Chapter 1.2
Sustainable Working Forests and Rangelands

Forestry agencies and partners can provide landowner assistance and incentives to help keep working forests working. Providing forestry assistance to landowners can improve the economics of, and encourage sustainable forest management. In urban and suburban areas, forest agencies can assist communities to develop sustainable forest management and green infrastructure programs. Assessments and strategies can identify viable and high potential working forest landscape where landowner assistance programs, such as Forest Stewardship can be targeted to yield the most benefit in terms of economic opportunities and ecosystem services. Assessment and strategies can also identify opportunities for multi-landowner, landscape scale planning and landowner aggregation for access to emerging ecosystem service markets (excerpted from the U.S. Forest Service State and Private Forestry Farm Bill Requirement and Redesign Strategies).

KEY FINDINGS

Land Use and Land Cover Impacts

- Permanent land cover change occurs most often (47,000 acres a year) in grassland/shrubland types, most dramatically in grazing lands along the edges of the Central Valley.
- Forest disturbance from harvest peaked between 1986 and 1992, with fire-caused disturbance most common in forests from 1992–2000. Most fire-related disturbance was in the chaparral and oak woodlands of the Sierra Nevada ecoregion.
- Monitoring of Best Management Practices on private and public forestlands shows generally high compliance with implementation, and effectiveness when implemented properly.
- Unmanaged outdoor recreation may adversely impact natural resources by causing erosion, spread of invasive weeds, compaction, plant damage, wildlife disturbance,

damage to cultural resources and others impacts.

Forests and Woodlands

- Both private and public forestlands appear to continue to build inventory volume.
- A recent U.S. Forest Service analysis indicates that while carbon sequestration is occurring, long-term carbon storage will be a function of management inputs over the next 100 years.
- A carbon sequestration and storage analysis of California's private timberlands suggests that less total storage and sequestration is occurring relative to public lands, but given management inputs may be more sustainable in the long-run.
- The propensity for the conversion of working forests and woodlands is increasing due to pressures from high costs, low income, infrastructure loss and generational turnover.

Forest Products Sector

- The softwood sawmill capacity in California shrank by 25 percent in the last few years, which is indicative of the overall contraction of the sector in jobs, capacity and overall economic activity.
- Ownership patterns have changed for large industrial landowners; they are now all privately held firms.
- Individual Timber Harvesting Plans (THPs) have increased in acreage (before 2009 their size was fairly steady). Acres under Non-Industrial Timber Management Plans (NTMPs) continue to rise but with smaller landowners increasing in participation. As of January 1, 2010, there are 711 NTMPs covering 301,598 acres.
- The acres of alternative prescriptions have declined and clearcutting acreage has been generally constant over the last several years.
- Cost reduction and regulatory streamlining is necessary for the forest products sector in California to compete and be sustainable in the long-term.
- The forest products infrastructure of California is declining. Climate change adaptation, biomass energy production and restoration activities depend on that infrastructure, as do many of the rural economies of California.

Rangelands and Range Industry

- Rangeland productivity is highly variable across space and time. Climate change may impact this further. Buffering public lands with grazing helps protect ecosystem health from development and protect development from wildfires originating on public wildlands.
- Like the timber industry, the ranching industry has been in steady long-term contraction. The maintenance of large ranches across California landscapes cannot rely on amenity values alone; these operations must be economically viable to avoid conversion, abandonment or fragmentation.
- The propensity for the conversion of working rangelands is increasing due to pressures from high costs, low income, infrastructure loss and generational turnover.

Landowner Assistance

- Addressing risk reduction on forestlands, high priority landscapes with significant timber or biomass energy assets at risk from wildfire or forest pests were found primarily in the Klamath/North Coast, Modoc and Sierra bioregions.

- High priority landscapes with rangeland productivity at risk from wildfire were found primarily in the Bay/Delta, Central Coast, Sierra and South Coast bioregions. Bioregions with smaller acreages of high priority landscapes or extensive areas of medium priority included the Klamath/North Coast, Modoc and Sacramento Valley bioregions.
- Regarding restoration, extensive areas of high and medium priority landscapes representing areas with significant timber or biomass energy assets that have been damaged by past wildfires or forest pest outbreaks are found in the Klamath/North Coast, Modoc and Sierra bioregions. Bioregions with smaller acreages of these priority areas include the South Coast and Bay/Delta bioregions.
- A clear opportunity exists to implement strategies for improving forest conditions across California. The costs and benefits are variable, but competing for resources to implement stand improvement projects often benefits from both matching resources and economies of scale. Opportunities to tie projects to landscape plans are currently limited, especially across public/private boundaries. Examples of successful landowner aggregation are with existing watershed and firesafe groups and CFIP projects that aggregate landowners with less than 20 acres.

