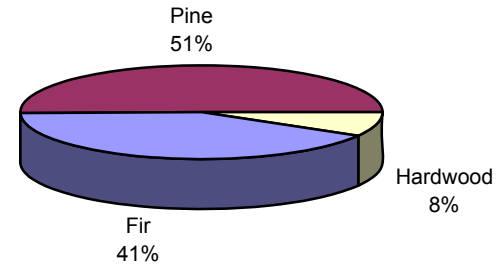


Chart A-6.2c Riverside county tons of dead trees by forest type

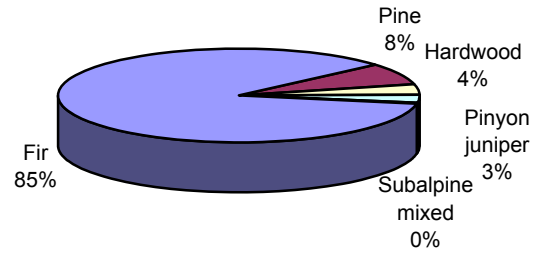


Chart A-6.2d Los Angeles county tons of dead trees by forest type

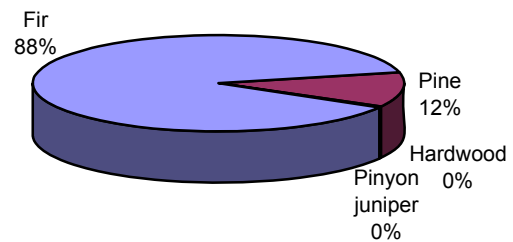
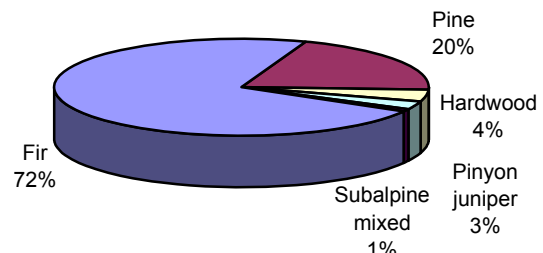


Chart A-6.2e Tons of dead trees by forest type in the four county area*



A-6.3 Acres of Dead Trees

Table A-6.3a San Bernardino county acres of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	10,832	23,360	63,549	97,741
Pine	3,249	6,889	46,787	56,925
Hardwood			27,627	27,627
Pinyon juniper			63,265	63,265
Subalpine mixed			8,633	8,633
Total	14,081	30,249	209,861	254,192

Table A-6.3b San Diego county acres of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	1,163	1,948	4,649	7,759
Pine	1,016	3,230	15,566	19,812
Hardwood			9,612	9,612
Total	2,178	5,178	29,827	37,183

Table A-6.3c Riverside county acres of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	3,156	7,599	32,399	43,154
Pine	341	1,025	6,201	7,568
Hardwood			10,642	10,642
Pinyon juniper			17,976	17,976
Subalpine mixed			1,082	1,082
Total	3,498	8,624	68,300	80,422

Table A-6.3d Los Angeles county acres of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	47	188	2,041	2,275
Pine	10	37	533	580
Hardwood			23	23
Pinyon juniper			30	30
Total	56	226	2,627	2,909

Table A-6.3e Acres of dead trees by forest type and mortality level in the four county area*

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	15,198	33,095	102,637	150,930
Pine	4,616	11,182	69,087	84,885
Hardwood			47,904	47,904
Pinyon juniper			81,271	81,271
Subalpine mixed			9,715	9,715
Total	19,814	44,277	310,614	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-6.3a San Bernardino county acres of dead trees by forest type

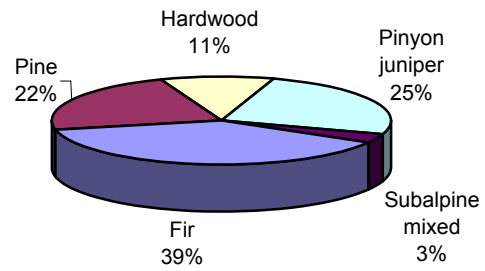


Chart A-6.3b San Diego county acres of dead trees by forest type

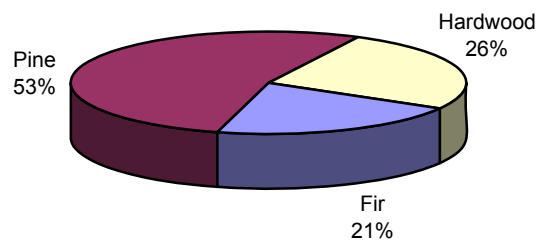


Chart A-6.3c Riverside county acres of dead trees by forest type

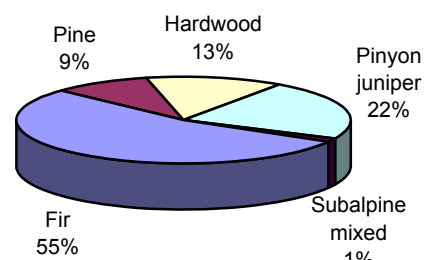


Chart A-6.3d Los Angeles county acres of dead trees by forest type

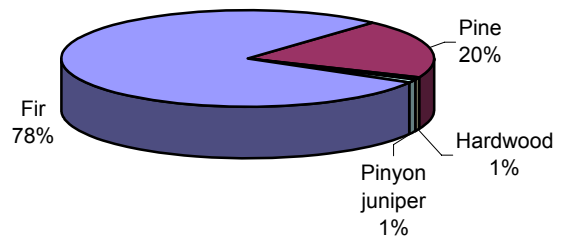
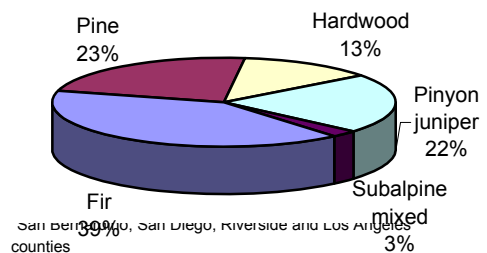


Chart A-6.3e Acres of dead trees by forest type in the four county area*



A-6.4 Cubic Feet of Dead Trees

Table A-6.4a San Bernardino county cubic feet of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	10,090,057	16,440,808	40,319,867	66,850,733
Pine	2,222,476	1,204,643	13,070,172	16,497,292
Hardwood			2,594,940	2,594,940
Pinyon juniper			3,196,143	3,196,143
Subalpine mixed			1,121,436	1,121,436
Total	12,312,533	17,645,452	60,302,558	90,260,543

Table A-6.4b San Diego county cubic feet of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	1,083,117	1,370,808	2,949,609	5,403,534
Pine	694,733	564,814	4,348,473	5,608,019
Hardwood			902,788	902,788
Total	1,777,850	1,935,622	8,200,870	11,914,342

Table A-6.4c Riverside county cubic feet of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	2,940,264	5,347,998	20,556,158	28,844,420
Pine	233,555	179,318	1,732,251	2,145,125
Hardwood			999,559	999,559
Pinyon juniper			908,142	908,142
Subalpine mixed			140,563	140,563
Total	3,173,819	5,527,316	24,336,674	33,037,809

Table A-6.4d Los Angeles county cubic feet of dead trees by forest type and mortality level

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	43,458	132,503	1,294,648	1,470,609
Pine	6,710	6,529	148,940	162,179
Hardwood			2,175	2,175
Pinyon juniper			1,507	1,507
Total	50,168	139,032	1,447,270	1,636,470

Table A-6.4e Cubic feet of dead trees by forest type and mortality level in the four county area*

Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Fir	14,156,897	23,292,118	65,120,282	102,569,296
Pine	3,157,474	1,955,304	19,299,837	24,412,615
Hardwood			4,499,462	4,499,462
Pinyon juniper			4,105,791	4,105,791
Subalpine mixed			1,261,999	1,261,999
Total	17,314,371	25,247,422	94,287,371	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-6.4a San Bernardino county cubic feet of dead trees by forest type

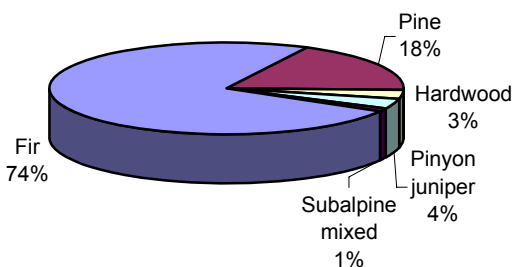


Chart A-6.4b San Diego county cubic feet of dead trees by forest type

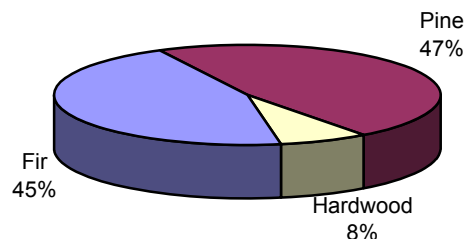


Chart A-6.4c Riverside county cubic feet of dead trees by forest type

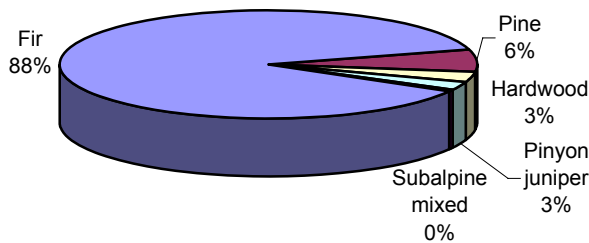


Chart A-6.4d Los Angeles county cubic feet of dead trees by forest type

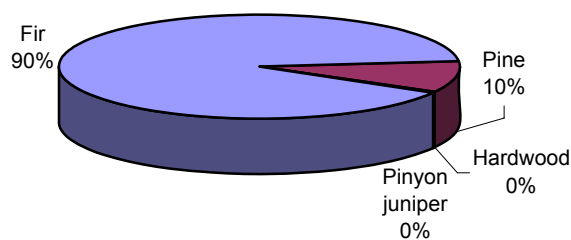
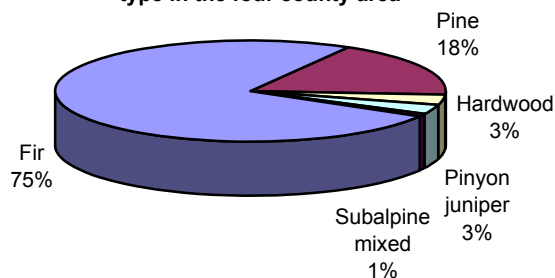


Chart A-6.4e Cubic feet of dead trees by forest type in the four county area*



A-7. Owner, Forest Type and Mortality Level

A-7.1 Number of Dead Trees

Table A-7.1a San Bernardino county number of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	187,545	265,097	791,574	1,244,217
	Pine	51,726	102,828	180,047	334,601
	Hardwood			412,913	412,913
	Pinyon juniper			324,620	324,620
	Subalpine mixed			5,571	5,571
	Total	239,271	367,925	1,714,726	2,321,922
Non federal	Fir	113,397	84,046	183,715	381,158
	Pine	42,516	29,464	42,122	114,102
	Hardwood			120,508	120,508
	Pinyon juniper			83,638	83,638
	Subalpine mixed			58	58
	Total	155,913	113,510	430,042	699,465
Grand total		395,184	481,435	2,144,768	3,021,387

Table A-7.1b San Diego county number of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	2,410	3,530	14,648	20,588
	Pine	4,528	12,888	22,796	40,212
	Hardwood			36,217	36,217
	Total	6,938	16,419	73,661	97,018
Non federal	Fir	29,895	25,581	56,699	112,175
	Pine	24,931	49,139	51,120	125,190
	Hardwood			149,362	149,362
	Total	54,826	74,719	257,182	386,727
Grand total		61,764	91,138	330,843	483,745

Table A-7.1c Riverside county number of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	59,508	76,706	306,831	443,045
	Pine	8,406	14,303	16,726	39,435
	Hardwood			177,008	177,008
	Pinyon juniper			87,342	87,342
	Subalpine mixed			16	16
	Total	67,914	91,010	587,923	746,846
Non federal	Fir	28,187	36,866	190,398	255,451
	Pine	1,498	5,389	12,719	19,606
	Hardwood			28,463	28,463
	Pinyon juniper			28,659	28,659
	Subalpine mixed			690	690
	Total	29,685	42,255	260,930	332,869
Grand total		97,599	133,265	848,852	1,079,716

Table A-7.1d Los Angeles county number of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	1,296	2,671	25,676	29,643
	Pine	285	717	2,206	3,208
	Hardwood			447	447
	Pinyon juniper			192	192
	Total	1,581	3,388	28,522	33,490
Non federal	Fir		143	5,640	5,783
	Pine			326	326
	Total		143	5,966	6,109
Grand total		1,581	3,531	34,487	39,599

Table A-7.1e Number of dead trees by forest type, owner and mortality level in the four county area*

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	269,100	369,856	1,268,475	1,907,431
	Pine	67,274	135,456	237,196	439,926
	Hardwood			654,153	654,153
	Pinyon juniper			430,368	430,368
	Subalpine mixed			6,276	6,276
	Total	336,374	505,312	2,596,468	3,438,154
Non federal	Fir	153,138	124,785	306,706	584,629
	Pine	66,616	79,272	90,867	236,754
	Hardwood			270,766	270,766
	Pinyon juniper			94,085	94,085
	Subalpine mixed			58	58
	Total	219,754	204,056	762,482	1,186,292
Grand total	556,127	709,369	3,358,950	4,624,446	

*San Bernardino, San Diego, Riverside and Los Angeles counties

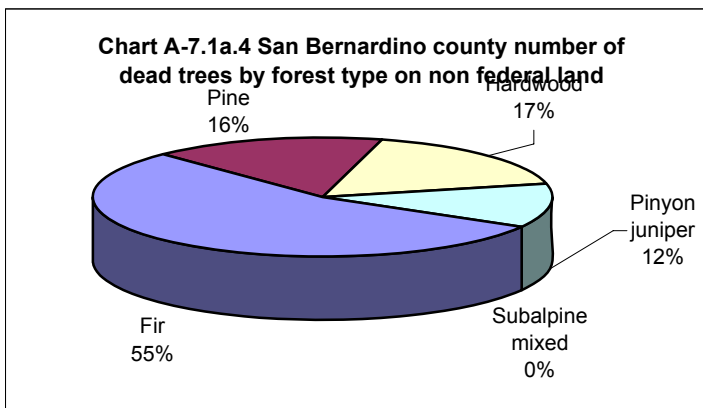
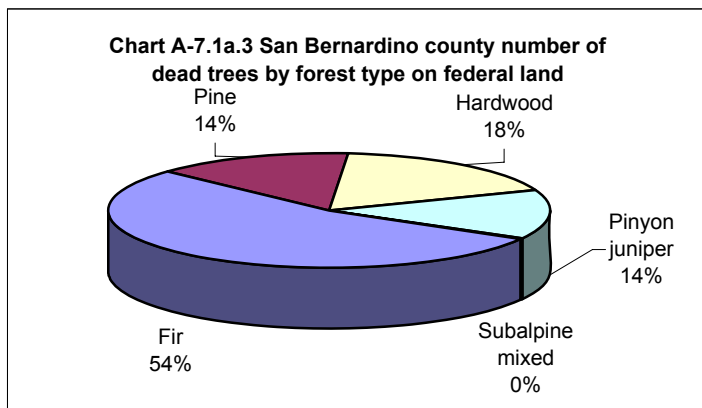
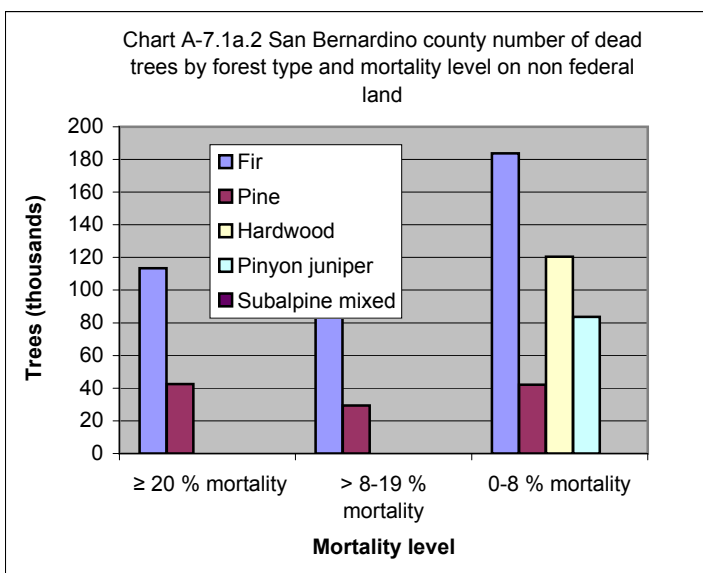
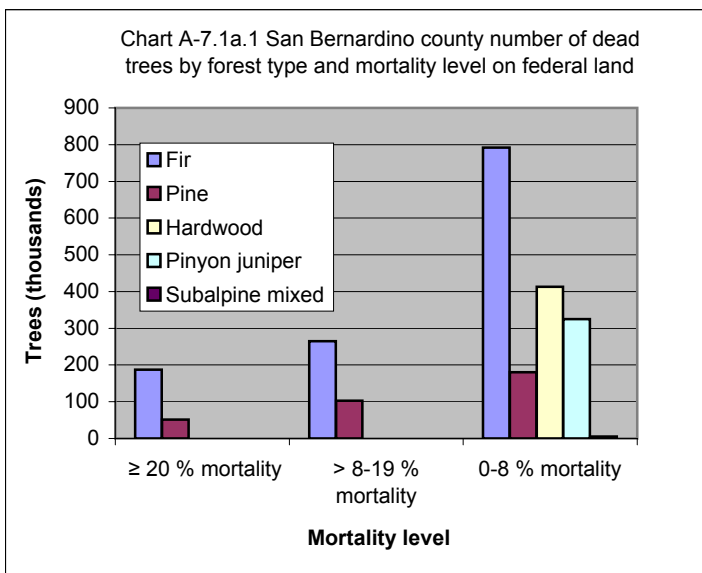


Chart A-7.1b.1 San Diego county number of dead trees by forest type and mortality level on federal land

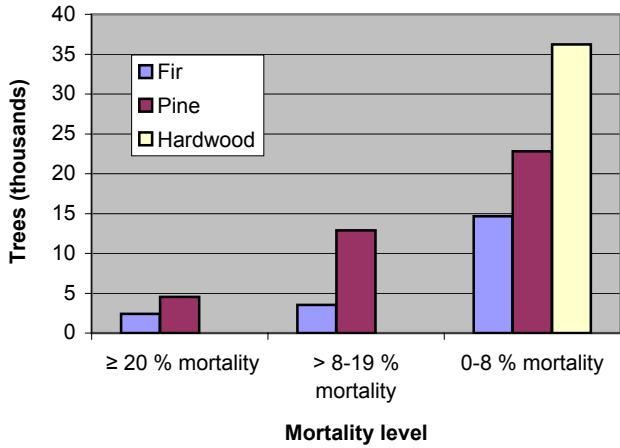


Chart A-7.1b.2 San Diego county number of dead trees by forest type and mortality level on non federal land

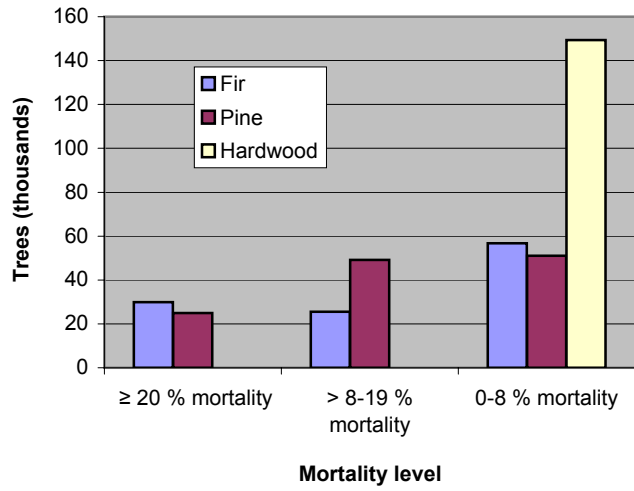


Chart A-7.1b.3 San Diego county number of dead trees by forest type on federal land

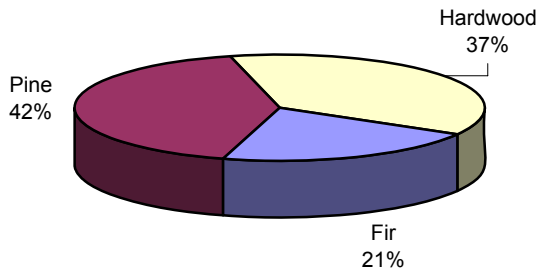


Chart A-7.1b.4 San Diego county number of dead trees by forest type on non federal land

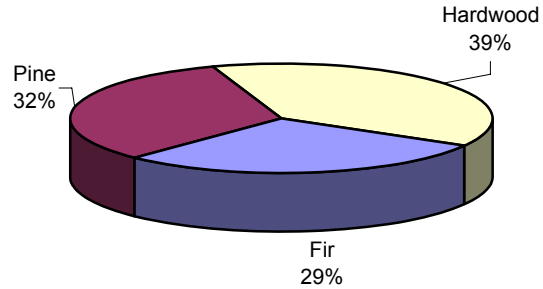


Chart A-7.1c.1 Riverside county number of dead trees by forest type and mortality level on federal land

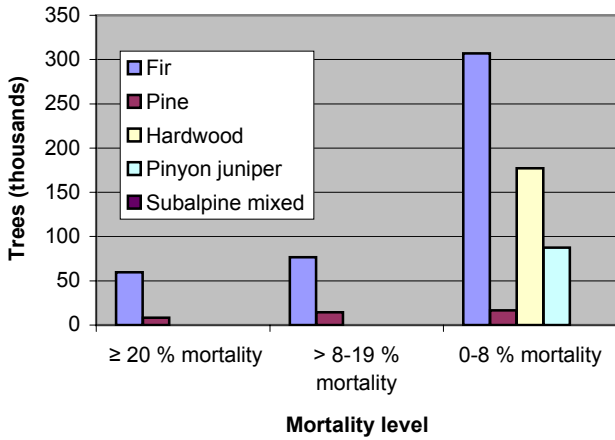


Chart A-7.1c.2 Riverside county number of dead trees by forest type and mortality level on non federal land

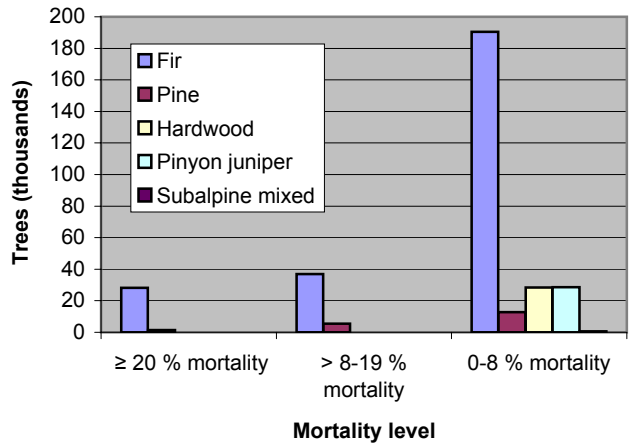


Chart A-7.1c.3 Riverside county number of dead trees by forest type on federal land

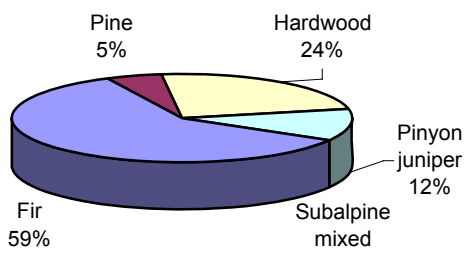


Chart A-7.1c.4 Riverside county number of dead trees by forest type on non federal land

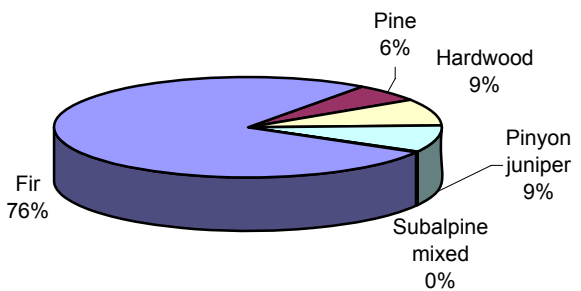


Chart A-7.1d.1 Los Angeles county number of dead trees by forest type and mortality level on federal land

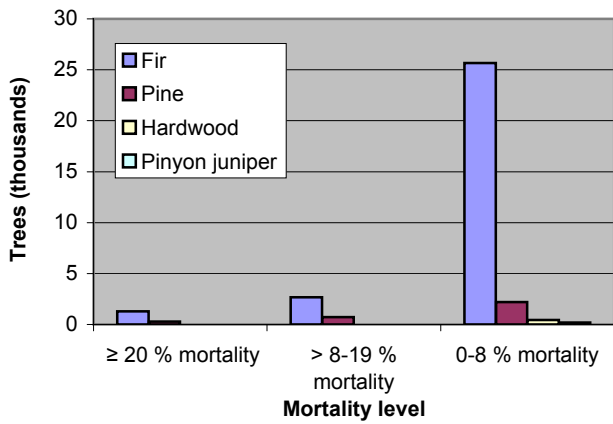


Chart A-7.1d.2 Los Angeles county number of dead trees by forest type and mortality level on non federal land

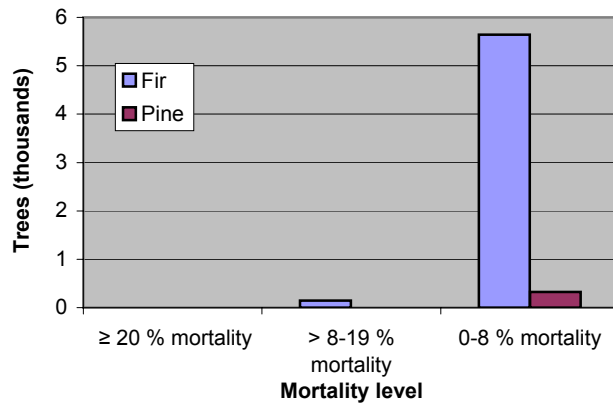


Chart A-7.1d.3 Los Angeles county number of dead trees by forest type on federal land

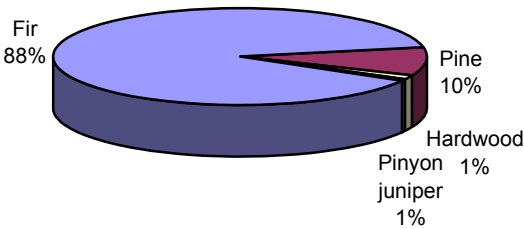


Chart A-7.1d.4 Los Angeles county number of dead trees by forest type on non federal land

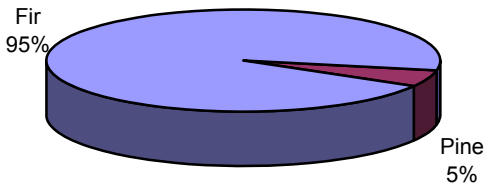
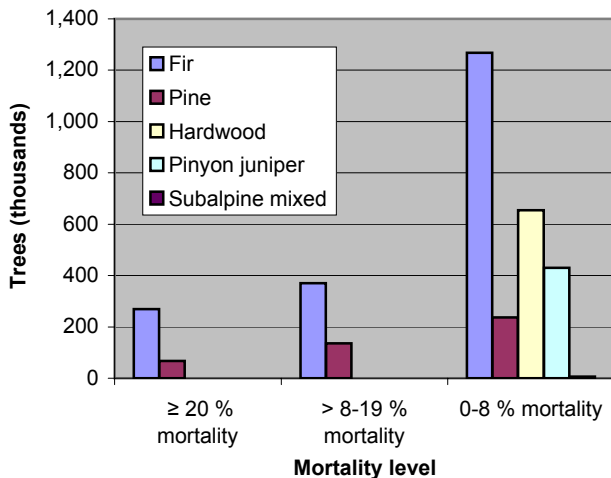
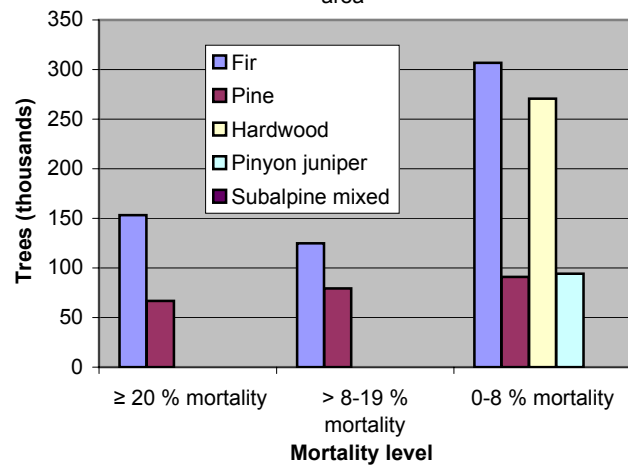


Chart A-7.1e.1 Number of dead trees by forest type and mortality level on federal land in four county area*



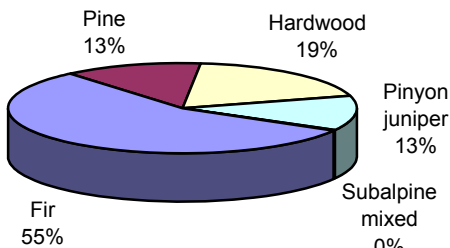
*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-7.1e.2 Number of dead trees by forest type and mortality level on non federal land in the four county area*



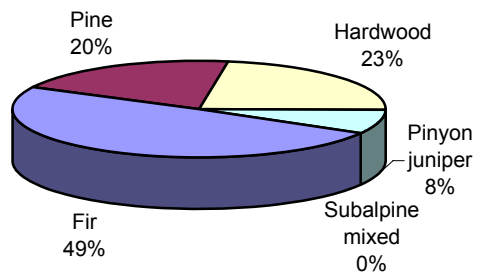
*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-7.1e.3 Number of dead trees by forest type on federal land in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-7.1e.4 Number of dead trees by forest type on non federal land in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

A-7.2 Tons of Dead Trees

Table A-7.2a San Bernardino county tons of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	126,325	240,795	646,027	1,013,147
	Pine	24,973	20,944	250,503	296,420
	Hardwood			48,528	48,528
	Pinyon juniper			50,217	50,217
	Subalpine mixed			20,890	20,890
	Total	151,298	261,739	1,016,165	1,429,202
Non federal	Fir	76,381	76,342	149,935	302,658
	Pine	20,526	6,001	58,606	85,133
	Hardwood			14,163	14,163
	Pinyon juniper			12,938	12,938
	Subalpine mixed			219	219
	Total	96,907	82,343	235,861	415,111
		248,205	344,082	1,252,026	1,844,313

Table A-7.2b San Diego county tons of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	1,623	3,207	11,955	16,785
	Pine	2,186	2,625	31,716	36,528
	Hardwood			4,256	4,256
	Total	3,809	5,832	47,928	57,569
Non federal	Fir	20,136	23,236	46,274	89,646
	Pine	12,036	10,009	71,125	93,170
	Hardwood			17,554	17,554
	Total	32,173	33,244	134,953	200,370
Grand total		35,982	39,076	182,880	257,939

Table A-7.2c Riverside county tons of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
	Fir	40,083	69,674	250,414	360,171
	Pine	4,058	2,913	23,271	30,242
	Hardwood			20,803	20,803
	Pinyon juniper			13,511	13,511
	Subalpine mixed			59	59
	Total	44,141	72,588	308,058	424,787
	Fir	18,986	33,486	155,389	207,861
	Pine	723	1,098	17,697	19,518
	Hardwood			3,345	3,345
	Pinyon juniper			4,433	4,433
	Subalpine mixed			2,587	2,587
	Total	19,709	34,584	183,452	237,744
		63,850	107,172	491,510	662,532

Table A-7.2d Los Angeles county tons of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	873	2,426	20,955	24,254
	Pine	137	146	3,069	3,353
	Hardwood			53	53
	Pinyon juniper			30	30
	Total	1,010	2,572	24,107	27,689
Non federal	Fir		130	4,603	4,733
	Pine			453	453
	Total		130	5,056	5,186
Grand total		1,010	2,702	29,163	32,875

Table A-7.2e All county tons of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	181,259	335,950	1,035,240	1,552,448
	Pine	32,479	27,590	330,015	390,084
	Hardwood			76,880	76,880
	Pinyon juniper			66,575	66,575
	Subalpine mixed			23,536	23,536
	Total	213,738	363,540	1,532,246	2,109,523
Non federal	Fir	103,150	113,345	250,312	466,807
	Pine	32,161	16,146	126,425	174,733
	Hardwood			31,822	31,822
	Pinyon juniper			14,554	14,554
	Subalpine mixed			219	219
	Total	135,311	129,491	423,333	688,135
Grand total	349,048	493,031	1,955,578	2,797,658	

*San Bernardino, San Diego, Riverside and Los Angeles counties

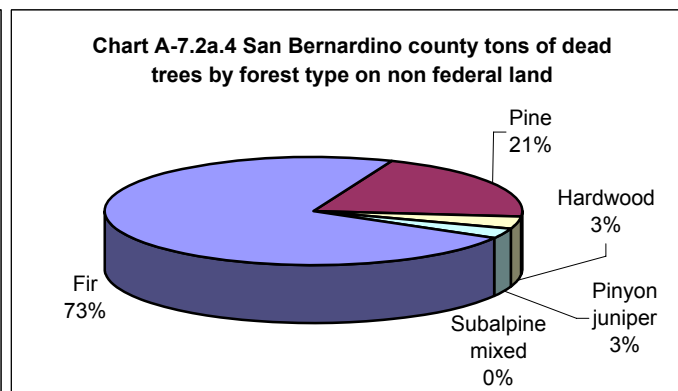
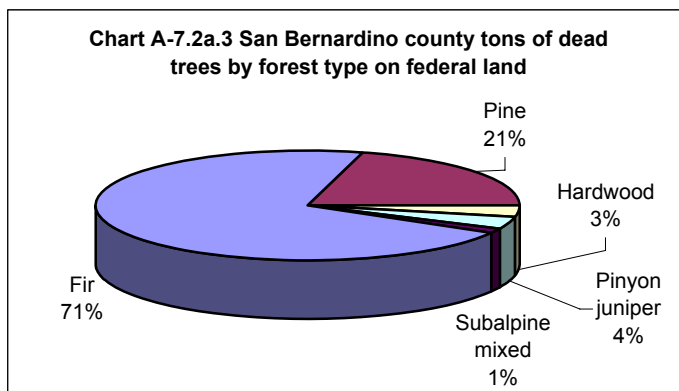
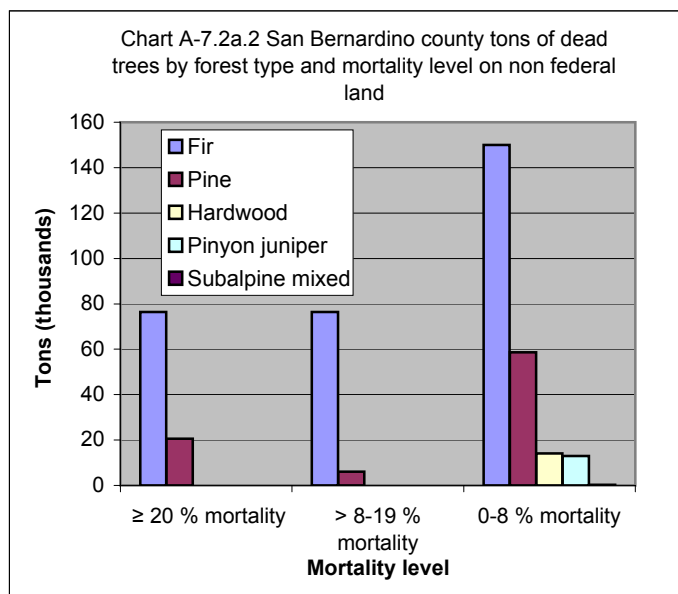
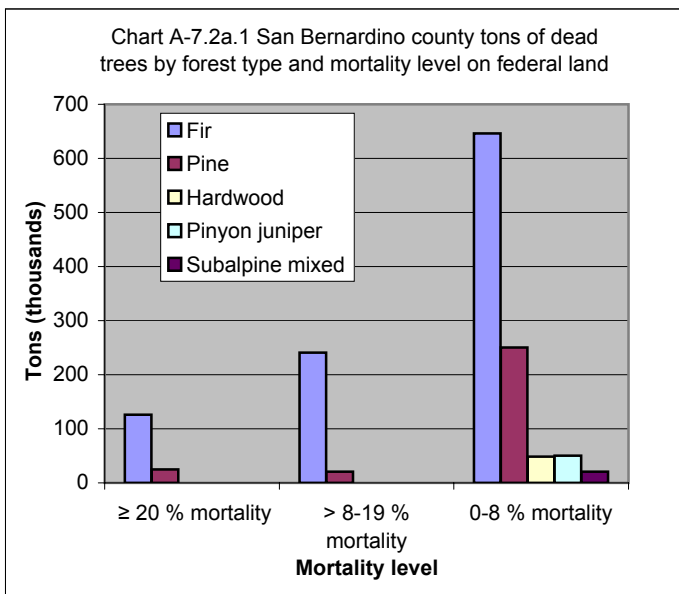


Chart A-7.2b.1 San Diego county tons of dead trees by forest type and mortality level on federal land

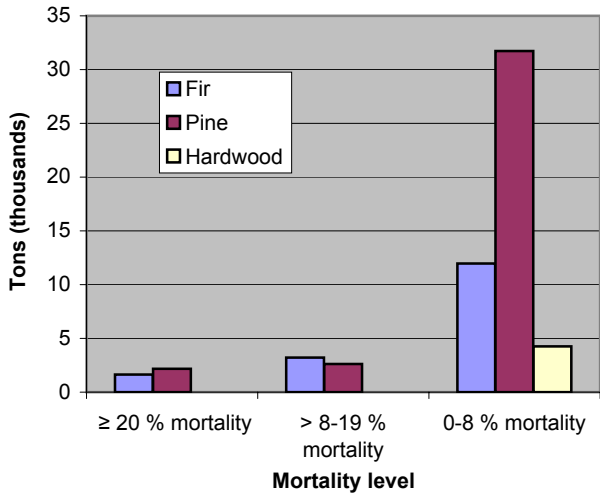


Chart A-7.2b.2 San Diego county tons of dead trees by forest type and mortality level on non federal land

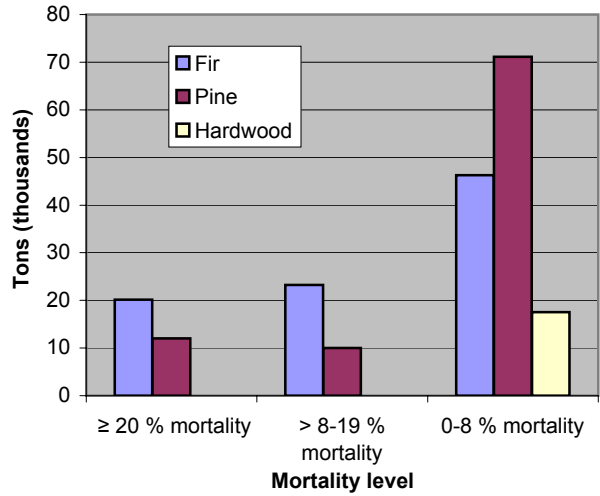


Chart A-7.2b.3 San Diego county tons of dead trees by forest type on federal land

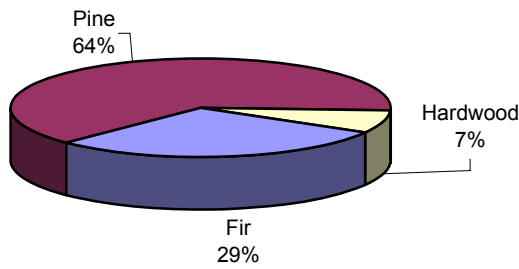


Chart A-7.2b.4 San Diego county tons of dead trees by forest type on non federal land

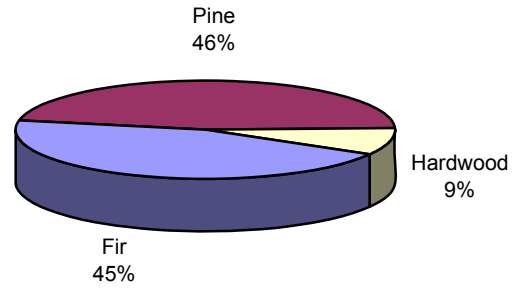


Chart A-7.2c.1 Riverside county tons of dead trees by forest type and mortality level on federal land

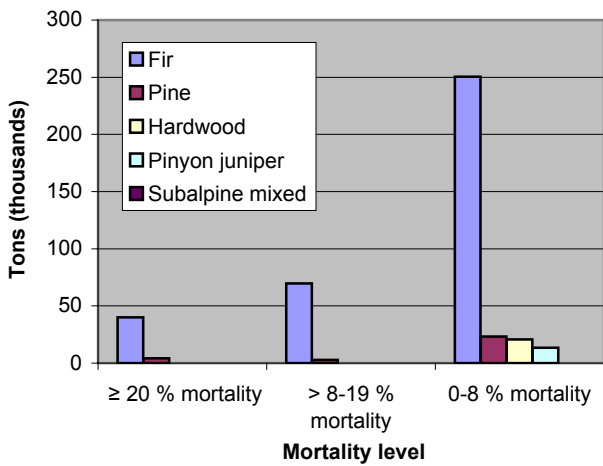


Chart A-7.2c.2 Riverside county tons of dead trees by forest type and mortality level on non federal land

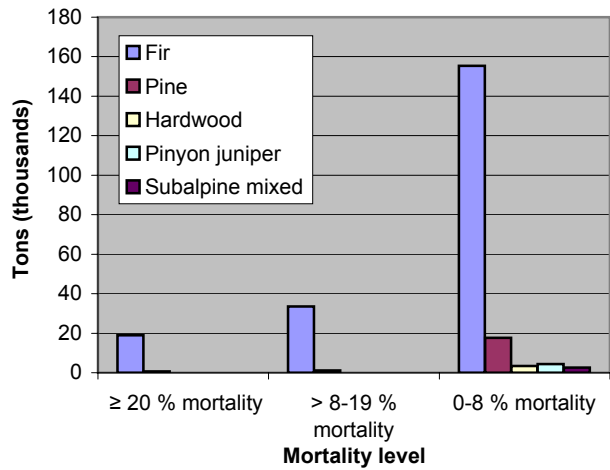


Chart A-7.2c.3 Riverside county tons of dead trees by forest type on federal land

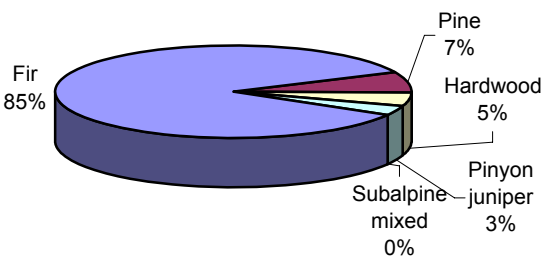
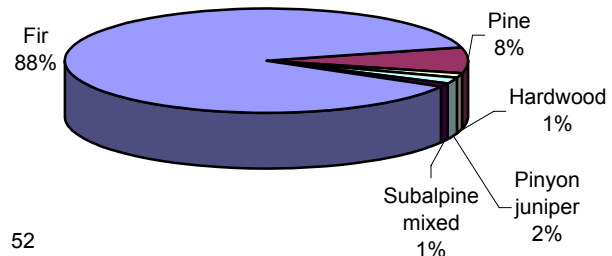
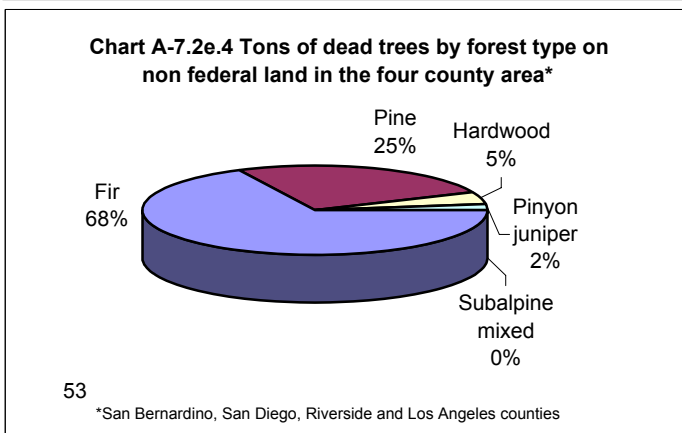
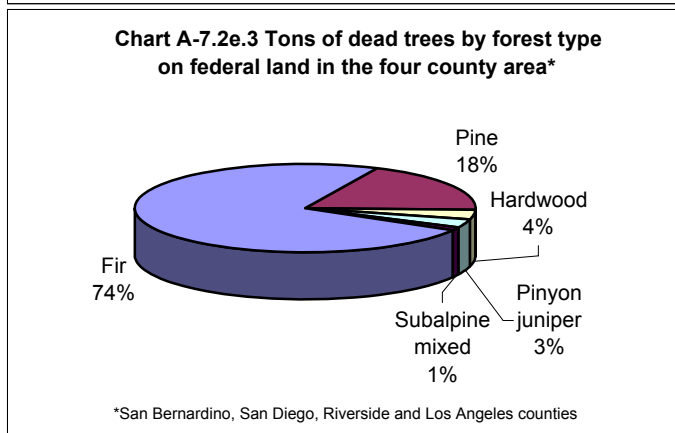
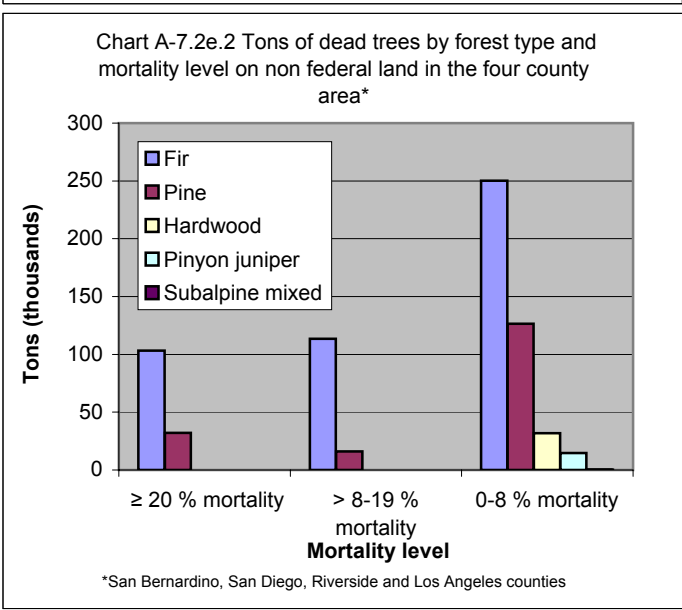
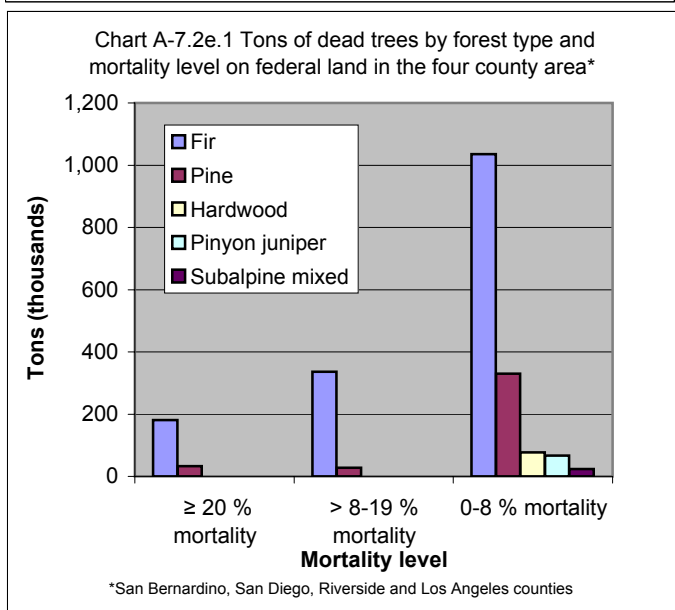
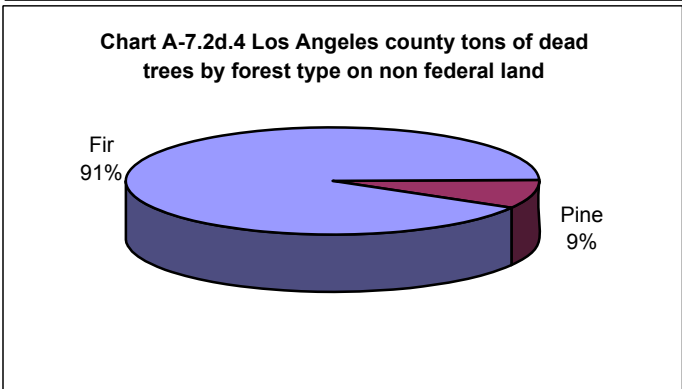
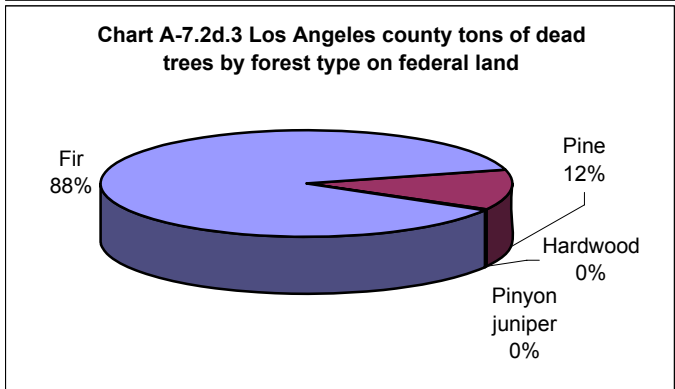
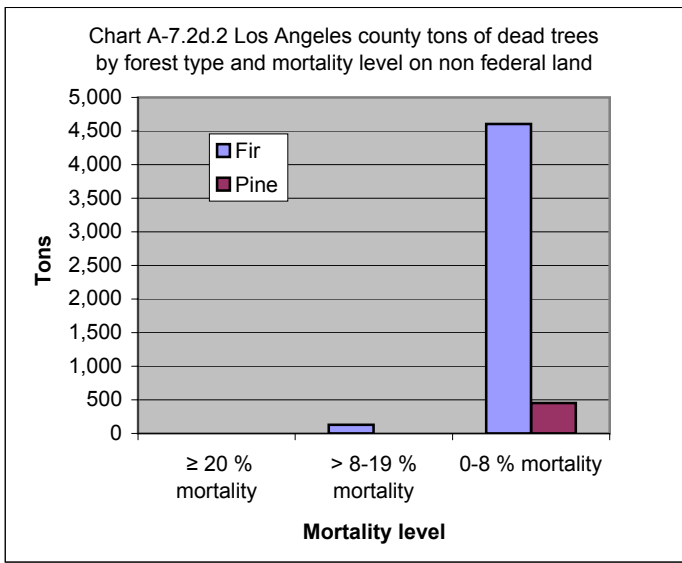
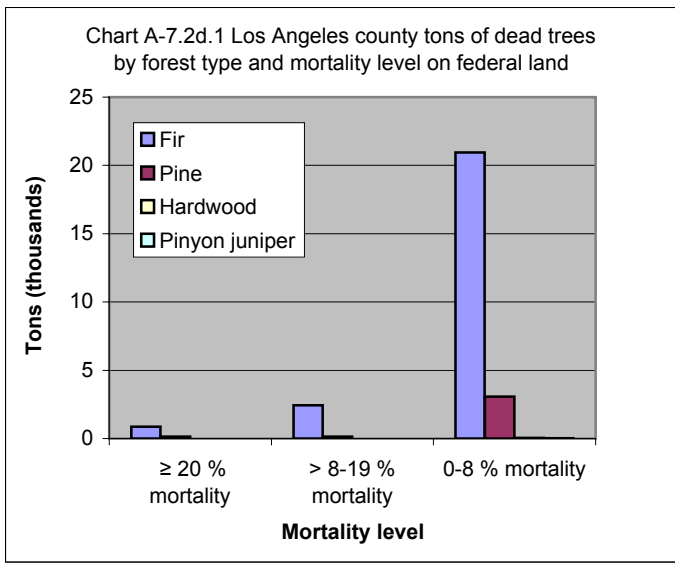


Chart A-7.2c.4 Riverside county tons of dead trees by forest type on non federal land





A-7.3 Acres of Dead Trees

Table A-7.3a San Bernardino county acres of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	6,750	17,737	51,578	76,066
	Pine	1,783	5,355	37,916	45,054
	Hardwood			21,386	21,386
	Pinyon juniper			50,304	50,304
	Subalpine mixed			8,544	8,544
	Total	8,534	23,092	169,728	201,353
Non federal	Fir	4,082	5,623	11,971	21,676
	Pine	1,466	1,534	8,871	11,871
	Hardwood			6,241	6,241
	Pinyon juniper			12,961	12,961
	Subalpine mixed			90	90
	Total	5,547	7,158	40,133	52,838
Grand total		14,081	30,249	209,861	254,192

Table A-7.3b San Diego county acres of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	87	236	954	1,277
	Pine	156	671	4,801	5,628
	Hardwood			1,876	1,876
	Total	243	907	7,631	8,781
Non federal	Fir	1,076	1,712	3,694	6,482
	Pine	860	2,559	10,765	14,184
	Hardwood			7,736	7,736
	Total	1,936	4,270	22,196	28,402
Grand total		2,178	5,178	29,827	37,183