KEY CONCEPTS

The concept of "working landscapes" was developed to encompass the idea that lands used for commodity production also produce crucial ecosystem goods and services, and that future demands make it essential that these systems are managed for joint production of ecosystem services and food and fiber (Huntsinger and Sayre 2007).

The sustainability of working landscapes broadly has many environmental, economic and social dimensions. These were discussed at length in the previous forest and rangeland assessment. However, within this chapter the topic is addressed by examining a variety of issues under land use and land cover impacts, cultural resources, pesticide use, the condition of the forests and rangelands, their associated economic sectors, current and developing policy, and assistance to landowners and communities.

CURRENT STATUS AND TRENDS

Overview of Management Context

Management activities (or lack of them) can affect (positive, neutral or negative) land cover condition, forest health, soils and protection of special sites or qualities, such as habitat, scenic views or cultural resources. All of these things are elements that relate to overall sustainability.

In the case of forest management, possible impacts on land cover come from such things as site preparation, harvesting, regeneration activities (including application of herbicides), fuel reduction and fire suppression. Range effects can come from grazing intensity and other practices, water pollution from livestock and related factors. In the case of recreation, site disturbance and compaction can take place. Other impacts can spread exotic species and cause loss of or damage to historical and cultural resources.

There are many laws, policies and programs (both regulatory and non-regulatory) across a number of agencies that address conditions and impacts of land uses on forests and rangelands. The overarching laws are federal and state statutes that deal with clean air, clean water and endangered species. There are other federal and state laws that deal with development of plans or permits and emphasize advance public outreach, evaluation of project design, possible impacts and their mitigation.

Federally-owned forests and rangelands are managed by agencies such as the U.S. Forest Service, Bureau of Land Management, National Park Service, and the Department of Defense (DOD). The largest landowner in California is the U.S. Forest Service, whose Region 5 manages 18 national forests and one grassland comprising 20.4 million acres. The Bureau of Land Management (BLM) and National Park Service are the next largest at 14.6 and 7.2 million acres respectively. Each of the agencies operates under numerous federal laws, regulations and policies that require extensive planning, consideration of wide-ranging impacts, application of sound management practices and evaluation of results.

Focuses of the new federal administration include national forest planning, budgeting for fire protection, biomass and renewable energy supply and state and private forestry assessment. Key areas of concern for the U.S. Forest Service include clean and abundant water, wildlife habitat, recreation and biomass opportunities for local economies and climate change mitigation and adaptation. Restoration, roadless area protection, the loss of private forests to development and fragmentation and the need to keep forest ownership and stewardship economically viable are areas of emphasis (Vilsack, 2009).

Approximately 14 million acres in California are designated as wilderness. Major additions were made in 2006 and 2009. In 2006, President Bush approved a wilderness bill focused on 273,000 acres in Northern California. President Obama signed three bills in 2009 that designated approximately 700,000 additional acres as wilderness in Riverside, Tulare, Mono, Inyo, San Bernardino and Los Angeles Counties. Significant portions were in reserved status already. Wild and scenic river protection was a part of both efforts.

On non-federal forestlands in California, the basic regulatory structure is delineated in the California Forest Practice Act. Detailed forest practice rules have been developed that utilize management practices required under the rules or requested by reviewing agencies. Permits must be obtained based on plans prepared by licensed professional foresters. These documents cover planning, operational and post-harvest (such as reforestation) aspects of harvesting. They are reviewed by other state agencies such as the Department of Fish and Game (DFG), the California Geological Survey and Regional Water Quality Control Boards (RWQCBs). Both DFG and the RWQCBs have additional permit authorities that cover areas of concern to these agencies.

Management of non-federal rangelands is less regulatory. For example, water quality is largely addressed through education and voluntary practices. Information sharing and monitoring occurs through the California Rangeland Water Quality Management Plan. This was developed in collaboration with state and federal agencies, cooperative extension and landowners to provide for development and implementation of ranch water quality plans on a voluntary basis (SWRCB, 1995).

Herbicide use is regulated by the U.S. Environmental Protection Agency (EPA) and by the California Department of Pesticide Regulation (DPR). Under state and federal law, only certain herbicides are approved for use in forestry, rangeland and noxious weed control. The application requires a permit and a written recommendation of a pest control advisor and must be done under the supervision of state-certified applicators. DPR provides oversight that includes product evaluation and registration, environmental monitoring, residue testing of fresh produce and local use enforcement through County Agricultural Commissioners. See the DPR website for additional information (http://www.cdpr.ca.gov/index.htm).