Table A-7.3c Riverside county acres of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	2,142	5,132	19,993	27,267
	Pine	290	745	3,522	4,557
	Hardwood			9,168	9,168
	Pinyon juniper			13,535	13,535
	Subalpine mixed			24	24
	Total	2,432	5,877	46,242	54,551
Non federal	Fir	1,015	2,467	12,406	15,887
	Pine	52	281	2,679	3,011
	Hardwood			1,474	1,474
	Pinyon juniper			4,441	4,441
	Subalpine mixed			1,058	1,058
	Total	1,066	2,747	22,058	25,871
Grand total		3,498	8,624	68,300	80,422

Table A-7.3d Los Angeles county acres of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	47	179	1,673	1,898
	Pine	10	37	465	512
	Hardwood			23	23
	Pinyon juniper			30	30
	Total	56	216	2,191	2,463
Non federal	Fir		10	367	377
	Pine			69	69
	Total		10	436	446
Grand total		56	226	2,627	2,909

Table A-7.3e Acres of dead trees by forest type, owner and mortality level in the four county area*

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	9,686	24,746	82,653	117,085
	Pine	2,319	7,054	49,951	59,324
	Hardwood			33,880	33,880
	Pinyon juniper			66,691	66,691
	Subalpine mixed			9,626	9,626
	Total	12,005	31,800	242,801	286,606
Non federal	Fir	5,512	8,349	19,985	33,846
	Pine	2,297	4,128	19,136	25,561
	Hardwood			14,024	14,024
	Pinyon juniper			14,580	14,580
	Subalpine mixed			90	90
	Total	7,809	12,477	67,813	88,099
Grand total		19,814	44,277	310,614	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

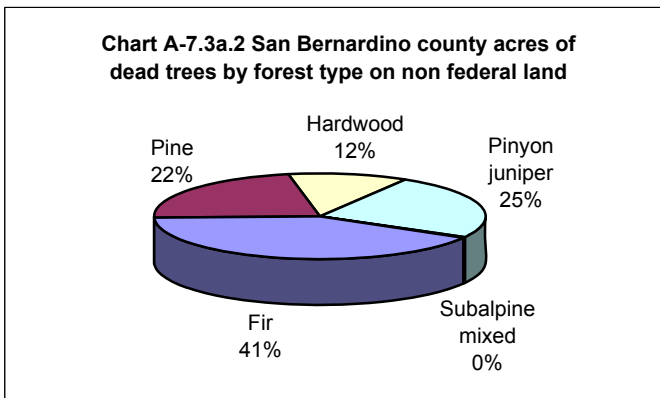
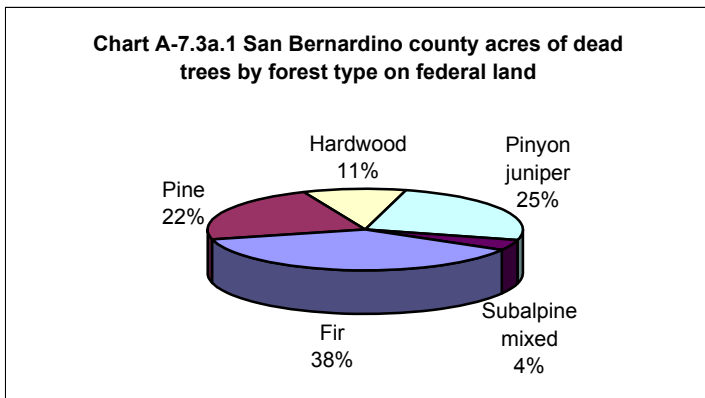
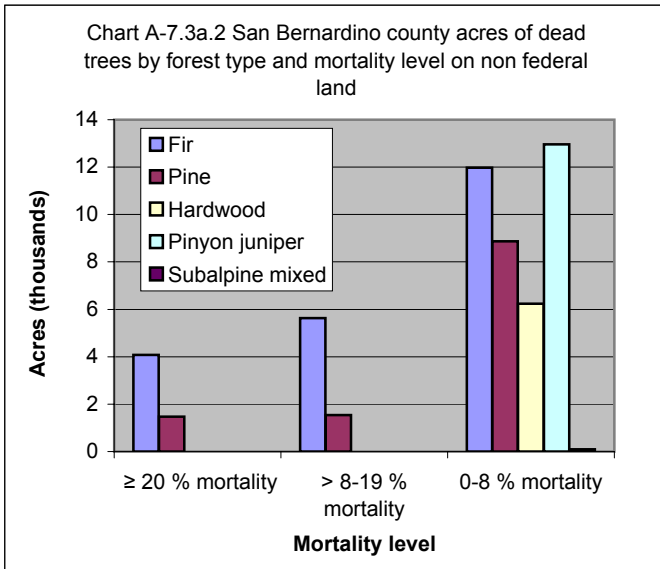
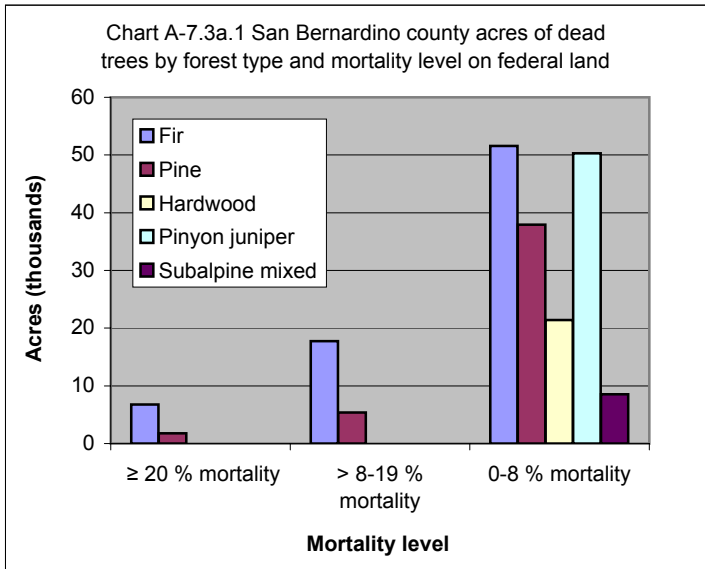


Table A-7.3b.1 San Diego county acres of dead trees by forest type and mortality level on federal land

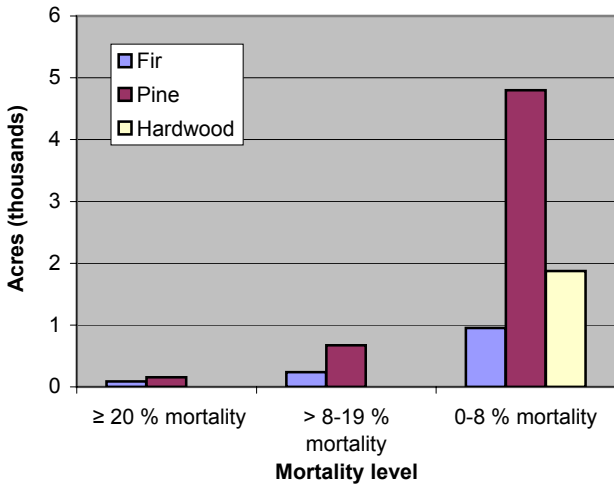


Table A-7.3b.2 San Diego county acres of dead trees by forest type and mortality level on non federal land

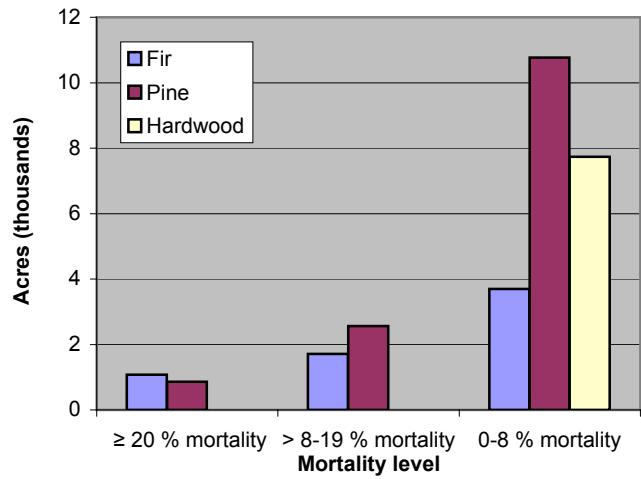


Chart A-7.3b.1 San Diego county acres of dead trees by forest type on federal land

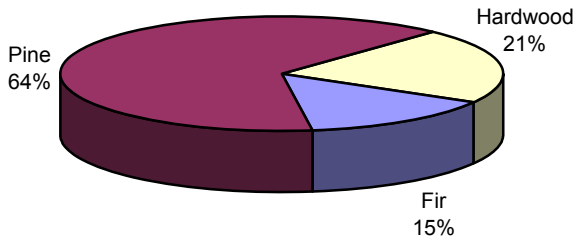


Chart A-7.3b.2 San Diego county acres of dead trees by forest type on non federal land

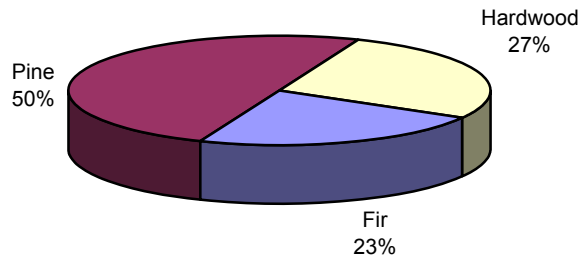


Table A-7.3c.1 Riverside county acres of dead trees by forest type and mortality level on federal land

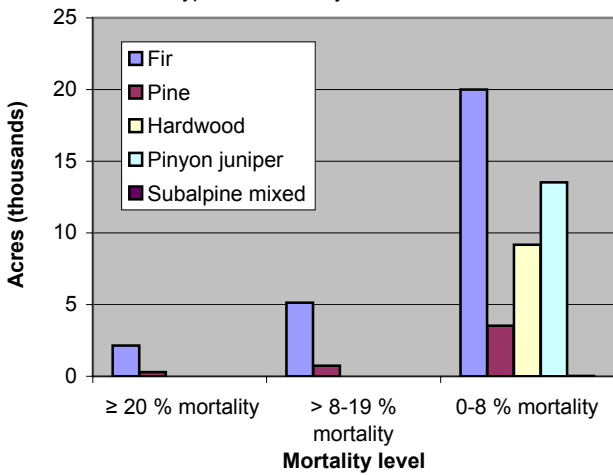


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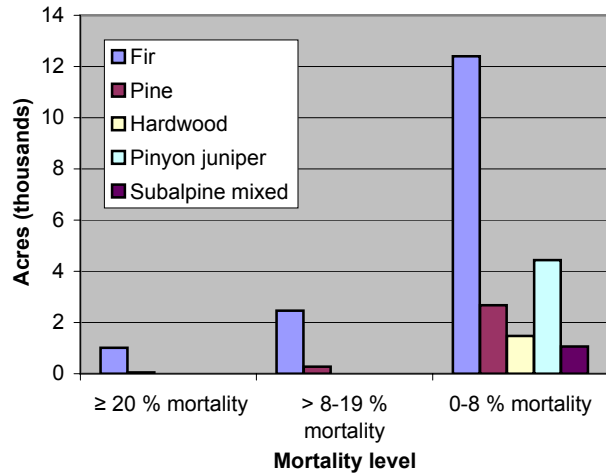


Chart A-7.3c.1 Riverside county acres of dead trees by forest type on federal land

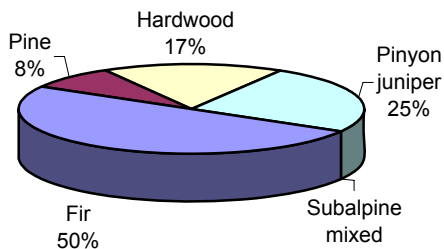


Chart A-7.3c.2 Riverside county acres of dead trees by forest type on non federal land

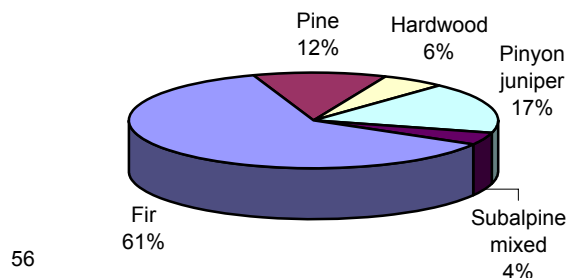


Table A-7.3d.1 Los Angeles county acres of dead trees by forest type and mortality level on federal land

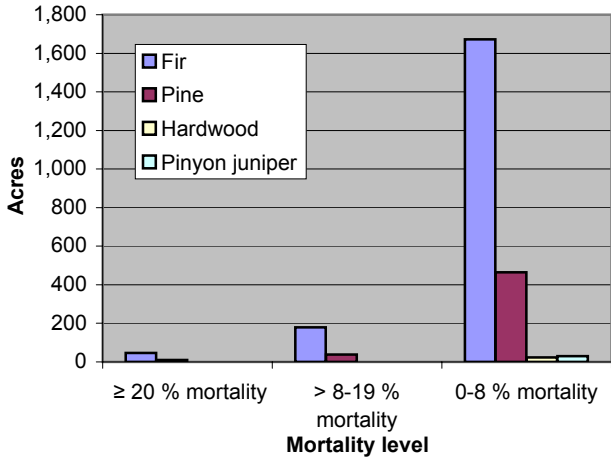


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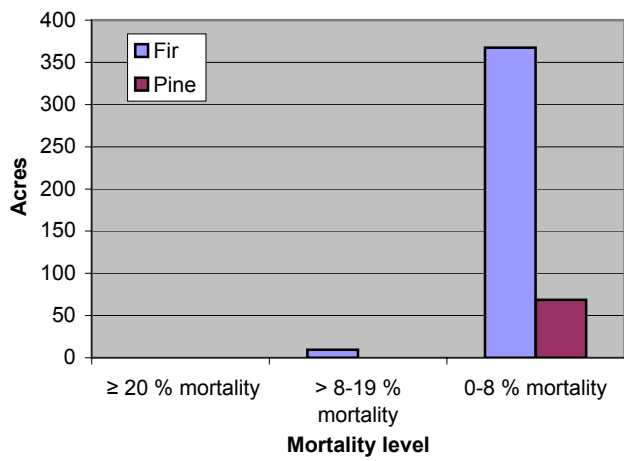


Chart A-7.3d.1 Los Angeles county acres of dead trees by forest type on federal land

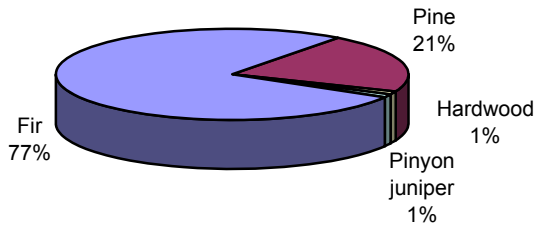


Chart A-7.3d.2 Los Angeles county acres of dead trees by forest type on non federal land

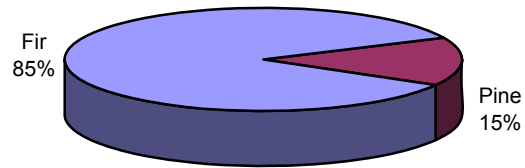
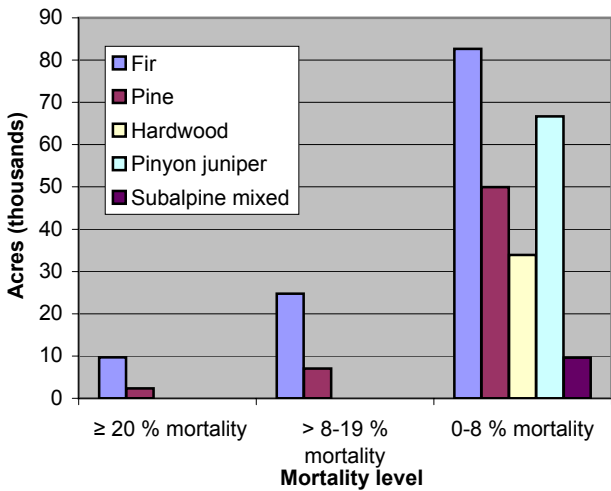
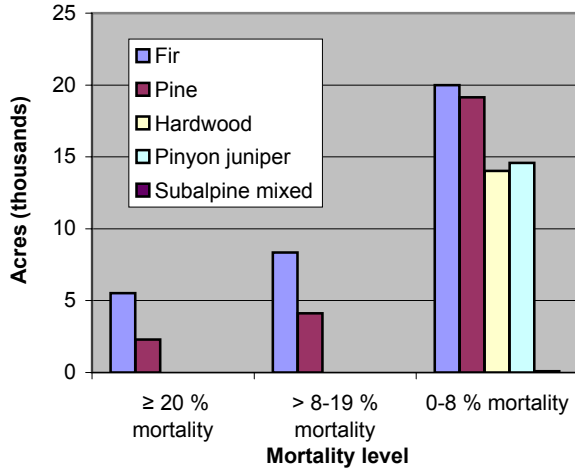


Table A-7.3e.1 Acres of dead trees by forest type and mortality level on federal land in the four county area*



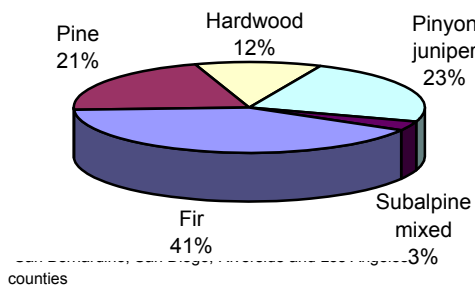
*San Bernardino, San Diego, Riverside and Los Angeles counties

Table A-7.3e.2 Acres of dead trees by forest type and mortality level on non federal land in the four county area*



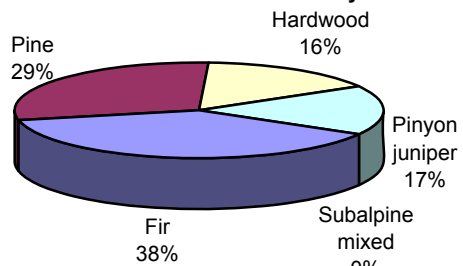
*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-7.3e.1 Acres of dead trees by forest type on federal land in the four county area*



counties

Chart A-7.3e.2 Acres of dead trees by forest type on non federal land in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

A-7.4 Cubic Feet of Dead Trees

Table A-7.4a San Bernardino county cubic feet of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	6,288,064	12,483,149	32,724,831	51,496,044
	Pine	1,219,835	936,348	10,592,123	12,748,306
	Hardwood			2,008,704	2,008,704
	Pinyon juniper			2,541,361	2,541,361
	Subalpine mixed			1,109,784	1,109,784
	Total	7,507,899	13,419,497	48,976,803	69,904,199
Non federal	Fir	3,801,993	3,957,660	7,595,036	15,354,689
	Pine	1,002,641	268,295	2,478,050	3,748,986
	Hardwood			586,236	586,236
	Pinyon juniper			654,782	654,782
	Subalpine mixed			11,652	11,652
	Total	4,804,634	4,225,954	11,325,755	20,356,344
Grand total		12,312,533	17,645,452	60,302,558	90,260,543

Table A-7.4b San Diego county cubic feet of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	80,794	166,242	605,581	852,617
	Pine	106,788	117,361	1,341,076	1,565,225
	Hardwood			176,184	176,184
	Total	187,582	283,603	2,122,841	2,594,026
Non federal	Fir	1,002,324	1,204,566	2,344,028	4,550,917
	Pine	587,945	447,453	3,007,396	4,042,794
	Hardwood			726,605	726,605
	Total	1,590,268	1,652,019	6,078,029	9,320,316
Grand total		1,777,850	1,935,622	8,200,870	11,914,342

Table A-7.4c Riverside county cubic feet of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	1,995,210	3,612,027	12,684,827	18,292,064
	Pine	198,230	130,246	983,975	1,312,450
	Hardwood			861,094	861,094
	Pinyon juniper			683,776	683,776
	Subalpine mixed			3,136	3,136
	Total	2,193,439	3,742,273	15,216,808	21,152,520
Non federal	Fir	945,055	1,735,971	7,871,331	10,552,356
	Pine	35,326	49,073	748,277	832,675
	Hardwood			138,465	138,465
	Pinyon juniper			224,365	224,365
	Subalpine mixed			137,427	137,427
	Total	980,380	1,785,043	9,119,866	11,885,289
Grand total		3,173,819	5,527,316	24,336,674	33,037,809

Table A-7.4d Los Angeles county cubic feet of dead trees by forest type, owner and mortality level

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	43,458	125,773	1,061,484	1,230,715
	Pine	6,710	6,529	129,784	143,023
	Hardwood			2,175	2,175
	Pinyon juniper			1,507	1,507
	Total	50,168	132,302	1,194,949	1,377,420
Non federal	Fir		6,730	233,164	239,895
	Pine			19,156	19,156
	Total		6,730	252,320	259,051
Grand total		50,168	139,032	1,447,270	1,636,470

Table A-7.4e Cubic feet of dead trees by forest type, owner and mortality level in the four county area*

Owner	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Fir	9,022,454	17,416,141	52,440,597	78,879,192
	Pine	1,586,495	1,233,459	13,954,156	16,774,111
	Hardwood			3,182,265	3,182,265
	Pinyon juniper			3,369,230	3,369,230
	Subalpine mixed			1,250,348	1,250,348
	Total	10,608,950	18,649,600	74,196,596	103,455,146
Non federal	Fir	5,134,442	5,875,977	12,679,685	23,690,104
	Pine	1,570,979	721,845	5,345,680	7,638,504
	Hardwood			1,317,197	1,317,197
	Pinyon juniper			736,561	736,561
	Subalpine mixed			11,652	11,652
	Total	6,705,421	6,597,822	20,090,775	33,394,018
Grand total		17,314,371	25,247,422	94,287,371	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties

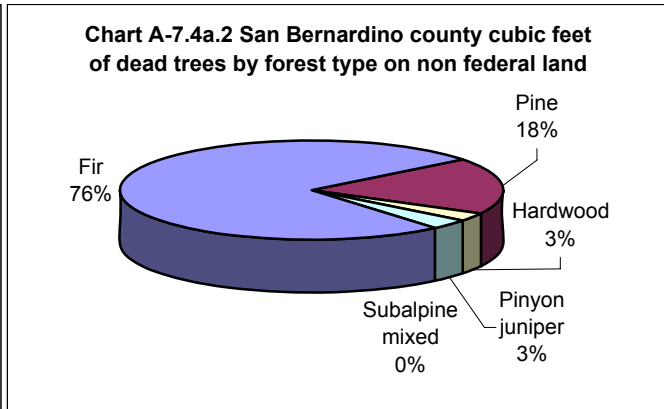
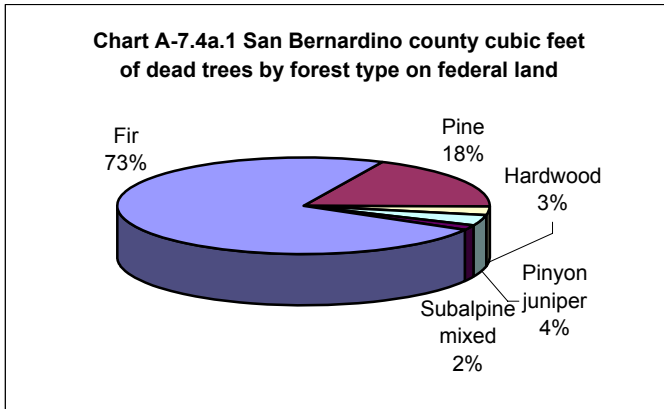
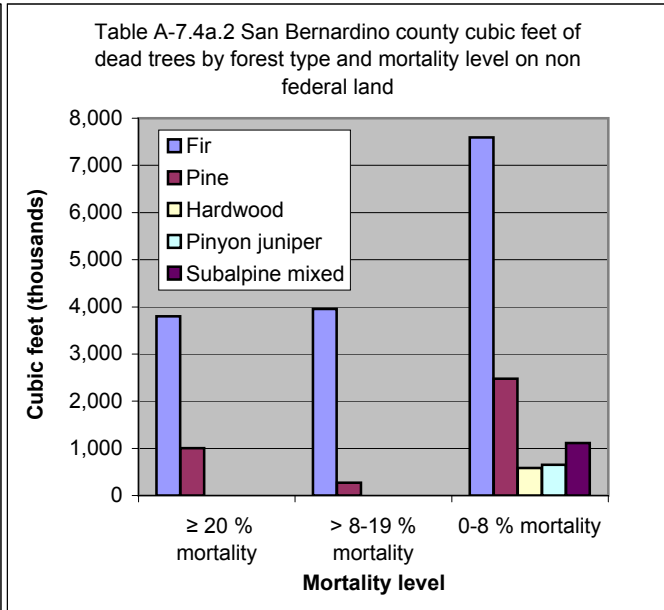
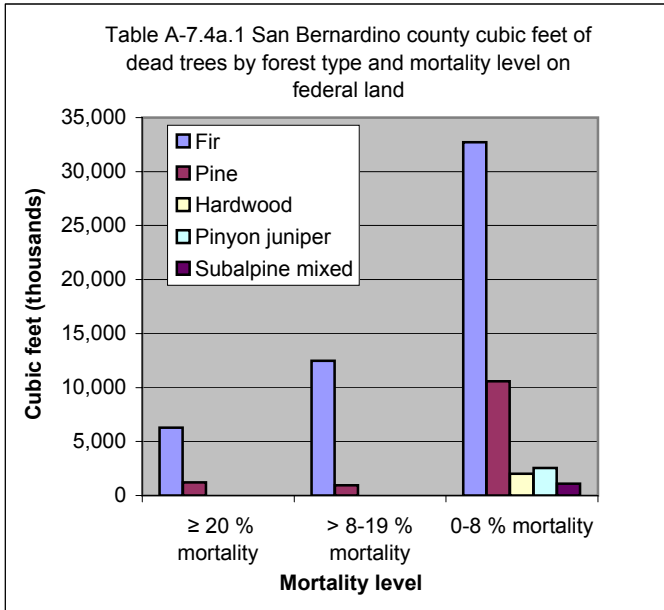


Table A-7.4b.1 San Diego county cubic feet of dead trees by forest type and mortality level on federal land

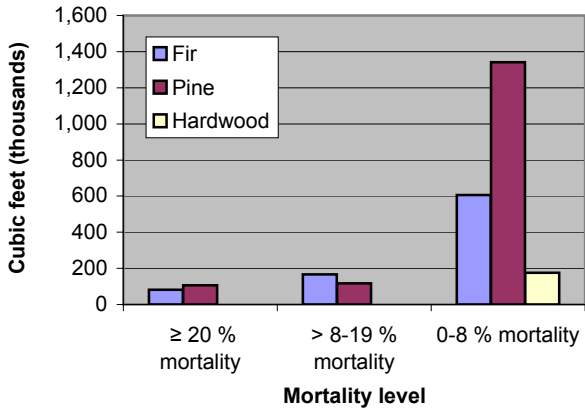


Table A-7.4b.2 San Diego county cubic feet of dead trees by forest type and mortality level on non federal land

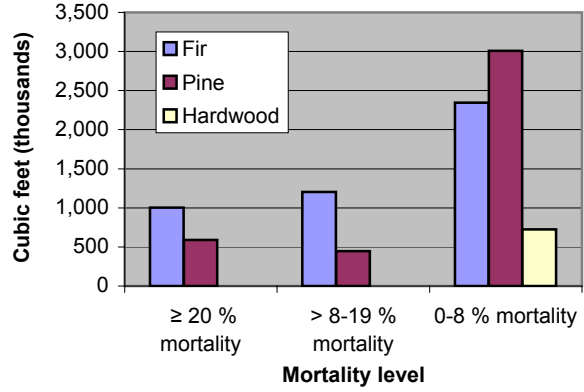


Chart A-7.4b.1 San Diego county cubic feet of dead trees by forest type on federal land

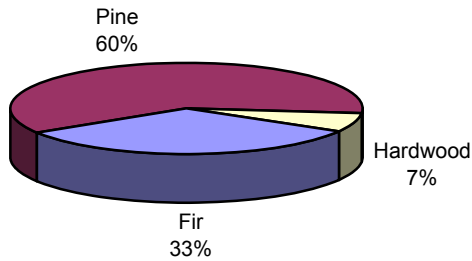


Chart A-7.4b.2 San Diego county cubic feet of dead trees by forest type on non federal land

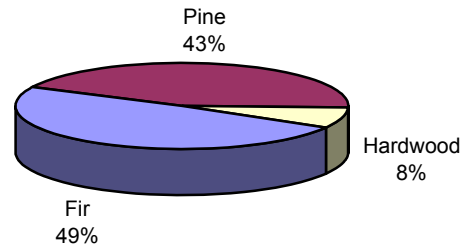


Table A-7.4c.1 Riverside county cubic feet of dead trees by forest type and mortality level on federal land

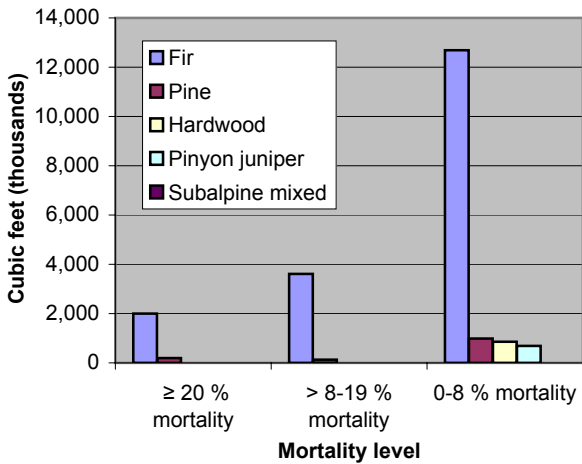
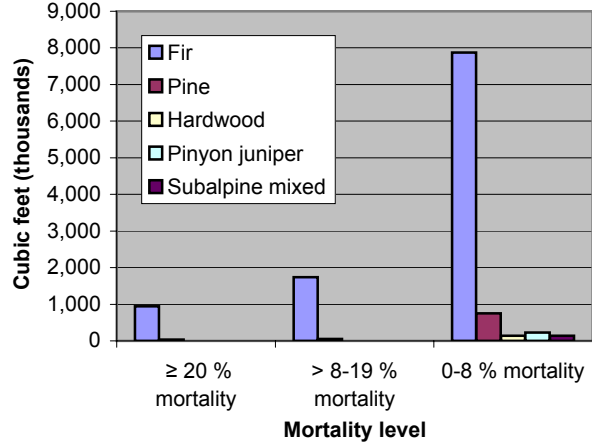
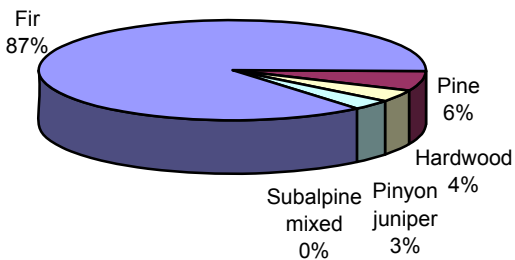


Table A-7.4c.2 Riverside county cubic feet of dead trees by forest type and mortality level on non federal land



Riverside county cubic feet of dead trees by forest type on federal land



Riverside county cubic feet of dead trees by forest type on non federal land

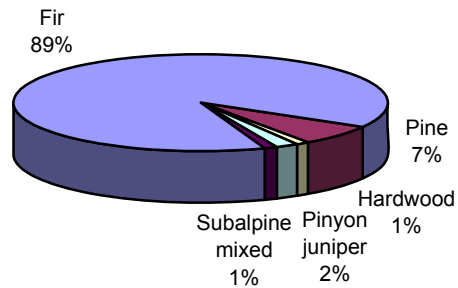


Table A-7.4d.1 Los Angeles county cubic feet of dead trees by forest type and mortality level on federal land

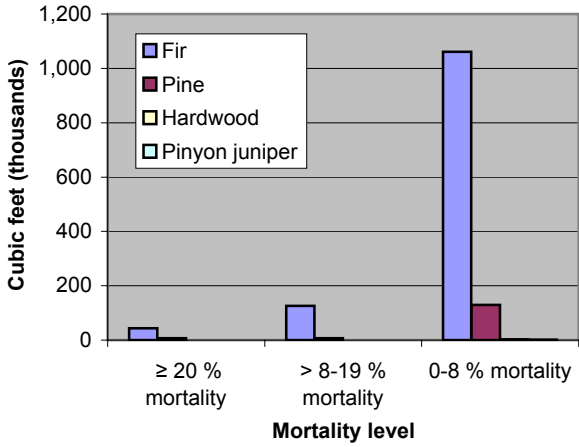


Table A-7.4d.2 Los Angeles county cubic feet of dead trees by forest type and mortality level on non federal land

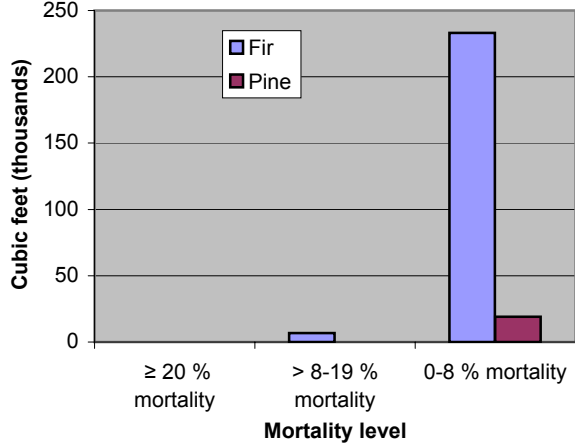


Chart A-7.4d.1 Los Angeles county cubic feet of dead trees by forest type on federal land

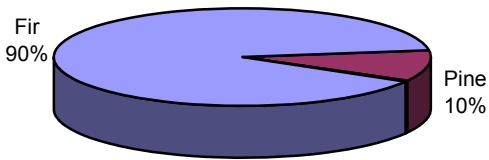


Chart A-7.4d.2 Los Angeles county cubic feet of dead trees by forest type on non federal land

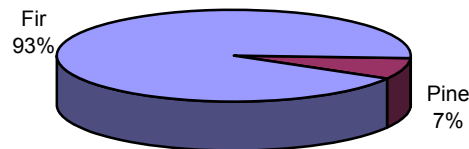
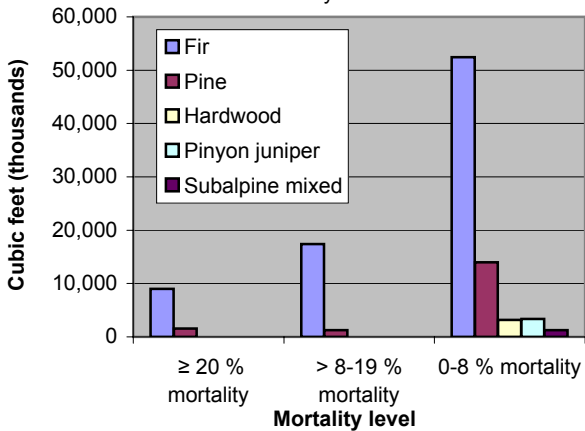
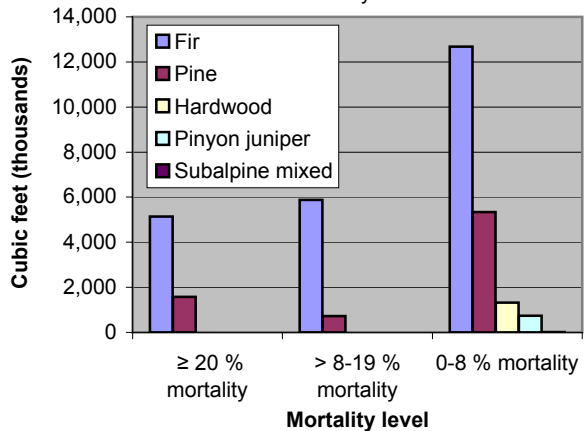


Table A-7.4e.1 Cubic feet of dead trees by forest type and mortality level on federal land in the four county area*



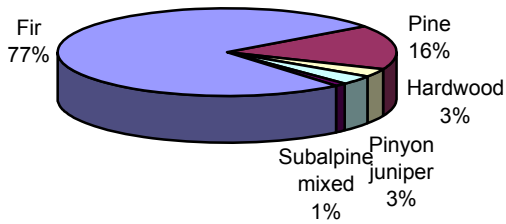
*San Bernardino, San Diego, Riverside and Los Angeles counties

Table A-7.4e.2 Cubic feet of dead trees by forest type and mortality level on non federal land in the four county area*



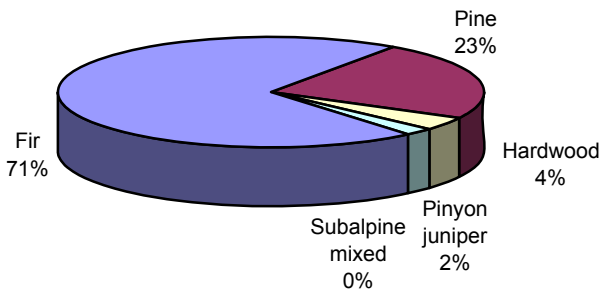
*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-7.4a.1 Cubic feet of dead trees by forest type on federal land in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-7.4e.2 Cubic feet of dead trees by forest type on non federal land in the four county area*



61 *San Bernardino, San Diego, Riverside and Los Angeles counties

A-8. Forest Land Cover Change in Acres by County and Owner

Table A-8 Forest Land Cover Change in Acres by County and Owner (acres)

County	Forest Land Changes	Federal	Non-Federal	Grand Total
Los Angeles	From MIX to SHB	32.35	3.85	36.19
	Los Angeles Total Acres Changed	32.35	3.85	36.19
Riverside	From CON to SHB	8.82		8.82
	From MIX to HDW	674.61	19.66	694.26
	From MIX to SHB	2,516.25	900.12	3,416.37
	Riverside Total Acres Changed	3,199.68	919.78	4,119.46
San Bernardino	From CON to SHB	1,291.16	362.92	1,654.08
	From MIX to HDW	5,695.81	1,450.49	7,146.30
	From MIX to SHB	513.62	53.11	566.73
	San Bernardino Total Acres Changed	7,500.59	1,866.52	9,367.11
San Diego	From CON to SHB	69.69	59.82	129.52
	From MIX to HDW	109.79	239.86	349.65
	From MIX to SHB	36.15	71.43	107.58
	San Diego Total Acres Changed	215.63	371.12	586.75
Grand Total for All Counties		10,948.25	3,161.27	14,109.51

"CON" stands for Conifer forest, "HDW" stands for Hardwood forest, "MIX" stands for Mixed Conifer and Hardwood forest, and "SHB" stands for Shrub dominated land cover

A-9. Owner and Risk

A-9.1 Number of Living Trees

Table A-9.1a San Bernardino county number of living trees by owner at risk in 2004

Owner	Trees		
	At risk	Not at risk	Total
Federal	6,970,823	14,292,135	21,262,958
Non Federal	1,319,025	4,495,761	5,814,786
Grand Total	8,289,848	18,787,896	27,077,744

Table A-9.1b San Diego county number of living trees by owner at risk in 2004

Owner	Trees		
	At risk	Not at risk	Total
Federal	416,607	498,452	915,060
Non Federal	495,319	2,707,155	3,202,474
Grand Total	911,927	3,205,607	4,117,534

Table A-9.1c Riverside county number of living trees by owner at risk in 2004

Owner	Trees		
	At risk	Not at risk	Total
Federal	443,289	5,789,575	6,232,864
Non Federal	206,066	2,635,845	2,841,910
Grand Total	649,355	8,425,420	9,074,774

Table A-9.1d Los Angeles county number of living trees by owner at risk in 2004

Owner	Trees		
	At risk	Not at risk	Total
Federal	230,943	43,780	274,723
Non Federal	47,058	2,981	50,040
Grand Total	278,002	46,761	324,763

Table A-9.1e Number of living trees by owner at risk in 2004 in the four county area*

Owner	Trees		
	At risk	Not at risk	Total
Federal	8,061,663	20,623,942	28,685,605
Non Federal	2,067,468	9,841,742	11,909,210
Grand Total	10,129,131	30,465,684	40,594,815

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-9.2 Tons of Living Trees

Table A-9.2a San Bernardino county tons of living trees by owner at risk in 2004

Owner	Tons		
	At risk	Not at risk	Total
Federal	2,187,193	4,814,590	7,001,783
Non Federal	436,349	1,368,503	1,804,852
Grand Total	2,623,542	6,183,092	8,806,634

Table A-9.2b San Diego county tons of living trees by owner at risk in 2004

Owner	Tons		
	At risk	Not at risk	Total
Federal	144,555	133,694	278,249
Non Federal	155,754	768,635	924,388
Grand Total	300,309	902,329	1,202,638

Table A-9.2c Riverside county tons of living trees by owner at risk in 2004

Owner	Tons		
	At risk	Not at risk	Total
Federal	185,628	1,823,226	2,008,854
Non Federal	72,635	1,026,657	1,099,292
Grand Total	258,264	2,849,883	3,108,147

Table A-9.2d Los Angeles county tons of living trees by owner at risk in 2004

Owner	Tons		
	At risk	Not at risk	Total
Federal	102,920	19,083	122,003
Non Federal	21,968	1,380	23,348
Grand Total	124,887	20,463	145,351

Table A-9.2e Tons of living trees by owner at risk in 2004 in the four county area*

Owner	Tons		
	At risk	Not at risk	Total
Federal	2,620,295	6,790,594	9,410,889
Non Federal	686,706	3,165,174	3,851,880
Grand Total	3,307,001	9,955,768	13,262,769

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-9.2a San Bernardino county tons of living trees by owner at risk in 2004

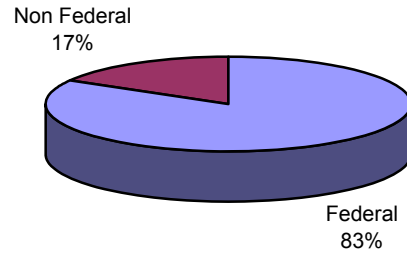


Chart A-9.2b San Diego county tons of living trees by owner at risk in 2004

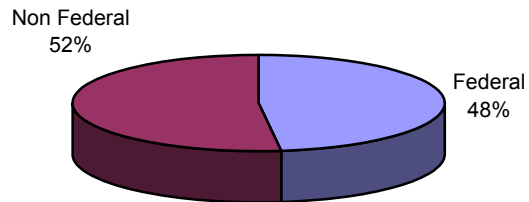


Chart A-9.2c Riverside county tons of living trees by owner at risk in 2004

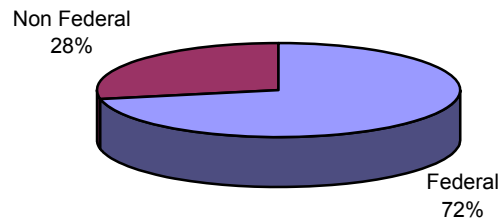


Chart A-9.2d Los Angeles county tons of living trees by owner at risk in 2004

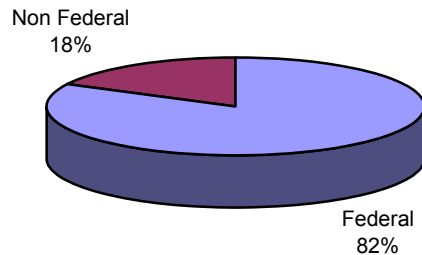
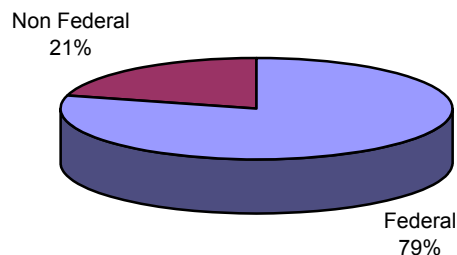


Chart A-9.2e Tons of living trees by owner at risk in 2004 in the four county area*



A-9.3 Acres of Living Trees

Table A-9.3a San Bernardino county acres of living trees by owner at risk in 2004

Owner	Acres		
	At risk	Not at risk	Total
Federal	69,391	131,962	201,353
Non Federal	13,599	39,239	52,838
Grand Total	82,991	171,201	254,192

Table A-9.3b San Diego county acres of living trees by owner at risk in 2004

Owner	Acres		
	At risk	Not at risk	Total
Federal	4,481	4,300	8,781
Non Federal	4,512	23,890	28,402
Grand Total	8,992	28,190	37,183

Table A-9.3c Riverside county acres of living trees by owner at risk in 2004

Owner	Acres		
	At risk	Not at risk	Total
Federal	3,891	50,660	54,551
Non Federal	1,998	23,874	25,871
Grand Total	5,889	74,533	80,422

Table A-9.3d Los Angeles county acres of living trees by owner at risk in 2004

Owner	Acres		
	At risk	Not at risk	Total
Federal	2,070	393	2,463
Non Federal	418	28	446
Grand Total	2,488	420	2,909

Table A-9.3e Acres of living trees by owner at risk in 2004 in the four county area*

Owner	Acres		
	At risk	Not at risk	Total
Federal	79,834	187,315	267,148
Non Federal	20,527	87,030	107,557
Grand Total	100,360	274,345	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-9.4 Cubic Feet of Living Trees

Table A-9.4a San Bernardino county cubic feet of living trees by owner at risk in 2004

Owner	Cubic feet		
	At risk	Not at risk	Total
Federal	99,472,092	216,726,278	316,198,371
Non Federal	19,388,864	60,820,038	80,208,902
Grand Total	118,860,956	277,546,316	396,407,272

Table A-9.4b San Diego county cubic feet of living trees by owner at risk in 2004

Owner	Cubic feet		
	At risk	Not at risk	Total
Federal	6,235,487	5,528,450	11,763,937
Non Federal	6,716,482	32,253,440	38,969,922
Grand Total	12,951,968	37,781,890	50,733,859

Table A-9.4c Riverside county cubic feet of living trees by owner at risk in 2004

Owner	Cubic feet		
	At risk	Not at risk	Total
Federal	8,577,158	81,972,991	90,550,149
Non Federal	3,345,111	47,321,466	50,666,576
Grand Total	11,922,269	129,294,456	141,216,726

Table 9.4d Los Angeles county cubic feet of living trees by owner at risk in 2004

Owner	Cubic feet		
	At risk	Not at risk	Total
Federal	4,758,873	879,988	5,638,860
Non Federal	1,024,955	63,837	1,088,792
Grand Total	5,783,828	943,825	6,727,652

Table 9.4e Cubic feet of living trees by owner at risk in 2004 in the four county area*

Owner	Cubic feet		
	At risk	Not at risk	Total
Federal	119,043,610	305,107,707	424,151,317
Non Federal	30,475,412	140,458,780	170,934,192
Grand Total	149,519,022	445,566,488	595,085,509

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-9.4a San Bernardino county cubic feet of living trees by owner at risk in 2004

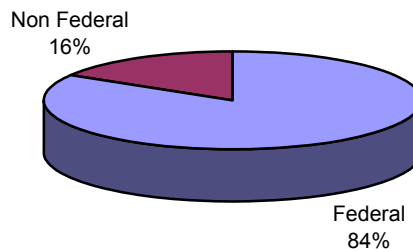


Chart A-9.4b San Diego county cubic feet of living trees by owner at risk in 2004

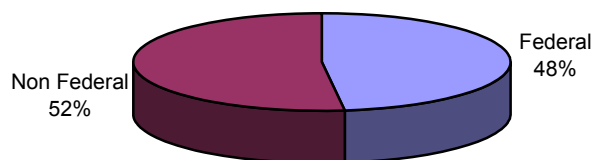


Chart A-9.4c Riverside county cubic feet of living trees by owner at risk in 2004

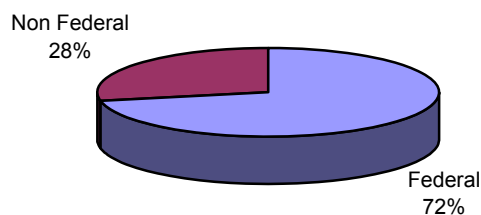


Chart A-9.4d Los Angeles county cubic feet of living trees by owner at risk in 2004

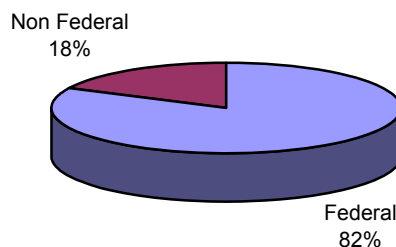
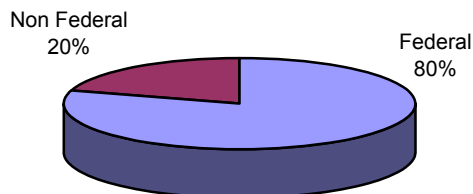


Chart A-9.4e Cubic feet of living trees by owner at risk in 2004 in the four county area*



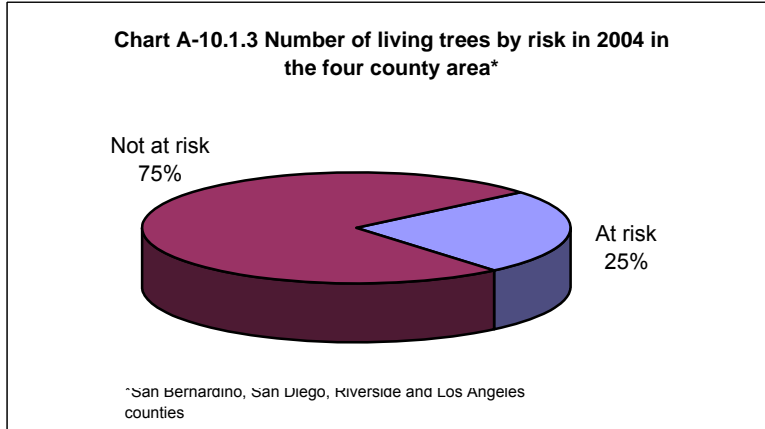
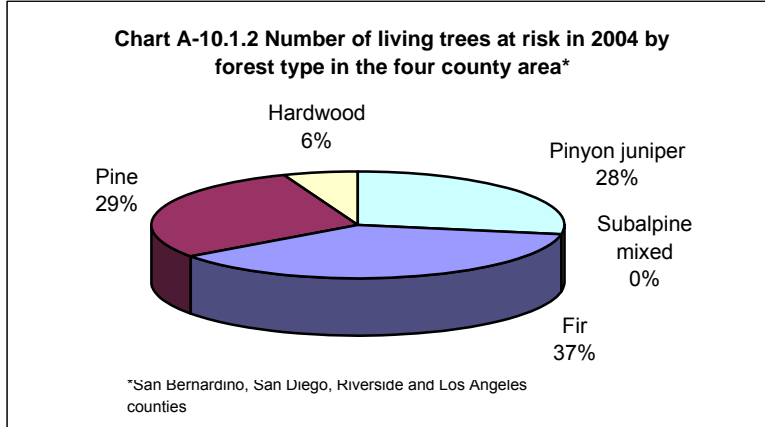
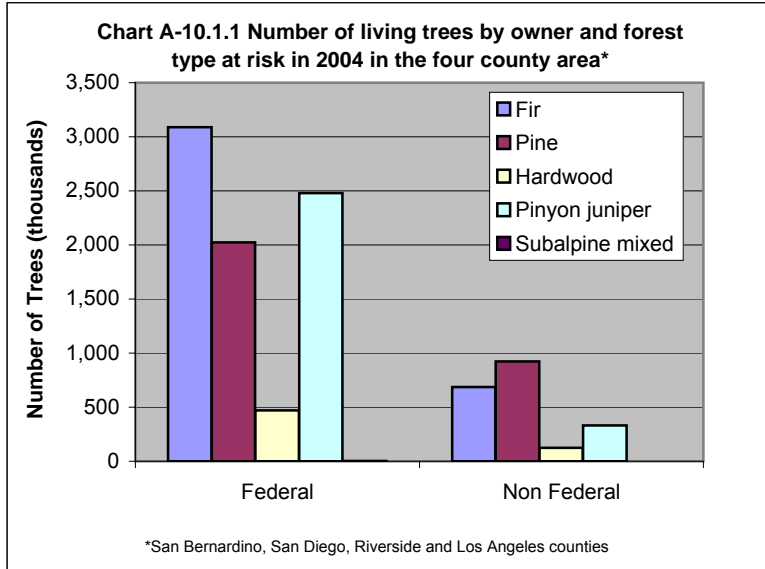
A-10. Owner, Forest Type and Risk

A-10.1 Number of Living Trees

Table A-10.1 Number of living trees by owner, forest type at risk in 2004 in the four county area*

Measure	Forest type	Federal			Non Federal			Grand total		
		At risk	Not at risk	Total	At risk	Not at risk	Total	At risk	Not at risk	Total
Trees	Fir	3,087,347	9,683,568	12,770,915	687,021	4,748,981	5,436,003	3,774,369	14,432,549	18,206,918
	Pine	2,023,789	2,927,880	4,951,668	922,161	1,706,288	2,628,449	2,945,950	4,634,168	7,580,117
	Hardwood	469,444	4,067,814	4,537,258	125,546	2,034,761	2,160,306	594,990	6,102,575	6,697,565
	Pinyon juniper	2,478,613	3,468,186	5,946,799	331,774	1,288,519	1,620,294	2,810,387	4,756,706	7,567,093
	Subalpine mixed	2,470	476,494	478,963	966	63,193	64,159	3,436	539,687	543,122
	Total	8,061,663	20,623,942	28,685,605	2,067,468	9,841,742	11,909,210	10,129,131	30,465,684	40,594,815