Overview of Land Use and Land Cover Impacts on Forests and Rangelands

Land use and land cover (LULC) are commonly considered together when analyzing impacts and trends over time. Land cover refers to the physical material at the surface of the earth including water, rock, grass, forest, shrub, and constructed attributes such as pavement and buildings. Land use may be defined as the use that humans put to land. Note that land use is also a term used in zoning. The sustainability of forest and rangeland ecosystems and economies in California is a function of both land cover changes and land use impacts. Land use practices and measures that contribute to sustainability include Best Management Practices (BMPs), monitoring, balancing forest harvest and growth over time and other management practices.

Land cover change in California from 1973 to 2000 was examined as part of the U.S. Geological Survey Land Cover Trends research (Loveland et al., 2002; Sleeter et al., 2010). Sleeter et al. (2010), reporting by ecoregions, found that the greatest net loss occurred in grassland/shrubland types with a loss of 5,131 square kilometers over the 27 years (73.4 square miles per year or 47,000 acres per year). This loss occurred most dramatically in grazing lands within the Chaparral and Oak Woodland types and along the edges of the Central Valley due to conversion to vineyards, orchards and large housing tracts. While losses in forest cover were observed to be as high as seven percent in the Coast Range, most losses were considered temporary as they were attributed to natural (e.g., fire, drought, pests) and man-made disturbances (e.g., harvest).

Agricultural net land losses in the Chaparral and Oak Woodlands were estimated to be 858 square kilometers over the 27 years (12.3 square miles per year or 7,850 acres per year). Forest cutting was the largest conversion of type class identified, but peaked between 1986 and 1992 (Sleeter et al., 2010). Fire disturbance surpassed harvest between 1992 and 2000 with 60 percent of all fires mapped occurring in this time period. Most fire-related disturbance was in the Chaparral and Oak Woodlands and Sierra Nevada Mountain ecoregions. Developed land increased by over a third from 1973 to 2000 with 97 percent of the new developed lands coming from three ecoregions: the Central Valley, Chaparral and Oak Woodlands, and the Mojave Basin and Range (Sleeter et al., 2010).

Development threats to ecosystems were examined in Chapter 1.1. The land cover types and bioregions most at risk for development in the next 10 to 30 years generally coincide with those areas most impacted in the past. These include South Coast grassland, shrublands and chaparral; Bay/Delta grassland, woodland and hardwood and redwood forestland; and Sierra grassland, woodlands and lower elevation forests. Possible forest and rangeland management impacts are covered briefly later in this chapter.

Effects on forest and rangeland sustainability from LULC vary by bioregion and site-specific geographic factors such as soil type and topography. Recent reductions in economic activity in the forest and rangeland industries translates to reduced activity on the landscape, which may lessen some effects but increase some environmental risks; those associated with road maintenance and fuel loads for example. Permanent conversion resulting from an increasing population remains a major threat to working landscapes and open space and the amenities derived from them. This is likely to most directly affect areas already built up and along major transportation corridors.

Forest and Rangeland Management Impacts on Water Quality and Wildlife

To a large degree these impacts are covered in Chapter 2.1 and Chapter 3.5. However, a brief summary is provided here in the context of land use impacts of forest and rangeland management.

- Based on biotic indicators, a majority of the state's waters are in fair or good condition. Impacts related to rangeland or silviculture sources, as indicted by the 303d list, have not changed significantly from 2002 to 2006. The percentage of impaired streams that have rangeland grazing or silviculture as a factor is highest in the Lahontan and North Coast regions. However, the total impaired stream miles with these factors were greatest in the North Coast region. Cattle and sheep grazing in high elevation areas of the Sierras has been criticized for polluting lakes and streams with suggestions to restrict grazing to lower elevations (Knudson, 2010).
- A number of cooperative instream monitoring projects are under way in coast and inland watersheds including Caspar Creek (USFS-PSW and the California Department of Forestry and

Fire Protection (CAL FIRE)), Little Creek (Cal Poly-SLO), Judd Creek (Sierra Pacific Industries) and South Fork Wages Creek (Campbell Timberland Management). Monitoring activities are addressed by the State Board of Forestry's Monitoring Study Group (MSG). Road crossings have been identified by research and monitoring (Brandow et al., 2006; Cafferata and Munn, 2002; USFS, 2004) as likely potential sources of sediment to watercourses. In response, road inventories that prioritize work and programs to systematically address those priorities have been developed by larger forest landowners.