*San Bernardino, San Diego, Riverside and Los Angeles counties

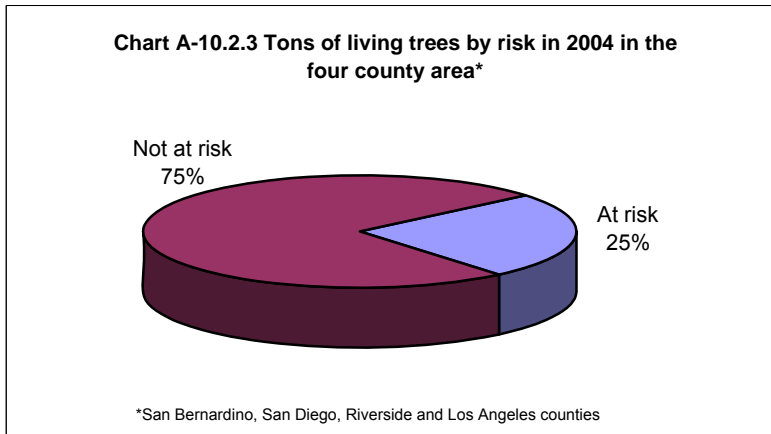
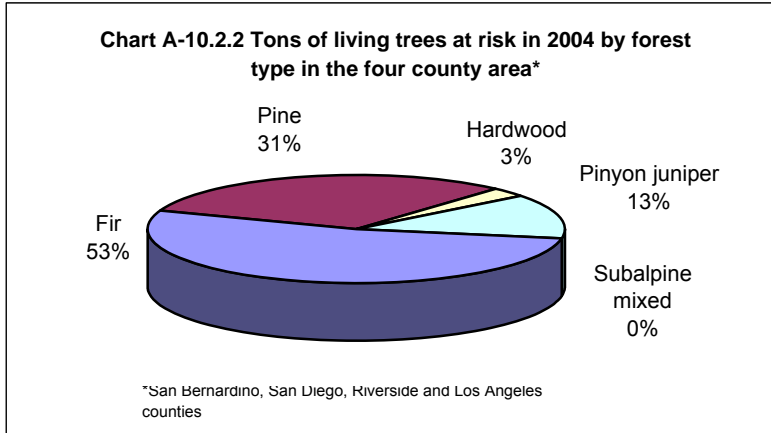
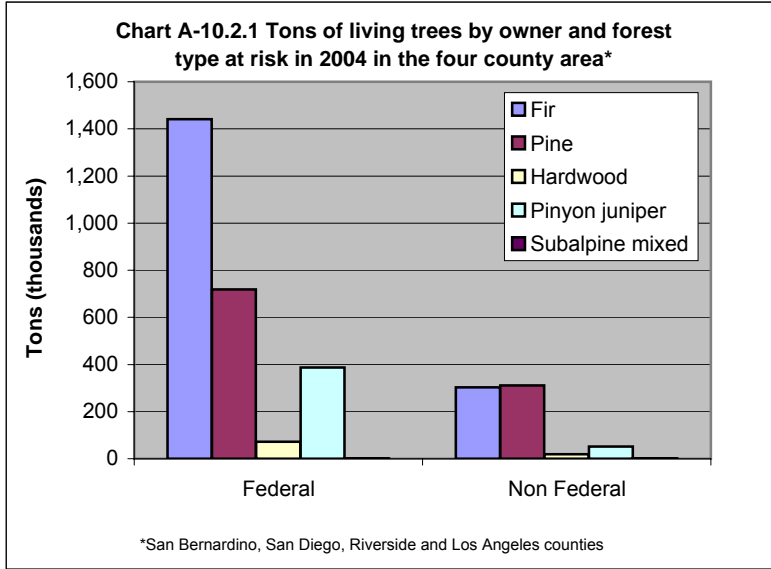


A-10.2 Tons of Living Trees

Table A-10.2 Tons of living trees by owner, forest type at risk in 2004 in the four county area*

Measure	Forest type	Federal			Non Federal			Grand total		
		At risk	Not at risk	Total	At risk	Not at risk	Total	At risk	Not at risk	Total
Tons	Fir	1,440,526	4,310,274	5,750,800	303,172	2,041,964	2,345,136	1,743,698	6,352,237	8,095,936
	Pine	718,451	951,294	1,669,745	311,653	560,886	872,539	1,030,104	1,512,180	2,542,284
	Hardwood	72,242	625,990	698,232	19,320	313,126	332,446	91,562	939,116	1,030,678
	Pinyon juniper	387,203	541,792	928,996	51,829	201,290	253,119	439,032	743,082	1,182,114
	Subalpine mixed	1,873	361,244	363,117	732	47,909	48,641	2,605	409,153	411,757
	Total	2,620,295	6,790,594	9,410,889	686,706	3,165,174	3,851,880	3,307,001	9,955,768	13,262,769

*San Bernardino, San Diego, Riverside and Los Angeles counties

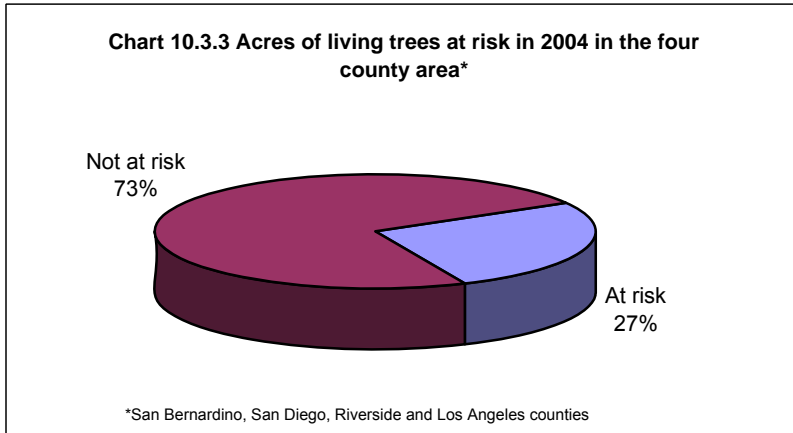
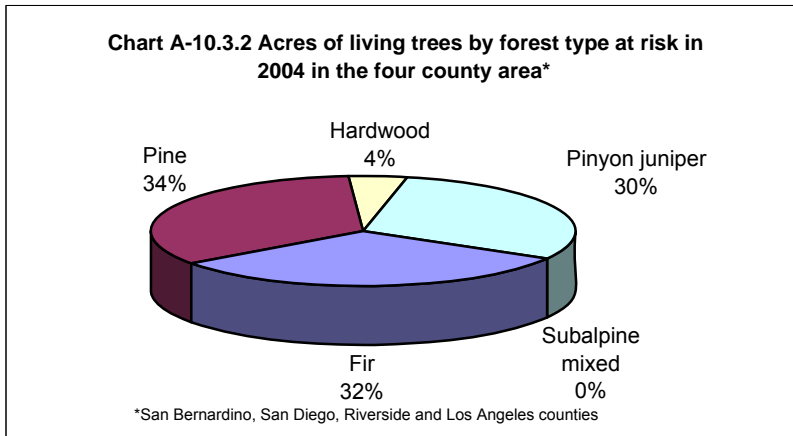
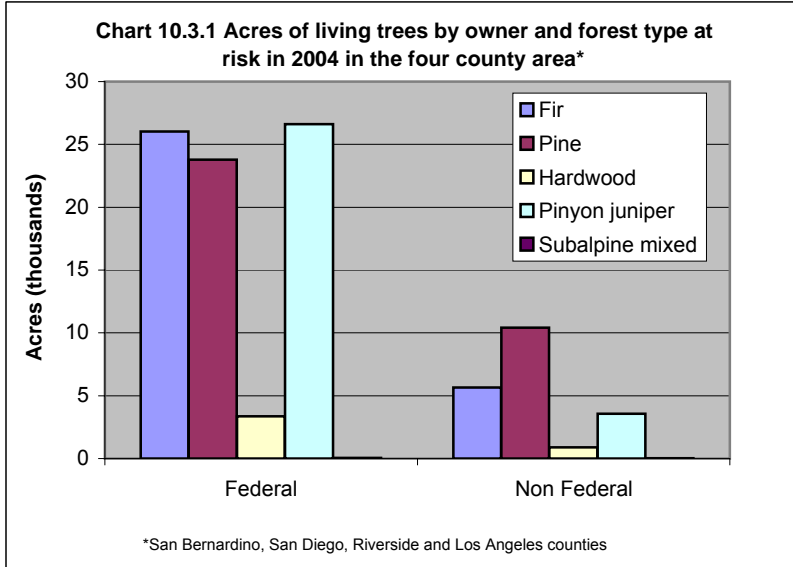


A-10.3 Acres of Living Trees

Table A-10.3 Acres of living trees by owner and forest type at risk in 2004 in the four county area*

Measure	Forest type	Federal			Non Federal			Grand total		
		At risk	Not at risk	Total	At risk	Not at risk	Total	At risk	Not at risk	Total
Acres	Fir	26,020	80,488	106,508	5,644	38,778	44,422	31,664	119,266	150,930
	Pine	23,791	31,960	55,751	10,404	18,730	29,134	34,195	50,690	84,885
	Hardwood	3,358	29,095	32,452	898	14,553	15,451	4,256	43,648	47,904
	Pinyon juniper	26,620	37,248	63,869	3,563	13,839	17,402	30,184	51,087	81,271
	Subalpine mixed	44	8,524	8,568	17	1,130	1,148	61	9,654	9,715
	Total	79,834	187,315	267,148	20,527	87,030	107,557	100,360	274,345	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

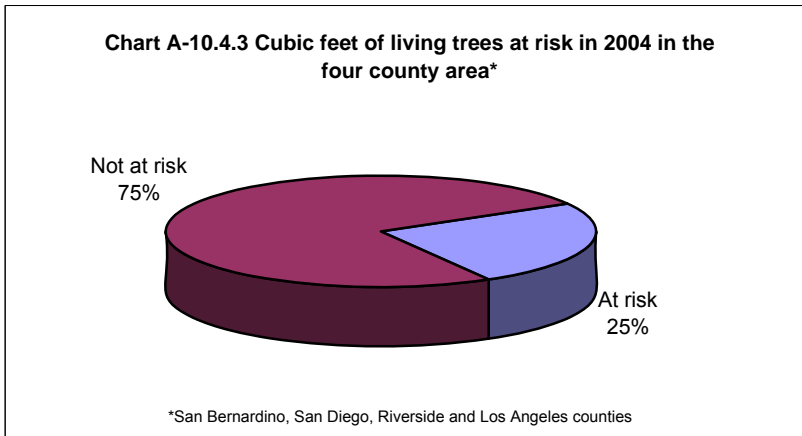
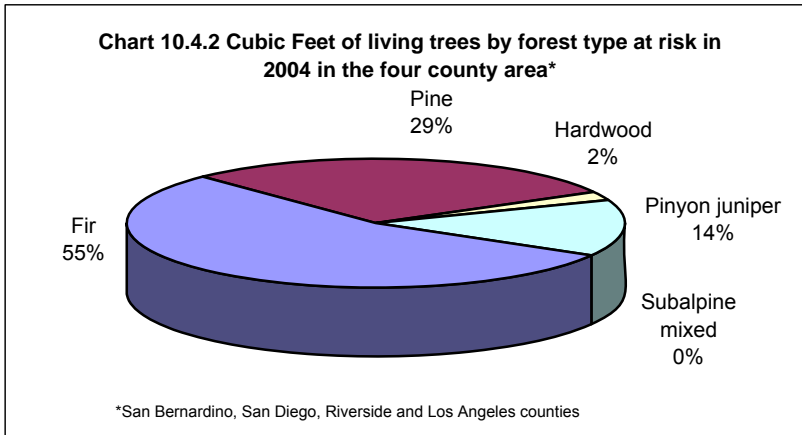
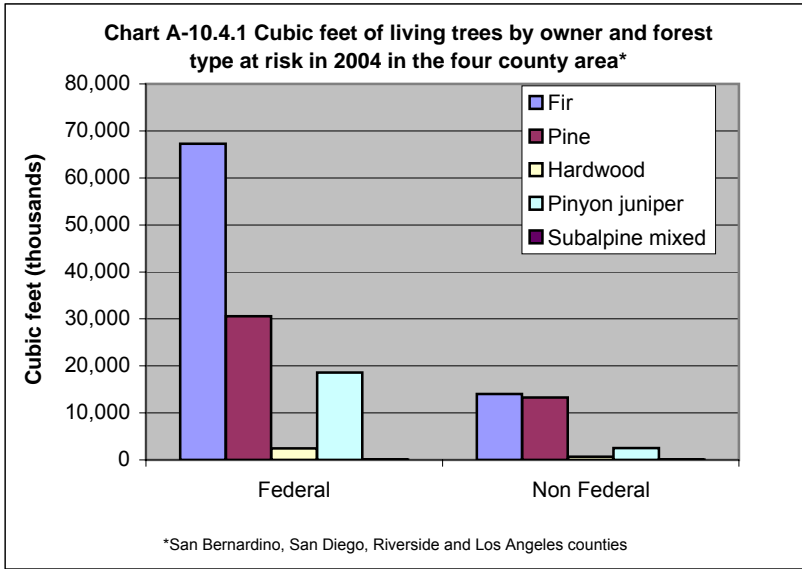


A-10.4 Cubic Feet of Living Trees

Table A-10.4 Cubic feet of living trees by owner and forest type at risk in 2004 in the four county area*

Measure	Forest type	Federal			Non Federal			Grand total		
		At risk	Not at risk	Total	At risk	Not at risk	Total	At risk	Not at risk	Total
Cubic feet	Fir	67,286,551	198,963,860	266,250,411	14,037,245	93,837,815	107,875,059	81,323,796	292,801,675	374,125,470
	Pine	30,597,282	40,399,220	70,996,502	13,252,105	23,833,060	37,085,165	43,849,388	64,232,280	108,081,667
	Hardwood	2,464,872	21,358,550	23,823,422	659,192	10,683,755	11,342,947	3,124,064	32,042,306	35,166,370
	Pinyon juniper	18,599,732	26,025,575	44,625,307	2,489,663	9,669,164	12,158,827	21,089,395	35,694,738	56,784,133
	Subalpine mixed	95,172	18,360,502	18,455,674	37,207	2,434,987	2,472,194	132,379	20,795,489	20,927,868
	Total		119,043,610	305,107,707	424,151,317	30,475,412	140,458,780	170,934,192	149,519,022	445,566,488

*San Bernardino, San Diego, Riverside and Los Angeles counties

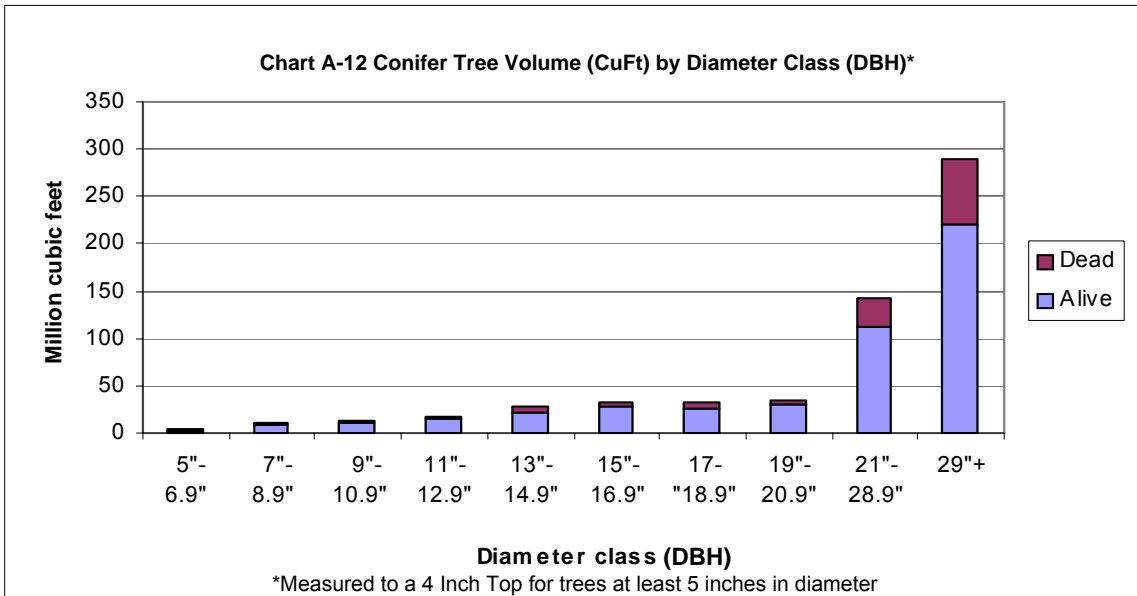


A-11. Number of Trees on Forest Land by Conifer Species

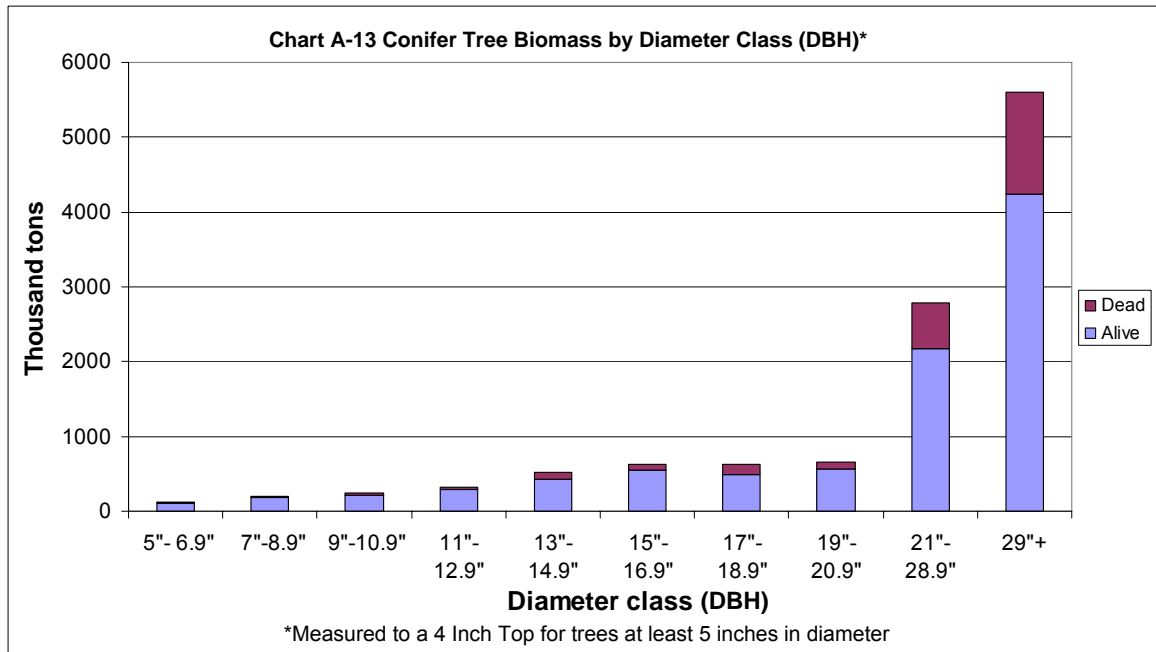
Table A-11 Number of Trees on Forest Land by Conifer Species (trees at least 5" in diameter)

Conifer Species	Number of Trees	% of Conifer trees	Alive	Dead	% Change
Bigcone Douglas-fir	90,797	0.33%	41,554	49,243	54.23%
Coulter pine	840,473	3.04%	464,927	375,546	44.68%
Grey pine	4,167	0.02%	0	4,167	100.00%
Incense cedar	1,920,557	6.95%	1,917,722	2,835	0.15%
Jeffrey pine	6,059,420	21.94%	5,405,386	654,034	10.79%
Limber pine	38,846	0.14%	36,852	1,994	5.13%
Lodgepole pine	702,573	2.54%	691,433	11,139	1.59%
Ponderosa pine	447,086	1.62%	200,127	246,959	55.24%
Singleleaf pinyon	6,811,631	24.66%	6,315,752	495,879	7.28%
Sugar pine	1,045,522	3.79%	830,322	215,200	20.58%
Western juniper	1,214,356	4.40%	1,204,993	9,363	0.77%
White fir	8,444,104	30.57%	7,003,507	1,440,597	17.06%
Total	27,619,532	100.00%	24,112,577	3,506,955	12.70%

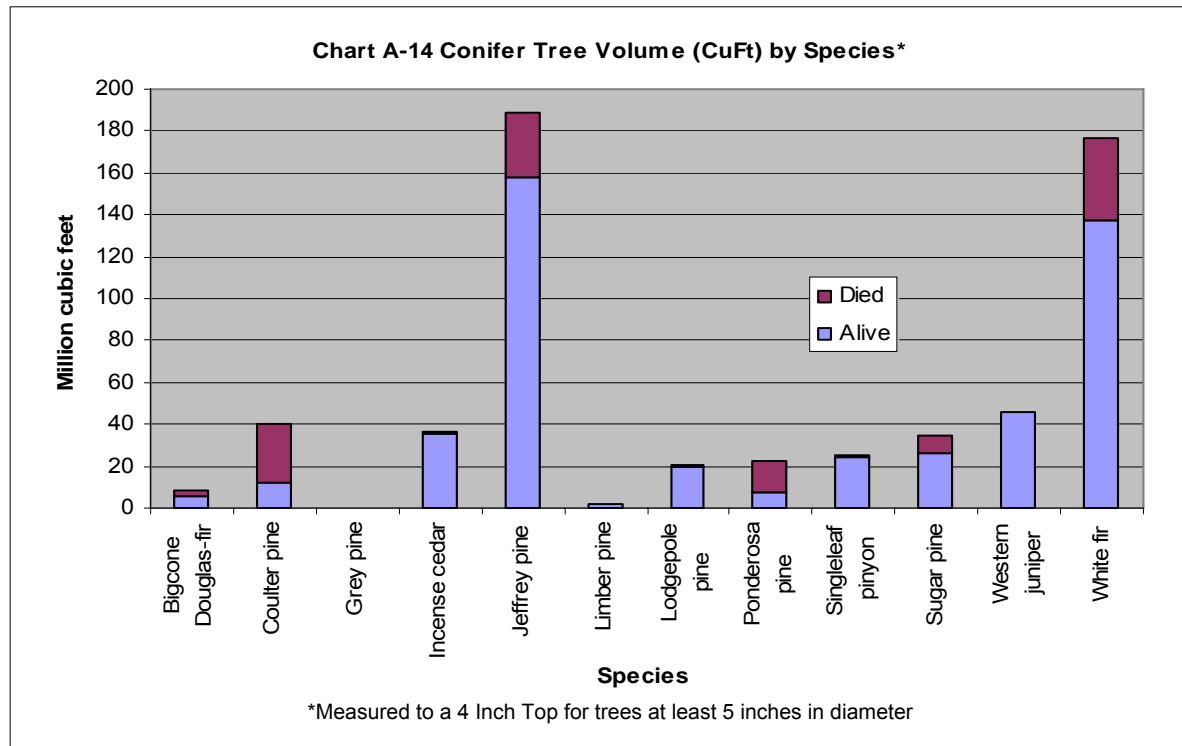
A-12. Conifer Volume by Diameter Class



A-13. Conifer Tree Biomass by Diameter Class



A-14. Conifer Tree Volume by Species



A-15. Owner and Treatment Area

A-15.1 Number of Dead Trees

Table A-15.1a San Bernardino county number of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	358,976	1,962,946	2,321,922
Non Federal	261,255	438,210	699,465
Grand Total	620,231	2,401,156	3,021,387

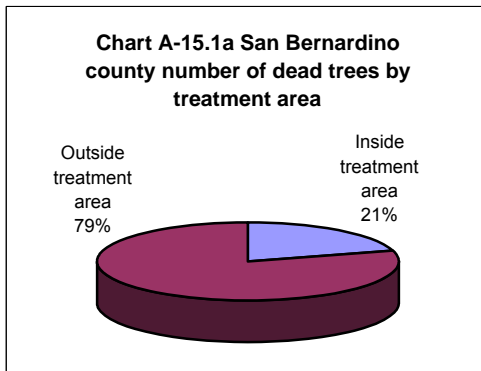


Table A-15.1b Riverside county number of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	109,178	637,669	746,846
Non Federal	88,138	244,732	332,869
Grand Total	197,315	882,401	1,079,716

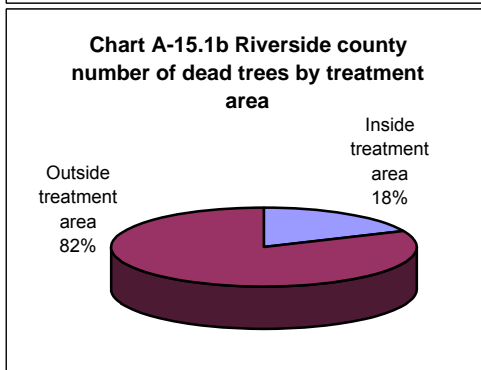


Table A-15.1c San Diego county number of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	50,101	46,916	97,018
Non Federal	235,565	151,162	386,727
Grand Total	285,666	198,079	483,745

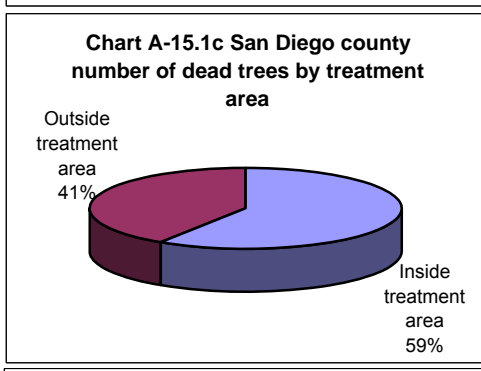


Table A-15.1d Los Angeles county number of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	11,173	22,318	33,490
Non Federal	127	5,981	6,109
Grand Total	11,300	28,299	39,599

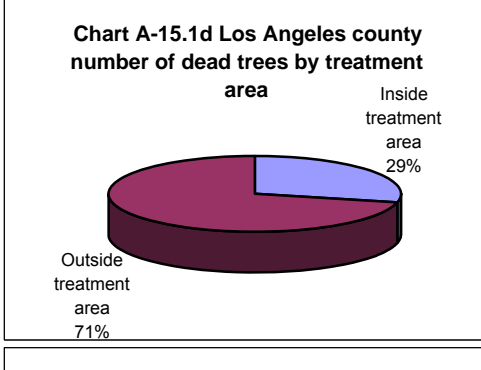
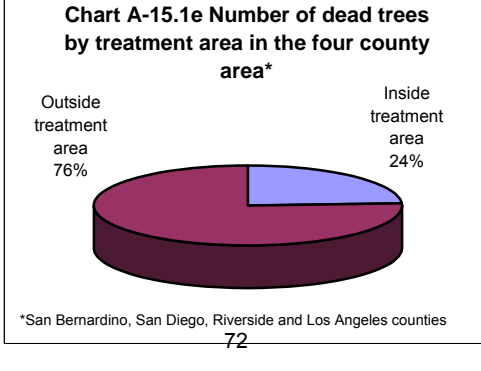


Table A-15.1e Number of dead trees by treatment area and owner in the four county area*

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	529,427	2,669,849	3,199,277
Non Federal	585,085	840,085	1,425,170
Grand Total	1,114,512	3,509,934	4,624,446



*San Bernardino, San Diego, Riverside and Los Angeles counties

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-15.2 Tons of Dead Trees

Table A-15.2a San Bernardino county tons of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	253,856	1,175,345	1,429,202
Non Federal	188,491	226,620	415,111
Grand Total	442,348	1,401,965	1,844,313

Table A-15.2b Riverside county tons of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	71,093	353,694	424,787
Non Federal	68,654	169,091	237,744
Grand Total	139,747	522,785	662,532

Table A-15.2c San Diego county tons of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	35,758	21,811	57,569
Non Federal	124,682	75,687	200,370
Grand Total	160,440	97,499	257,939

Table A-15.2d Los Angeles county tons of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	9,242	18,447	27,689
Non Federal	132	5,053	5,186
Grand Total	9,375	23,500	32,875

Table A-15.2e Tons of dead trees by treatment area and owner in the four county area*

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	369,950	1,569,297	1,939,247
Non Federal	381,960	476,451	858,411
Grand Total	751,910	2,045,749	2,797,659

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-15.3 Acres of Dead Trees

Table A-15.3a San Bernardino county acres of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	25,185	176,168	201,353
Non Federal	16,840	35,998	52,838
Grand Total	42,025	212,166	254,192

Chart A-15.3a San Bernardino county acres of dead trees by treatment area

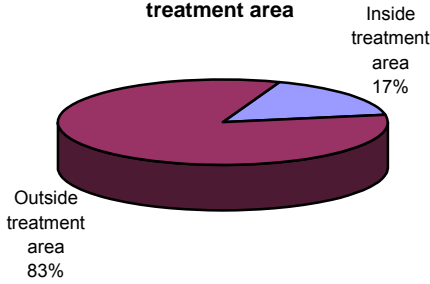


Table A-15.3b Riverside county acres of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	7,254	47,296	54,551
Non Federal	5,689	20,182	25,871
Grand Total	12,943	67,479	80,422

Chart A-15.3b Riverside county acres of dead trees by treatment area

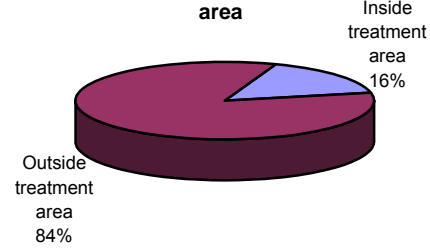


Table A-15.3c San Diego county acres of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	5,487	3,294	8,781
Non Federal	16,869	11,533	28,402
Grand Total	22,356	14,827	37,183

Chart A-15.3c San Diego county acres of dead trees by treatment area

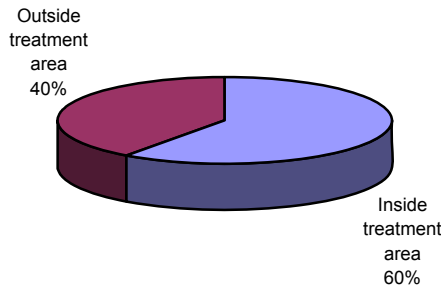


Table A-15.3d Los Angeles county acres of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	758	1,705	2,463
Non Federal	15	430	446
Grand Total	774	2,135	2,909

Chart A-15.3d Los Angeles county acres of dead trees by treatment area

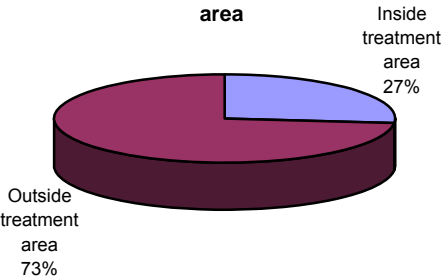
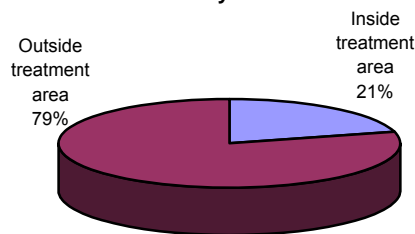


Table A-15.3e Acres of dead trees by treatment area and owner in the four county area

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	38,685	228,464	267,148
Non Federal	39,414	68,143	107,557
Grand Total	78,098	296,607	374,705

Chart A-15.3e Acres of dead trees by treatment area in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

A-15.4 Cubic Feet of Dead Trees

Table A-15.4a San Bernardino county cubic feet of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	12,509,905	57,394,294	69,904,199
Non Federal	9,299,057	11,057,287	20,356,344
Grand Total	21,808,962	68,451,581	90,260,543

Table A-15.4b Riverside county cubic feet of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	3,514,505	17,638,015	21,152,520
Non Federal	3,449,310	8,435,979	11,885,289
Grand Total	6,963,815	26,073,995	33,037,809

Table A-15.4c San Diego county cubic feet of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	1,570,831	1,023,195	2,594,026
Non Federal	5,856,347	3,463,969	9,320,316
Grand Total	7,427,178	4,487,164	11,914,342

Table A-15.4d Los Angeles county cubic feet of dead trees by treatment area and owner

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	465,819	911,601	1,377,420
Non Federal	6,141	252,910	259,051
Grand Total	471,960	1,164,510	1,636,470

Table A-15.4e Cubic feet of dead trees by treatment area and owner in the four county area*

Owner	Inside treatment area	Outside treatment area	Grand Total
Federal	18,061,060	76,967,105	95,028,164
Non Federal	18,610,855	23,210,145	41,821,000
Grand Total	36,671,915	100,177,250	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-16. Treatment Area and Mortality Level

A-16.1 Number of Dead Trees

Table A-16.1a San Bernardino county number of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	122,726	120,075	377,430	620,231
Outside treatment area	272,458	361,360	1,767,338	2,401,156
Total	395,184	481,435	2,144,768	3,021,387

Table A-16.1b San Diego county number of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	40,295	60,824	184,547	285,666
Outside treatment area	21,469	30,314	146,295	198,079
Total	61,764	91,138	330,843	483,745

Table A-16.1c Riverside county number of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	19,520	24,319	153,476	197,315
Outside treatment area	78,079	108,946	695,376	882,401
Total	97,599	133,265	848,852	1,079,716

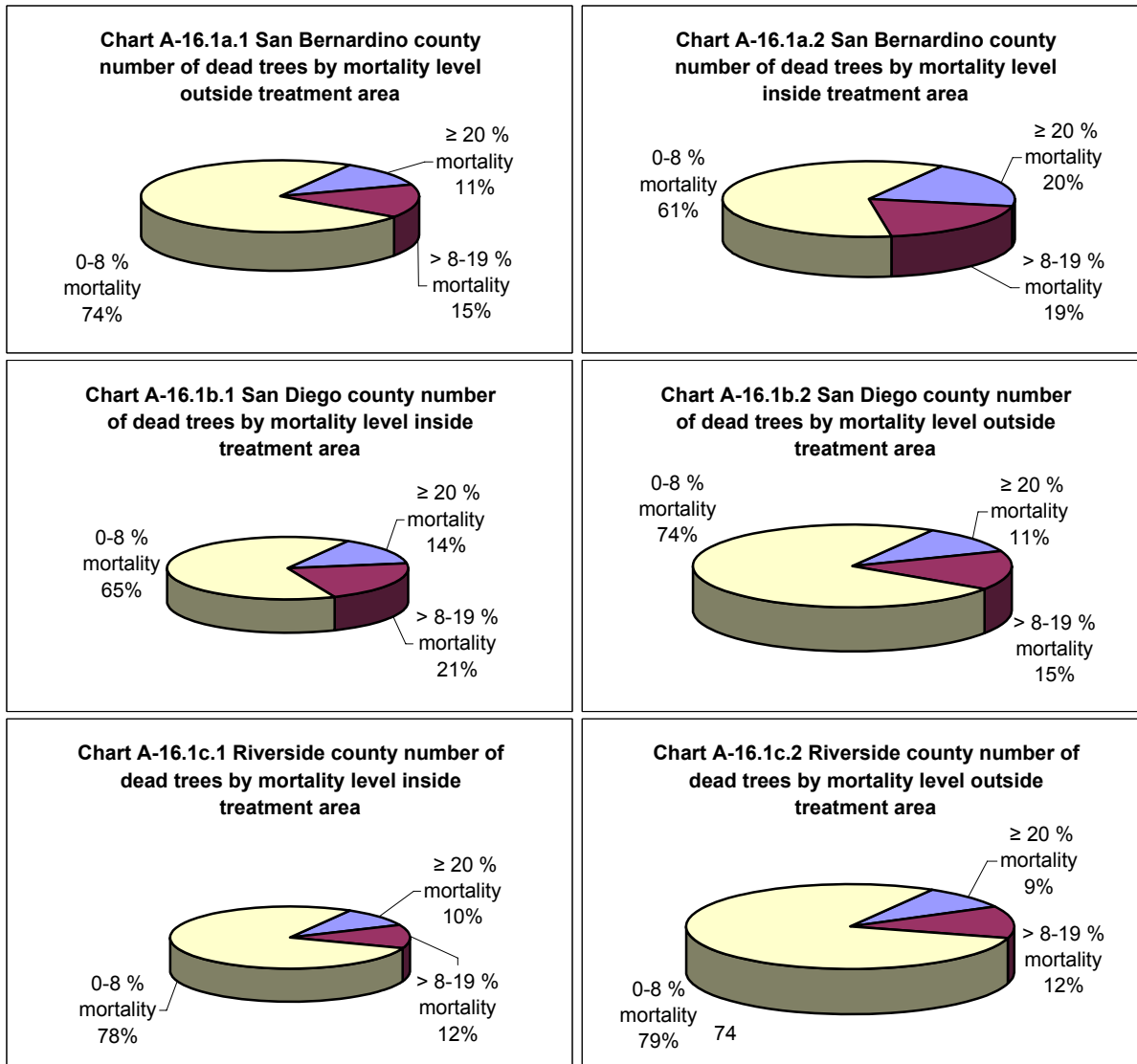
Table A-16.1d Los Angeles county number of dead trees by mortality level and treatment area

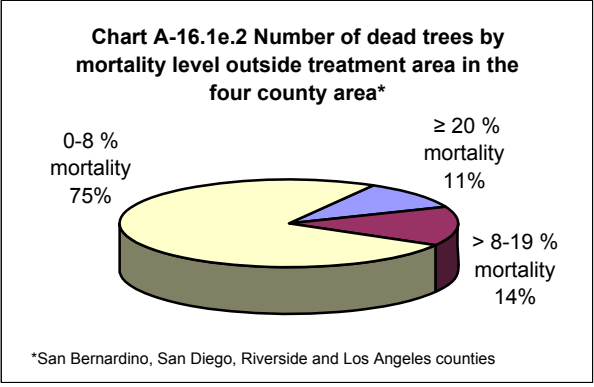
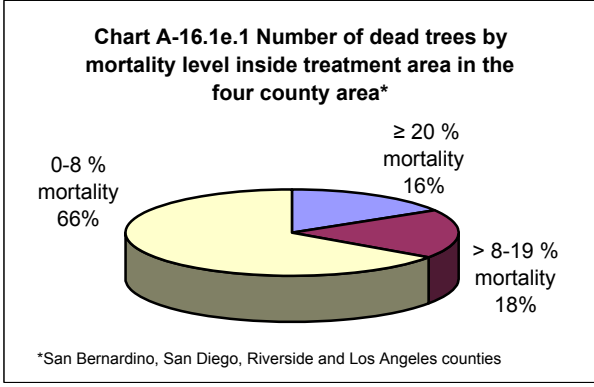
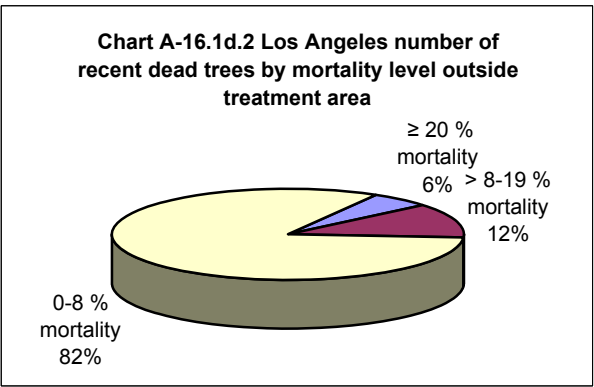
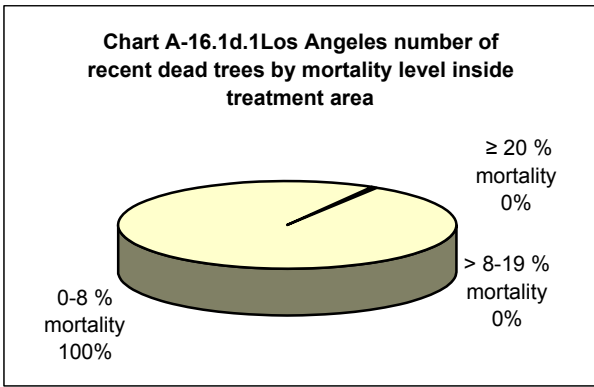
Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	0	56	11,244	11,300
Outside treatment area	1,581	3,475	23,243	28,299
Total	1,581	3,531	34,487	39,599

Table A-16.1e Number of dead trees by mortality level and treatment area in the four county area*

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	182,541	205,273	726,697	1,114,512
Outside treatment area	373,586	504,095	2,632,253	3,509,934
Total	556,127	709,369	3,358,950	4,624,446

*San Bernardino, San Diego, Riverside and Los Angeles counties





A-16.2 Tons of Dead Trees

Table A-16.2a San Bernardino county tons of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	76,198	85,314	280,835	442,348
Outside treatment area	172,007	258,767	971,191	1,401,965
Total	248,205	344,082	1,252,026	1,844,313

Table A-16.2b San Diego county tons of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	23,072	26,015	111,353	160,440
Outside treatment area	12,910	13,062	71,527	97,499
Total	35,982	39,076	182,880	257,939

Table A-16.2c Riverside county tons of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	12,942	20,268	106,538	139,747
Outside treatment area	50,908	86,904	384,972	522,785
Total	63,850	107,172	491,510	662,532

Table A-16.2d Los Angeles county tons of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	0	51	9,324	9,375
Outside treatment area	1,010	2,651	19,838	23,500
Total	1,010	2,702	29,163	32,875

Table A-16.2e Tons of dead trees by mortality level and treatment area in the four county area*

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	112,212	131,647	508,050	751,910
Outside treatment area	236,836	361,384	1,447,528	2,045,749
Total	349,048	493,031	1,955,578	2,797,658

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-16.3 Acres of Dead Trees

Table A-16.3a San Bernardino county acres of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	4,366	7,534	30,125	42,025
Outside treatment area	9,715	22,715	179,736	212,166
Total	14,081	30,249	209,861	254,192

Table A-16.3b San Diego county acres of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	1,418	3,454	17,484	22,356
Outside treatment area	760	1,724	12,343	14,827
Total	2,178	5,178	29,827	37,183

Table A-16.3c Riverside county acres of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	701	1,589	10,654	12,943
Outside treatment area	2,797	7,036	57,646	67,479
Total	3,498	8,624	68,300	80,422

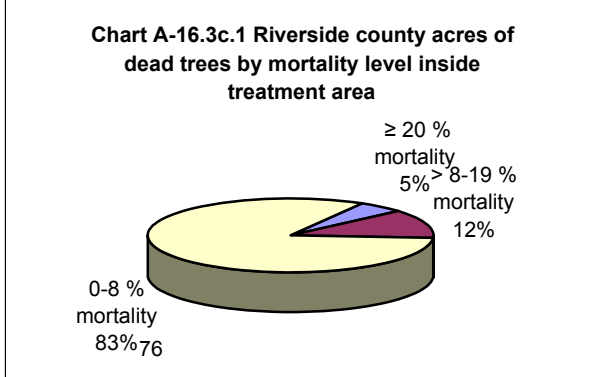
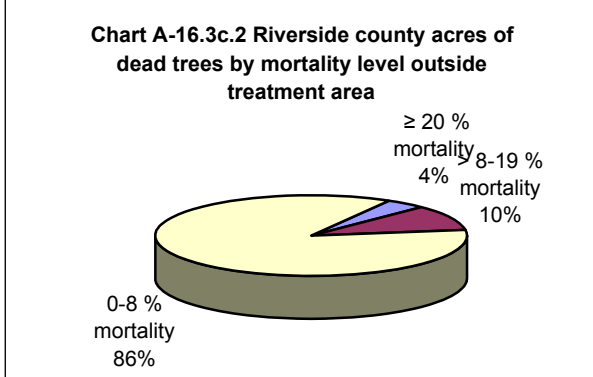
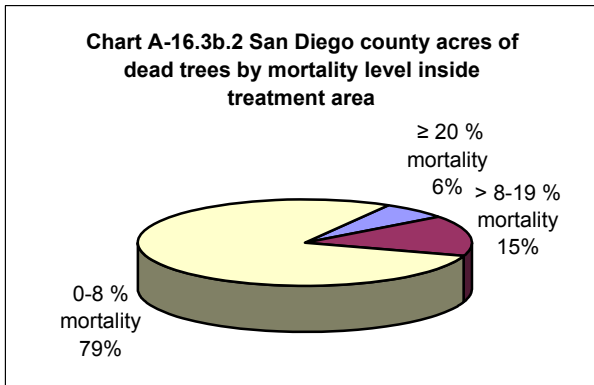
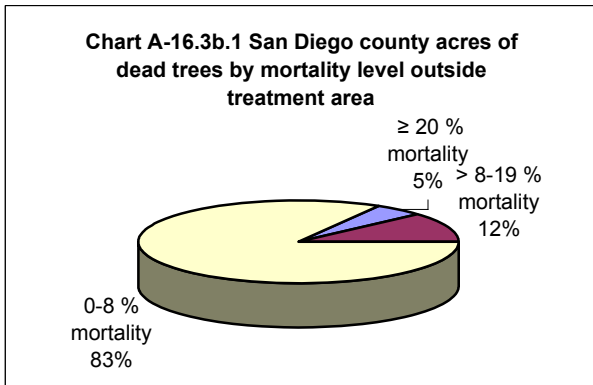
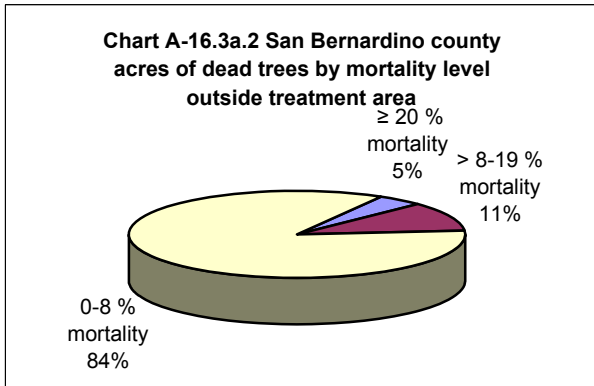
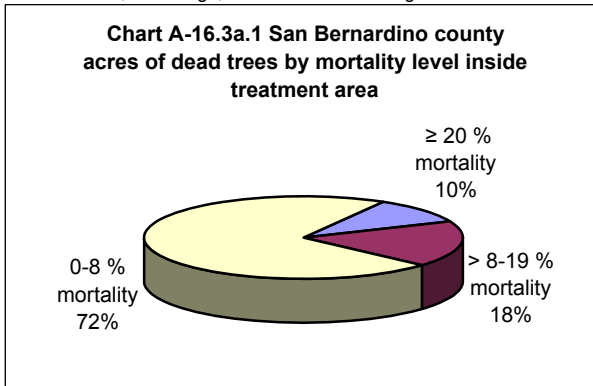
Table A-16.3d Los Angeles county acres of dead trees by mortality level and treatment area

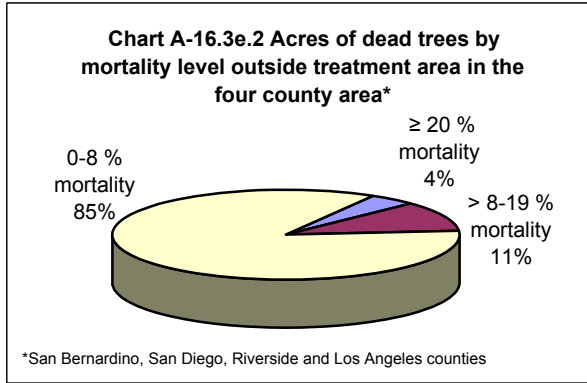
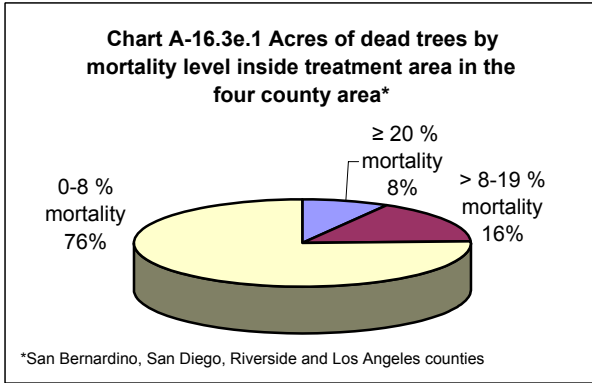
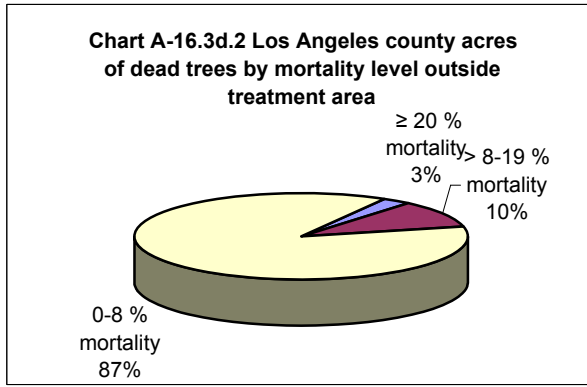
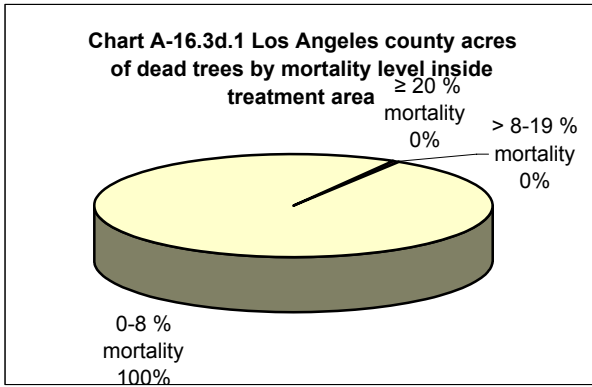
Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area		4	770	774
Outside treatment area	56	222	1,857	2,135
Total	56	226	2,627	2,909

Table A-16.3e Acres of dead trees by mortality level and treatment area in the four county area*

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	6,485	12,581	59,033	78,098
Outside treatment area	13,329	31,696	251,581	296,607
Total	19,814	44,277	310,614	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties





A-16.4 Cubic Feet of Dead Trees

Table A-16.4a San Bernardino county cubic feet of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	3,777,677	4,373,835	13,657,450	21,808,962
Outside treatment area	8,534,856	13,271,617	46,645,108	68,451,581
Total	12,312,533	17,645,452	60,302,558	90,260,543

Table A-16.4b San Diego county cubic feet of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	1,138,874	1,288,342	4,999,963	7,427,178
Outside treatment area	638,976	647,280	3,200,907	4,487,164
Total	1,777,850	1,935,622	8,200,870	11,914,342

Table A-16.4c Riverside county cubic feet of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	643,726	1,046,942	5,273,147	6,963,815
Outside treatment area	2,530,094	4,480,374	19,063,527	26,073,995
Total	3,173,819	5,527,316	24,336,674	33,037,809

Table A-16.4d Los Angeles county cubic feet of dead trees by mortality level and treatment area

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	0	2,626	469,334	471,960
Outside treatment area	50,168	136,406	977,936	1,164,510
Total	50,168	139,032	1,447,270	1,636,470

Table A-16.4e Cubic feet of dead trees by mortality level and treatment area in the four county area*

Treatment area	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Inside treatment area	5,560,277	6,711,744	24,399,894	36,671,915
Outside treatment area	11,754,094	18,535,678	69,887,478	100,177,250
Total	17,314,371	25,247,422	94,287,371	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-17. Owner, Treatment Area and Mortality Level

A-17.1 Number of Dead Trees

Table A-17.1a San Bernardino county number of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	45,359	70,021	243,596	358,976
	Outside treatment area	193,912	297,904	1,471,130	1,962,946
	Total	239,271	367,925	1,714,726	2,321,922
Non Federal	Inside treatment area	77,367	50,054	133,834	261,255
	Outside treatment area	78,546	63,456	296,208	438,210
	Total	155,913	113,510	430,042	699,465
Grand Total		395,184	481,435	2,144,768	3,021,387

Table A-17.1b Riverside county number of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	7,204	10,141	91,832	109,178
	Outside treatment area	60,710	80,869	496,090	637,669
	Total	67,914	91,010	587,923	746,846
Non Federal	Inside treatment area	12,316	14,177	61,644	88,138
	Outside treatment area	17,368	28,078	199,286	244,732
	Total	29,685	42,255	260,930	332,869
Grand Total		97,599	133,265	848,852	1,079,716

Table A-17.1c San Diego county number of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	4,892	12,925	32,283	50,101
	Outside treatment area	2,045	3,493	41,377	46,916
	Total	6,938	16,419	73,661	97,018
Non Federal	Inside treatment area	35,403	47,898	152,264	235,565
	Outside treatment area	19,424	26,821	104,918	151,162
	Total	54,826	74,719	257,182	386,727
Grand Total		61,764	91,138	330,843	483,745

Table A-17.1d Los Angeles county number of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area		51	11,121	11,173
	Outside treatment area	1,581	3,337	17,400	22,318
	Total	1,581	3,388	28,522	33,490
Non Federal	Inside treatment area		4	123	127
	Outside treatment area		138	5,843	5,981
	Total		143	5,966	6,109
Grand Total		1,581	3,531	34,487	39,599

Table A-17.1e Number of dead trees by owner, treatment area and mortality level in the four county area*

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	57,456	93,139	378,833	529,427
	Outside treatment area	258,248	385,602	2,025,998	2,669,849
	Total	315,704	478,742	2,404,831	3,199,277
Non Federal	Inside treatment area	125,086	112,134	347,865	585,085
	Outside treatment area	115,338	118,493	606,254	840,085
	Total	240,424	230,627	954,119	1,425,170
Grand Total		556,127	709,369	3,358,950	4,624,446

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-17.2 Tons of Dead Trees

Table A-17.2a San Bernardino county tons of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	28,357	49,685	175,815	253,856
	Outside treatment area	122,941	212,054	840,350	1,175,345
	Total	151,298	261,739	1,016,165	1,429,202
Non Federal	Inside treatment area	47,841	35,630	105,020	188,491
	Outside treatment area	49,066	46,713	130,841	226,620
	Total	96,907	82,343	235,861	415,111
Grand Total		248,205	344,082	1,252,026	1,844,313

Table A-17.2b Riverside county tons of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	4,752	7,843	58,498	71,093
	Outside treatment area	39,390	64,745	249,560	353,694
	Total	44,141	72,588	308,058	424,787
Non Federal	Inside treatment area	8,190	12,425	48,039	68,654
	Outside treatment area	11,519	22,159	135,412	169,091
	Total	19,709	34,584	183,452	237,744
Grand Total		63,850	107,172	491,510	662,532

Table A-17.2c San Diego county tons of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	2,610	3,771	29,376	35,758
	Outside treatment area	1,199	2,060	18,552	21,811
	Total	3,809	5,832	47,928	57,569
Non Federal	Inside treatment area	20,462	22,243	81,977	124,682
	Outside treatment area	11,711	11,001	52,975	75,687
	Total	32,173	33,244	134,953	200,370
Grand Total		35,982	39,076	182,880	257,939

Table A-17.2d Los Angeles county tons of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area		47	9,196	9,242
	Outside treatment area	1,010	2,526	14,911	18,447
	Total	1,010	2,572	24,107	27,689
Non Federal	Inside treatment area		4	128	132
	Outside treatment area		126	4,928	5,053
	Total		130	5,056	5,186
Grand Total		1,010	2,702	29,163	32,875

Table A-17.2e Tons of dead trees by owner, treatment area and mortality level in the four county area*

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	35,719	61,346	272,885	369,950
	Outside treatment area	164,540	281,385	1,123,372	1,569,297
	Total	200,259	342,731	1,396,257	1,939,247
Non Federal	Inside treatment area	76,493	70,301	235,165	381,960
	Outside treatment area	72,296	79,999	324,156	476,451
	Total	148,789	150,301	559,321	858,411
Grand Total		349,048	493,031	1,955,578	2,797,658

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-17.3 Acres of Dead Trees

Table A-17.3a San Bernardino county acres of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	1,615	4,392	19,178	25,185
	Outside treatment area	6,919	18,700	150,550	176,168
	Total	8,534	23,092	169,728	201,353
Non Federal	Inside treatment area	2,751	3,142	10,947	16,840
	Outside treatment area	2,797	4,016	29,186	35,998
	Total	5,547	7,158	40,133	52,838
Grand Total		14,081	30,249	209,861	254,192

Table A-17.3b Riverside county acres of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	258	650	6,346	7,254
	Outside treatment area	2,173	5,227	39,896	47,296
	Total	2,432	5,877	46,242	54,551
Non Federal	Inside treatment area	442	939	4,308	5,689
	Outside treatment area	624	1,808	17,750	20,182
	Total	1,066	2,747	22,058	25,871
Grand Total		3,498	8,624	68,300	80,422

Table A-17.3c San Diego county acres of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	171	697	4,619	5,487
	Outside treatment area	72	210	3,012	3,294
	Total	243	907	7,631	8,781
Non Federal	Inside treatment area	1,247	2,757	12,865	16,869
	Outside treatment area	688	1,513	9,331	11,533
	Total	1,936	4,270	22,196	28,402
Grand Total		2,178	5,178	29,827	37,183

Table A-17.3d Los Angeles county acres of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area		3	755	758
	Outside treatment area	56	213	1,436	1,705
	Total	56	216	2,191	2,463
Non Federal	Inside treatment area		0	15	15
	Outside treatment area		9	421	430
	Total		10	436	446
Grand Total		56	226	2,627	2,909

Table A-17.3e Acres of dead trees by owner, treatment area and mortality level in the four county area*

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	2,044	5,742	30,898	38,685
	Outside treatment area	9,220	24,350	194,893	228,464
	Total	11,265	30,092	225,791	267,148
Non Federal	Inside treatment area	4,441	6,838	28,135	39,414
	Outside treatment area	4,109	7,346	56,688	68,143
	Total	8,549	14,185	84,823	107,557
Grand Total		19,814	44,277	310,614	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-17.4 Cubic Feet of Dead Trees

Table A-17.4a San Bernardino county cubic feet of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	1,406,347	2,547,020	8,556,537	12,509,905
	Outside treatment area	6,101,552	10,872,477	40,420,266	57,394,294
	Total	7,507,899	13,419,497	48,976,803	69,904,199
Non Federal	Inside treatment area	2,371,330	1,826,814	5,100,913	9,299,057
	Outside treatment area	2,433,304	2,399,140	6,224,842	11,057,287
	Total	4,804,634	4,225,954	11,325,755	20,356,344
Grand Total		12,312,533	17,645,452	60,302,558	90,260,543

Table A-17.4b Riverside county cubic feet of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	236,297	403,770	2,874,438	3,514,505
	Outside treatment area	1,957,142	3,338,503	12,342,370	17,638,015
	Total	2,193,439	3,742,273	15,216,808	21,152,520
Non Federal	Inside treatment area	407,429	643,172	2,398,709	3,449,310
	Outside treatment area	572,952	1,141,871	6,721,157	8,435,979
	Total	980,380	1,785,043	9,119,866	11,885,289
Grand Total		3,173,819	5,527,316	24,336,674	33,037,809

Table A-17.4c San Diego county cubic feet of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	128,310	179,084	1,263,436	1,570,831
	Outside treatment area	59,272	104,519	859,405	1,023,195
	Total	187,582	283,603	2,122,841	2,594,026
Non Federal	Inside treatment area	1,010,563	1,109,257	3,736,526	5,856,347
	Outside treatment area	579,705	542,762	2,341,503	3,463,969
	Total	1,590,268	1,652,019	6,078,029	9,320,316
Grand Total		1,777,850	1,935,622	8,200,870	11,914,342

Table A-17.4d Los Angeles county cubic feet of dead trees by owner, treatment area and mortality level

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area		2,417	463,402	465,819
	Outside treatment area	50,168	129,885	731,548	911,601
	Total	50,168	132,302	1,194,949	1,377,420
Non Federal	Inside treatment area		209	5,932	6,141
	Outside treatment area		6,522	246,388	252,910
	Total		6,730	252,320	259,051
Grand Total		50,168	139,032	1,447,270	1,636,470

Table A-17.4d Cubic feet of dead trees by owner, treatment area and mortality level in the four county area*

Owner	Status	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Grand Total
Federal	Inside treatment area	1,770,955	3,132,292	13,157,813	18,061,060
	Outside treatment area	8,168,134	14,445,383	54,353,588	76,967,105
	Total	9,939,088	17,577,675	67,511,401	95,028,164
Non Federal	Inside treatment area	3,789,322	3,579,452	11,242,081	18,610,855
	Outside treatment area	3,585,961	4,090,294	15,533,890	23,210,145
	Total	7,375,283	7,669,747	26,775,970	41,821,000
Grand Total		17,314,371	25,247,422	94,287,371	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-18. Treatment Area, Forest Type and Mortality Level

A-18.1 Number of Dead Trees

Table A-18.1a San Bernardino county number of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	88,831	86,366	261,303	436,499
	Pine	33,895	33,710	42,231	109,836
	Hardwood			70,228	70,228
	Pinyon juniper			3,667	3,667
	Total	122,726	120,075	377,430	620,231
Outside treatment area	Fir	212,112	262,778	713,986	1,188,875
	Pine	60,346	98,582	179,938	338,867
	Hardwood			463,193	463,193
	Pinyon juniper			404,591	404,591
	Subalpine mixed			5,629	5,629
Total	272,458	361,360	1,767,338	2,401,156	
Total	Fir	300,942	349,143	975,289	1,625,375
	Pine	94,242	132,292	222,169	448,703
	Hardwood			533,421	533,421
	Pinyon juniper			408,259	408,259
	Subalpine mixed			5,629	5,629
Total	395,184	481,435	2,144,768	3,021,387	

Table A-18.1b Riverside county number of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	18,439	21,733	112,961	153,133
	Pine	1,082	2,585	7,525	11,191
	Hardwood			32,990	32,990
	Total	19,520	24,319	153,476	197,315
Outside treatment area	Fir	69,256	91,839	384,268	545,363
	Pine	8,822	17,107	21,920	47,850
	Hardwood			172,481	172,481
	Pinyon juniper			116,001	116,001
	Subalpine mixed			706	706
Total	78,079	108,946	695,376	882,401	
Total	Fir	87,695	113,572	497,229	698,496
	Pine	9,904	19,692	29,445	59,041
	Hardwood			205,471	205,471
	Pinyon juniper			116,001	116,001
	Subalpine mixed			706	706
Total	97,599	133,265	848,852	1,079,716	

Table A-18.1c San Diego county number of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	18,964	19,337	44,115	82,417
	Pine	21,331	41,487	46,197	109,014
	Hardwood			94,235	94,235
	Total	40,295	60,824	184,547	285,666
Outside treatment area	Fir	13,341	9,774	27,232	50,346
	Pine	8,128	20,540	27,720	56,388
	Hardwood			91,344	91,344
	Total	21,469	30,314	146,295	198,079
Total	Fir	32,305	29,111	71,347	132,763
	Pine	29,459	62,027	73,916	165,403
	Hardwood			185,579	185,579
	Total	61,764	91,138	330,843	483,745

Table A-18.1d Los Angeles number of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir		56	10,987	11,043
	Pine			257	257
	Total		56	11,244	11,300
Outside treatment area	Fir	1,296	2,758	20,329	24,383
	Pine	285	717	2,275	3,276
	Hardwood			447	447
	Pinyon juniper			192	192
	Total	1,581	3,475	23,243	28,299
Total	Fir	1,296	2,814	31,316	35,426
	Pine	285	717	2,532	3,533
	Hardwood			447	447
	Pinyon juniper			192	192
	Total	1,581	3,531	34,487	39,599

Table I-18.1e Number of dead trees by forest type, treatment area and mortality level in the four county area*

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	126,234	127,492	429,366	683,092
	Pine	56,308	77,781	96,210	230,299
	Hardwood			197,454	197,454
	Pinyon juniper			3,667	3,667
	Total	182,541	205,273	726,697	1,114,512
Outside treatment area	Fir	296,005	367,148	1,145,815	1,808,968
	Pine	77,581	136,947	231,853	446,381
	Hardwood			727,465	727,465
	Pinyon juniper			520,785	520,785
	Subalpine mixed			6,335	6,335
Total	Total	373,586	504,095	2,632,253	3,509,934
	Fir	422,238	494,640	1,575,181	2,492,060
	Pine	133,889	214,728	328,063	676,680
	Hardwood			924,919	924,919
	Pinyon juniper			524,453	524,453
	Subalpine mixed			6,335	6,335
Total	556,127	709,369	3,358,950	4,624,446	

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-18.1a.1 San Bernardino county number of dead trees outside treatment area by forest type

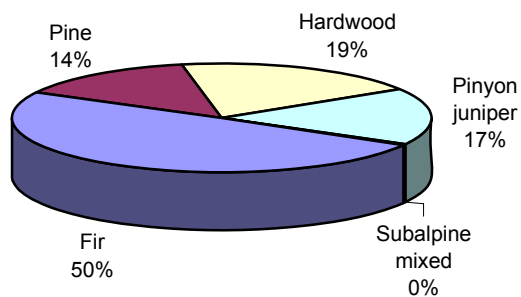


Chart A-18.1a.2 San Bernardino county number of dead trees inside treatment area by forest type

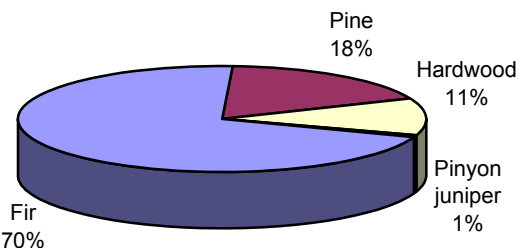


Chart A-18.1b.1 Riverside county number of dead trees outside treatment area by forest type

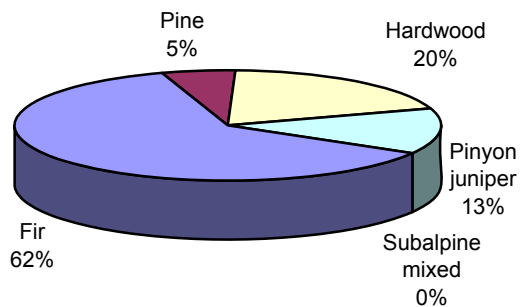


Chart A-18.1b.2 Riverside county number of dead trees inside treatment area by forest type

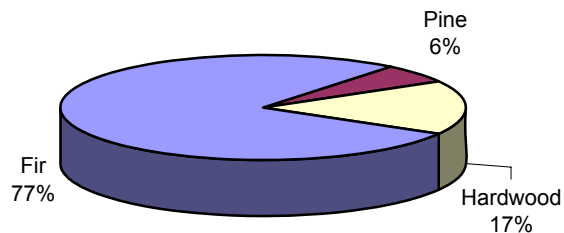


Chart A-18.1c.1 San Diego county number of dead trees outside treatment area by forest type

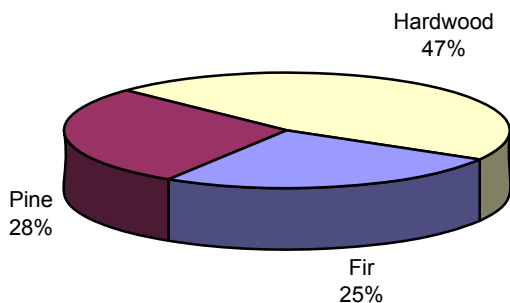


Chart A-18.1c.2 San Diego county number of dead trees inside treatment area by forest type

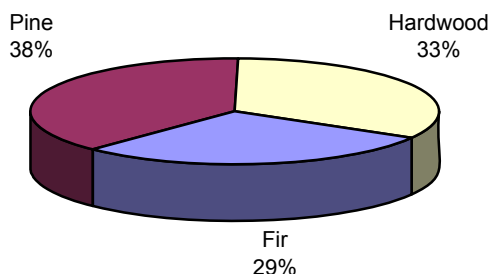


Chart A-18.1d.1 Los Angeles county number of dead trees outside treatment area by forest type

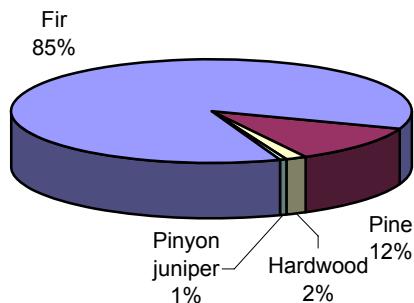


Chart A-18.1d.2 Los Angeles county number of dead trees inside treatment area by forest type

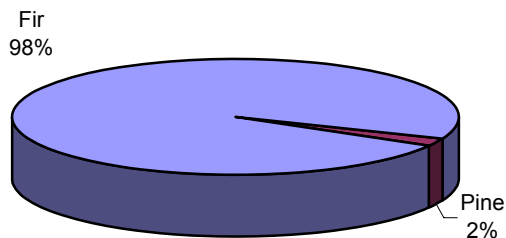
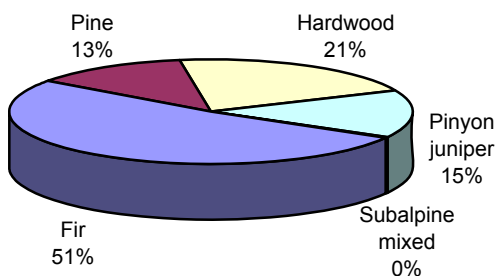
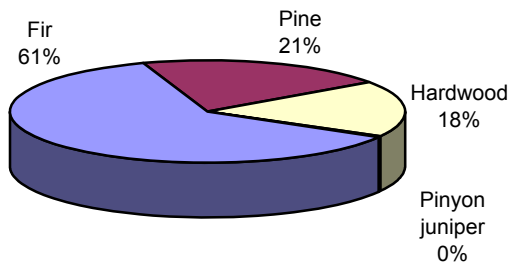


Chart A-18.1e.1 Number of dead trees outside treatment area by forest type in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-18.1e.2 Number of dead trees inside treatment area by forest type in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

A-18.2 Tons of Dead Trees

Table A-18.2a San Bernardino county tons of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	59,834	78,448	213,257	351,539
	Pine	16,364	6,866	58,757	81,988
	Hardwood			8,254	8,254
	Pinyon juniper			567	567
	Total	76,198	85,314	280,835	442,348
Outside treatment area	Fir	142,873	238,688	582,705	964,266
	Pine	29,135	20,080	250,351	299,566
	Hardwood			54,437	54,437
	Pinyon juniper			62,588	62,588
	Subalpine mixed			21,109	21,109
Total	172,007	258,767	971,191	1,401,965	
Total	Fir	202,706	317,136	795,962	1,315,805
	Pine	45,499	26,946	309,109	381,553
	Hardwood			62,691	62,691
	Pinyon juniper			63,155	63,155
	Subalpine mixed			21,109	21,109
	Total	248,205	344,082	1,252,026	1,844,313

Table A-18.2b Riverside county tons of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	12,420	19,741	92,191	124,352
	Pine	522	527	10,469	11,518
	Hardwood			3,877	3,877
	Total	12,942	20,268	106,538	139,747
Outside treatment area	Fir	46,649	83,420	313,612	443,681
	Pine	4,259	3,484	30,498	38,242
	Hardwood			20,271	20,271
	Pinyon juniper			17,945	17,945
	Subalpine mixed			2,646	2,646
Total	50,908	86,904	384,972	522,785	
Total	Fir	59,069	103,161	405,803	568,033
	Pine	4,781	4,011	40,968	49,760
	Hardwood			24,148	24,148
	Pinyon juniper			17,945	17,945
	Subalpine mixed			2,646	2,646
	Total	63,850	107,172	491,510	662,532

Table A-18.2c San Diego county tons of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	12,774	17,564	36,004	66,342
	Pine	10,298	8,450	64,274	83,023
	Hardwood			11,075	11,075
	Total	23,072	26,015	111,353	160,440
Outside treatment area	Fir	8,986	8,878	22,225	40,089
	Pine	3,924	4,184	38,567	46,675
	Hardwood			10,735	10,735
	Total	12,910	13,062	71,527	97,499
Total	Fir	21,760	26,442	58,229	106,431
	Pine	14,223	12,634	102,841	129,698
	Hardwood			21,810	21,810
	Total	35,982	39,076	182,880	257,939

Table A-18.2d Los Angeles county tons of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir		51	8,967	9,017
	Pine			358	358
	Total		51	9,324	9,375
Outside treatment area	Fir	873	2,505	16,591	19,970
	Pine	137	146	3,165	3,448
	Hardwood			53	53
	Pinyon juniper			30	30
	Total	1,010	2,651	19,838	23,500
Total	Fir	873	2,556	25,558	28,987
	Pine	137	146	3,522	3,806
	Hardwood			53	53
	Pinyon juniper			30	30
	Total	1,010	2,702	29,163	32,875

Table A-18.2e Tons of dead trees by forest type, treatment area and mortality level in the four county area*

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	85,027	115,804	350,419	551,250
	Pine	27,185	15,843	133,858	176,886
	Hardwood			23,206	23,206
	Pinyon juniper			567	567
	Total	112,212	131,647	508,050	751,910
Outside treatment area	Fir	199,381	333,491	935,133	1,468,005
	Pine	37,456	27,894	322,581	387,930
	Hardwood			85,496	85,496
	Pinyon juniper			80,562	80,562
	Subalpine mixed			23,755	23,755
	Total	236,836	361,384	1,447,528	2,045,749
Total	Fir	284,408	449,295	1,285,552	2,019,255
	Pine	64,640	43,737	456,440	564,817
	Hardwood			108,702	108,702
	Pinyon juniper			81,129	81,129
	Subalpine mixed			23,755	23,755
	Total	349,048	493,031	1,955,578	2,797,658

*San Bernardino, San Diego, Riverside and Los Angeles counties

A-18.3 Acres of Dead Trees

Table A-18.3a San Bernardino county acres of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	3,197	5,778	17,026	26,002
	Pine	1,169	1,755	8,893	11,818
	Hardwood			3,637	3,637
	Pinyon juniper			568	568
	Total	4,366	7,534	30,125	42,025
Outside treatment area	Fir	7,635	17,582	46,523	71,739
	Pine	2,081	5,134	37,893	45,107
	Hardwood			23,990	23,990
	Pinyon juniper			62,697	62,697
	Subalpine mixed			8,633	8,633
	Total	9,715	22,715	179,736	212,166
Total	Fir	10,832	23,360	63,549	97,741
	Pine	3,249	6,889	46,787	56,925
	Hardwood			27,627	27,627
	Pinyon juniper			63,265	63,265
	Subalpine mixed			8,633	8,633
	Total	14,081	30,249	209,861	254,192

Table A-18.3b Riverside county acres of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	664	1,454	7,360	9,478
	Pine	37	135	1,585	1,757
	Hardwood			1,709	1,709
	Total	701	1,589	10,654	12,943
Outside treatment area	Fir	2,493	6,145	25,039	33,676
	Pine	304	891	4,616	5,811
	Hardwood			8,933	8,933
	Pinyon juniper			17,976	17,976
	Subalpine mixed			1,082	1,082
	Total	2,797	7,036	57,646	67,479
Total	Fir	3,156	7,599	32,399	43,154
	Pine	341	1,025	6,201	7,568
	Hardwood			10,642	10,642
	Pinyon juniper			17,976	17,976
	Subalpine mixed			1,082	1,082
	Total	3,498	8,624	68,300	80,422

Table A-18.3c San Diego county acres of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	683	1,294	2,875	4,851
	Pine	735	2,160	9,729	12,624
	Hardwood			4,881	4,881
	Total	1,418	3,454	17,484	22,356
Outside treatment area	Fir	480	654	1,774	2,909
	Pine	280	1,070	5,837	7,187
	Hardwood			4,731	4,731
	Total	760	1,724	12,343	14,827
Total	Fir	1,163	1,948	4,649	7,759
	Pine	1,016	3,230	15,566	19,812
	Hardwood			9,612	9,612
	Total	2,178	5,178	29,827	37,183

Table 18.3d Los Angeles county acres of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir		4	716	720
	Pine			54	54
	Total		4	770	774
Outside treatment area	Fir	47	185	1,325	1,556
	Pine	10	37	479	526
	Hardwood			23	23
	Pinyon juniper			30	30
	Total	56	222	1,857	2,135
Total	Fir	47	188	2,041	2,275
	Pine	10	37	533	580
	Hardwood			23	23
	Pinyon juniper			30	30
	Total	56	226	2,627	2,909

Table 18.3e Acres of dead trees by forest type, treatment area and mortality level in the four county area*

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	4,544	8,530	27,977	41,051
	Pine	1,941	4,050	20,261	26,253
	Hardwood			10,227	10,227
	Pinyon juniper			568	568
	Total	6,485	12,581	59,033	78,098
Outside treatment area	Fir	10,654	24,565	74,660	109,879
	Pine	2,675	7,132	48,826	58,632
	Hardwood			37,677	37,677
	Pinyon juniper			80,702	80,702
	Subalpine mixed			9,715	9,715
	Total	13,329	31,696	251,581	296,607
Total	Fir	15,198	33,095	102,637	150,930
	Pine	4,616	11,182	69,087	84,885
	Hardwood			47,904	47,904
	Pinyon juniper			81,271	81,271
	Subalpine mixed			9,715	9,715
	Total	19,814	44,277	310,614	374,705

*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-18.3a.1 San Bernardino county acres of dead trees by forest type outside treatment area

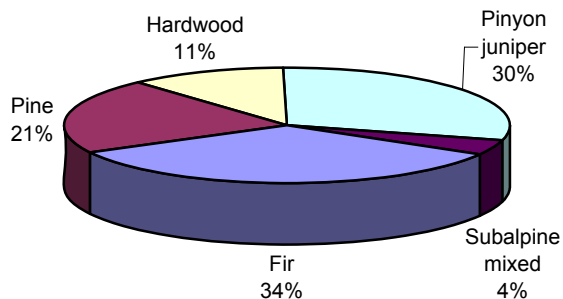


Chart A-18.3a.1 San Bernardino county acres of dead trees by forest type inside treatment area

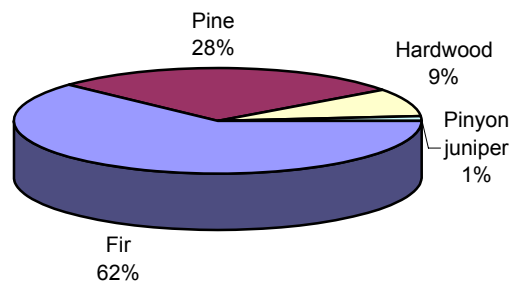


Chart A-18.3b.1 Riverside county acres of dead trees by forest type outside treatment area

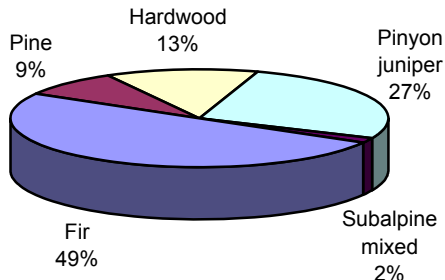


Chart A-18.3b.2 Riverside county acres of dead trees by forest type inside treatment area

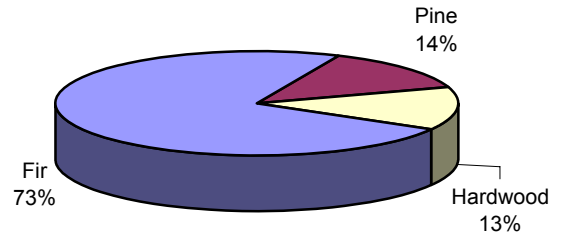


Chart A-18.3c.1 San Diego county acres of dead trees by forest type outside treatment area

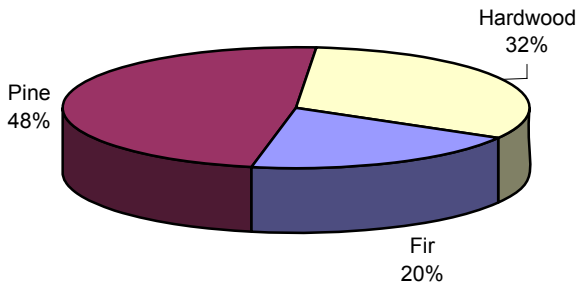


Chart A-18.3c.2 San Diego county acres of dead trees by forest type inside treatment area

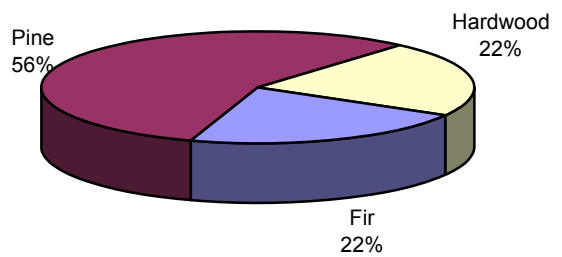


Chart A-18.3d.1 Los Angeles county acres of dead trees by forest type outside treatment area

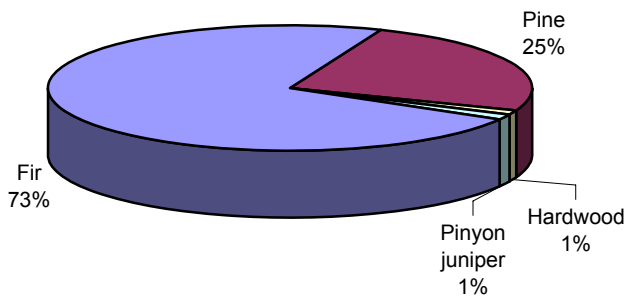


Chart A-18.3d.2 Los Angeles county acres of dead trees by forest type inside treatment area

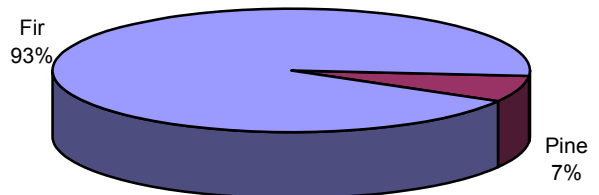
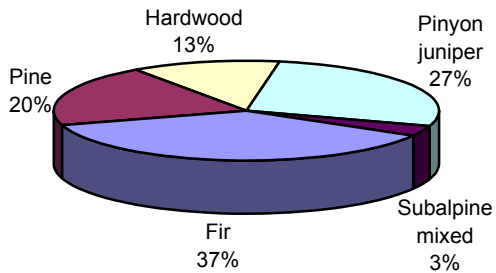
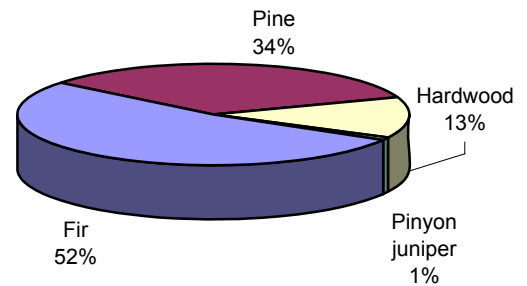


Chart A-18.3e.1 Acres of dead trees by forest type outside treatment area in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

Chart A-18.3e.2 Acres of dead trees by forest type inside treatment area in the four county area*



*San Bernardino, San Diego, Riverside and Los Angeles counties

A-18.4 Cubic feet of Dead Trees

Table A-18.4a San Bernardino county cubic feet of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	2,978,336	4,066,876	10,802,644	17,847,856
	Pine	799,341	306,958	2,484,456	3,590,755
	Hardwood			341,639	341,639
	Pinyon juniper			28,711	28,711
	Total	3,777,677	4,373,835	13,657,450	21,808,962
Outside treatment area	Fir	7,111,721	12,373,932	29,517,223	49,002,877
	Pine	1,423,135	897,685	10,585,716	12,906,536
	Hardwood			2,253,301	2,253,301
	Pinyon juniper			3,167,431	3,167,431
	Subalpine mixed			1,121,436	1,121,436
	Total	8,534,856	13,271,617	46,645,108	68,451,581
Total	Fir	10,090,057	16,440,808	40,319,867	66,850,733
	Pine	2,222,476	1,204,643	13,070,172	16,497,292
	Hardwood			2,594,940	2,594,940
	Pinyon juniper			3,196,143	3,196,143
	Subalpine mixed			1,121,436	1,121,436
	Total	12,312,533	17,645,452	60,302,558	90,260,543

Table A-18.4b Riverside county cubic feet of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	618,220	1,023,402	4,669,979	6,311,601
	Pine	25,505	23,540	442,679	491,725
	Hardwood			160,489	160,489
	Total	643,726	1,046,942	5,273,147	6,963,815
Outside treatment area	Fir	2,322,044	4,324,596	15,886,179	22,532,819
	Pine	208,050	155,778	1,289,573	1,653,400
	Hardwood			839,070	839,070
	Pinyon juniper			908,142	908,142
	Subalpine mixed			140,563	140,563
	Total	2,530,094	4,480,374	19,063,527	26,073,995
Total	Fir	2,940,264	5,347,998	20,556,158	28,844,420
	Pine	233,555	179,318	1,732,251	2,145,125
	Hardwood			999,559	999,559
	Pinyon juniper			908,142	908,142
	Subalpine mixed			140,563	140,563
	Total	3,173,819	5,527,316	24,336,674	33,037,809

Table A-18.4c San Diego county cubic feet of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	635,829	910,568	1,823,798	3,370,195
	Pine	503,045	377,774	2,717,738	3,598,556
	Hardwood			458,427	458,427
	Total	1,138,874	1,288,342	4,999,963	7,427,178
Outside treatment area	Fir	447,288	460,240	1,125,811	2,033,339
	Pine	191,688	187,040	1,630,735	2,009,463
	Hardwood			444,361	444,361
	Total	638,976	647,280	3,200,907	4,487,164
Total	Fir	1,083,117	1,370,808	2,949,609	5,403,534
	Pine	694,733	564,814	4,348,473	5,608,019
	Hardwood			902,788	902,788
	Total	1,777,850	1,935,622	8,200,870	11,914,342

Table A-18.4d Los Angeles county cubic feet of dead trees by forest type, treatment area and mortality level

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir		2,626	454,209	456,835
	Pine			15,125	15,125
	Total		2,626	469,334	471,960
Outside treatment area	Fir	43,458	129,877	840,439	1,013,774
	Pine	6,710	6,529	133,816	147,055
	Hardwood			2,175	2,175
	Pinyon juniper			1,507	1,507
	Total	50,168	136,406	977,936	1,164,510
Total	Fir	43,458	132,503	1,294,648	1,470,609
	Pine	6,710	6,529	148,940	162,179
	Hardwood			2,175	2,175
	Pinyon juniper			1,507	1,507
	Total	50,168	139,032	1,447,270	1,636,470

Table A-18.4e Cubic feet of dead trees by forest type, treatment area and mortality level in the four county area*

Status	Forest type	≥ 20 % mortality	> 8-19 % mortality	0-8 % mortality	Total
Inside treatment area	Fir	4,232,386	6,003,472	17,750,630	27,986,488
	Pine	1,327,891	708,273	5,659,997	7,696,161
	Hardwood			960,555	960,555
	Pinyon juniper			28,711	28,711
	Total	5,560,277	6,711,744	24,399,894	36,671,915
Outside treatment area	Fir	9,924,511	17,288,646	47,369,652	74,582,809
	Pine	1,829,583	1,247,031	13,639,840	16,716,455
	Hardwood			3,538,907	3,538,907
	Pinyon juniper			4,077,080	4,077,080
	Subalpine mixed			1,261,999	1,261,999
	Total	11,754,094	18,535,678	69,887,478	100,177,250
Total	Fir	14,156,897	23,292,118	65,120,282	102,569,296
	Pine	3,157,474	1,955,304	19,299,837	24,412,615
	Hardwood			4,499,462	4,499,462
	Pinyon juniper			4,105,791	4,105,791
	Subalpine mixed			1,261,999	1,261,999
	Total	17,314,371	25,247,422	94,287,371	136,849,164

*San Bernardino, San Diego, Riverside and Los Angeles counties

Appendix B. Maps

Figure 1. Forest Land and Owner by County

Figure 2. Mortality Zone and Ownership

Figure 3. Tree Mortality and Ownership

Figure 4. Tree Mortality Level

Figure 5. Major Forest Types and Ownership

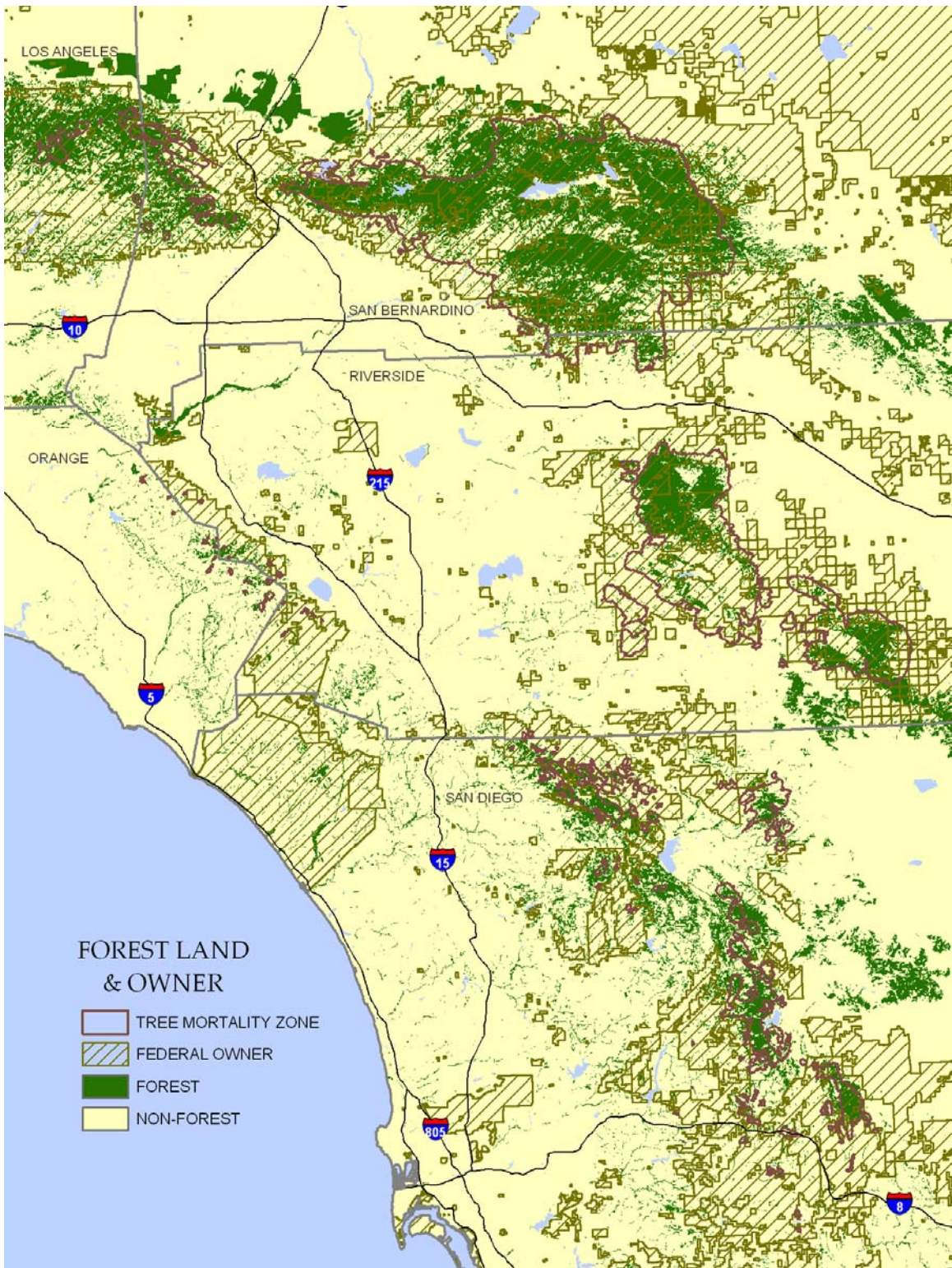


Figure 1. Forest Land and Owner by County

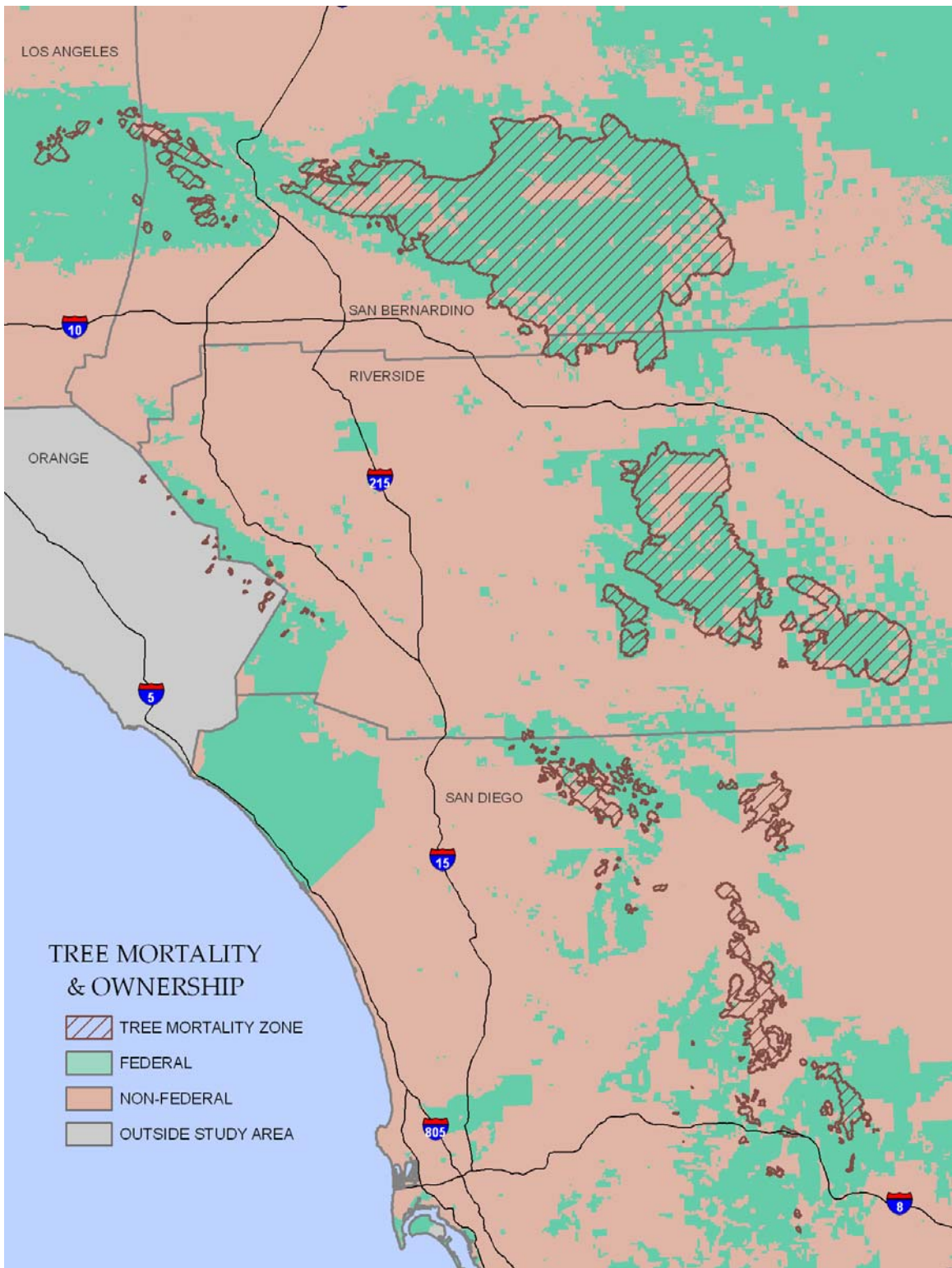


Figure 2. Mortality Zone and Ownership

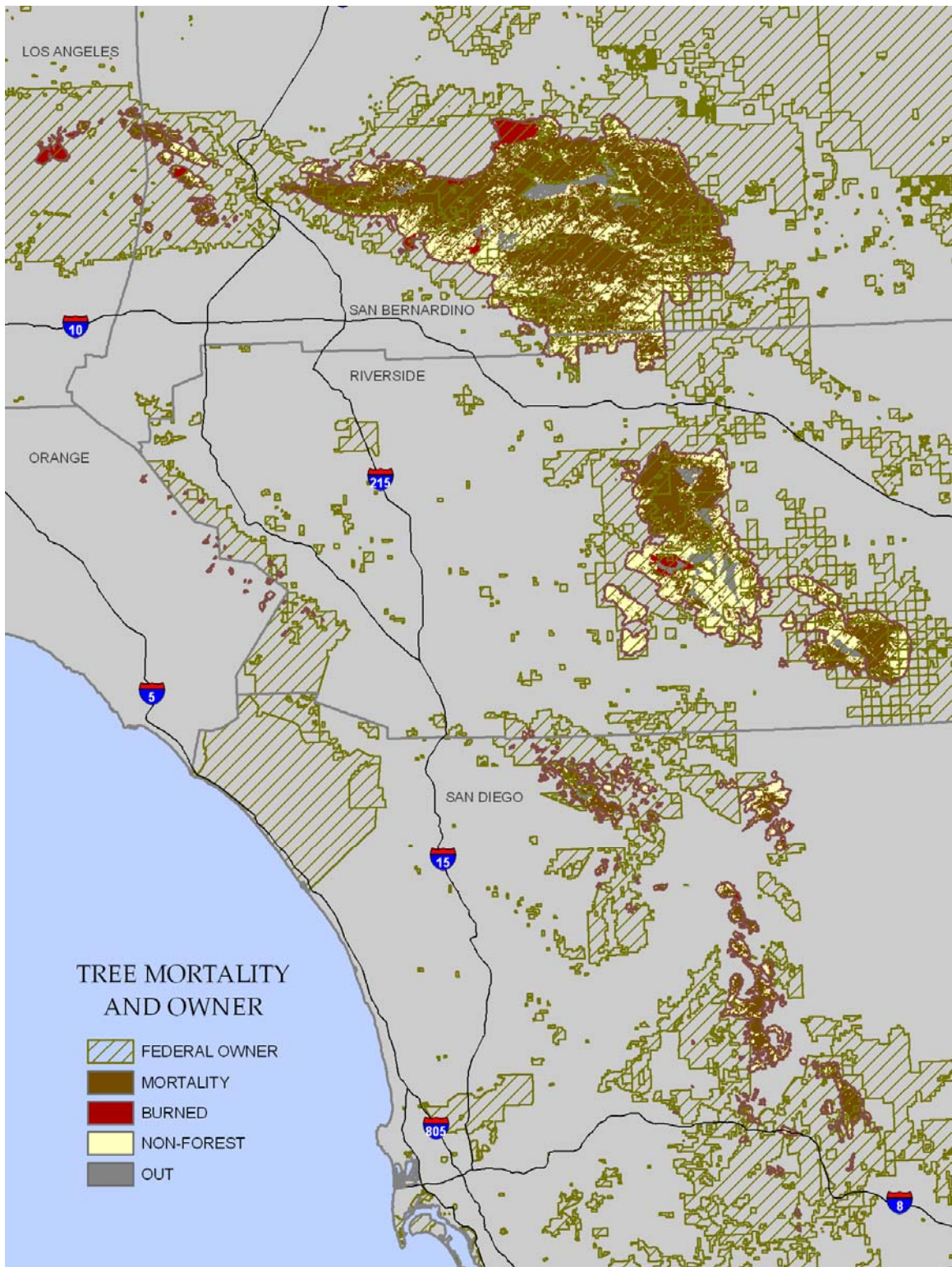


Figure 3. Tree Mortality and Ownership

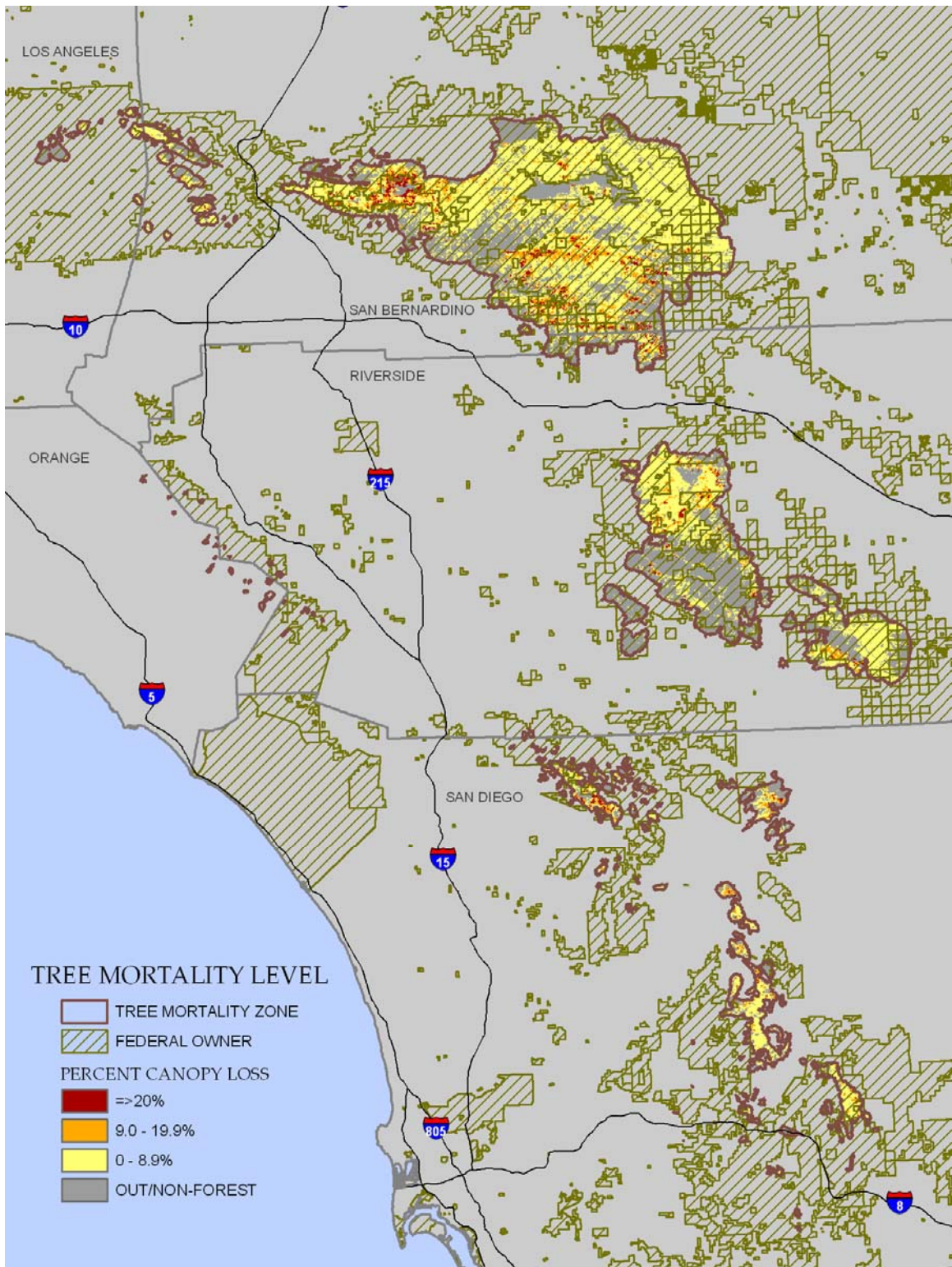


Figure 4. Tree Mortality Level

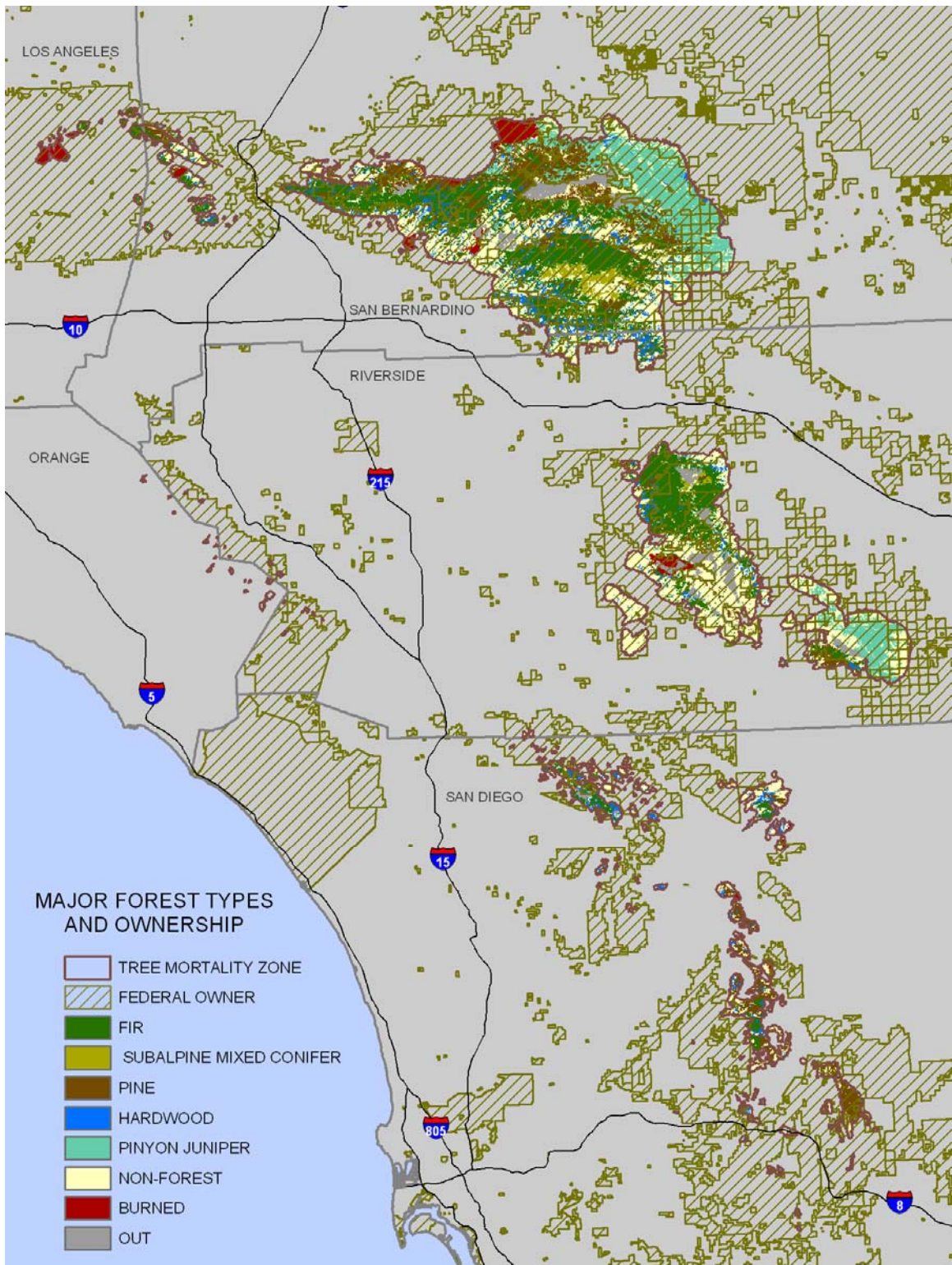


Figure 5. Major Forest Types and Ownership