- Data collected for the MSG found that overall the rate of compliance with forest practice rules designed to protect water quality and aquatic habitat is generally high, and the rules are highly effective in preventing erosion, sedimentation and sediment transport to channels when properly implemented. There are specific areas where improvements in implementation or effectiveness could be made and these are enumerated with specific recommendations.
- In the case of water quality monitoring on national forest lands, results show that while some improvements are necessary, the program performed reasonably well in protecting water quality on national forest lands in California (Brandow et al., 2006). Effects classified as elevated were typically caused by lack of or inadequate implementation of good practices and most elevated effects were related to engineering practices. Roads, and in particular stream crossings, were found to be the most problematic.
- Unmanaged outdoor recreation often occurs near water or other sensitive sites and is associated with one-quarter of all imperiled species in the U.S. (Wilcove et al., 2000). Potential impacts include spread of invasive weeds, erosion, compaction, plant damage, wildlife disturbance and damage to cultural resources (Collins and Brown, 2007). The USFS identified about 14 thousand miles of unauthorized trails created by off-highway vehicle users in 2004 alone. Off-Highway Vehicle use is one of the fastest growing forms of outdoor recreation. Private property is also impacted by unmanaged outdoor recreation. Dumping is also a major problem in many forest and rangeland areas, with concomitant concerns for hazardous materials and impacts to water bodies.
- Impacts on fish and wildlife habitat can be both positive and negative. Management of forests or rangelands can enhance or recreate habitat or habitat elements required by individual or groups of species. Examples of negative impacts can include reduction of biodiversity, simplification or destruction of habitat (such as loss of seral stages or areas directly providing or linking habitats), removal of key habitat elements (such as nesting or feeding components), decreased connectivity of habitat, and increased threats to remaining habitats from fire, insects, disease and sedimentation. A detailed analysis is not covered by this statewide assessment, but can be found in documents such as the California Wildlife Action Plan (DFG, 2007a) or recovery plans for threatened and endangered wildlife or fish species.

Forest and Rangeland Management Impacts on Soils

The soil of forests and rangelands is fundamental to ecological and economic productivity. Erosion potential for timberlands involves such factors as the potential for surface erosion, debris slides and landslides. The Forest and Range 2003 Assessment identified low to moderate surface erosion and debris slide potentials on private timberlands with the Coast and Klamath regions tending to moderate. The area of highest landslide potential on private timberlands exists in the Coast Range Province. In the Klamath Province, the erosion potential is highly varied while in the Sierra Nevada, Modoc and Cascade Provinces, the potential generally is low. The Natural Resource Conservation Service has estimated erosion due to wind on non-federal pasture land in California at 0.4 tons per acre per year. Most rangeland management depends on monitoring the condition of rangeland vegetation and distributing animals to reduce grazing impacts.

Wildfire also can increase the chance of erosion due to wind and rain by removing vegetation, litter, and even creating a burned layer on top of the soil that resists penetration by water. Significant landslide activity from fire areas has impacted homes and infrastructure, most recently in Southern California. Post-fire mitigation practices reduce risk, but may be overwhelmed by severe storms in combination with topographic and edaphic factors.

There has been a growing consensus that better measures are needed concerning the impact of management activities on soil biota and other factors related to soil productivity. This has led to the creation of the North American Long-Term Soil Productivity cooperative research program. The objectives of the program are to:

- define how site carrying capacity is related to changes in soil porosity and organic matter,
- develop an understanding of the controlling natural process,
- produce practical, soil based measures for monitoring changes in site carrying capacity and
- develop generalized estimation models for site carrying capacity, subject to soil and climatic variables.

Forest and Rangeland Management Impacts on Cultural, Historical and Related Values

Many prehistoric and historic archaeological sites, features and artifacts are found on forests and rangelands. Preservation and protection of such sites is part of sustainability. Examples include Native American villages and campsites, petroglyphs, milling stations, housepits and places of cultural importance to Native California Indians such as gathering areas, dance grounds and religious/sacred sites. Historical resources include a variety of structures, buildings, towns, mining features, logging camps, sawmills, cemeteries, trails or roads and artifacts.

No statewide data layer is available that summarizes the location of these resources and from which to create a priority landscape. These resources are a priority to identify and protect as part of any program of sustainable forest and rangeland management. In many cases and for a number of reasons, information on existing prehistoric, historic, ethnographic, and paleontological resources is often limited in its dissemination.

Threats to these resources include the following.

- Resource management and fire suppression activities, as well as development and other land uses.
- Fire under some circumstances can destroy or damage cultural or historic resources and sometimes alter native plant communities and lead to infestation by exotic invasive plants. Increased visibility of the ground surface may expose site constituents to damage or to collection of artifacts by the public.
- Mechanical treatment can dislodge and damage resources.
- Grazing animals, especially large, heavy animals such as cattle can dislodge and damage cultural resources.
- Application of herbicides can harm traditional use plants, or threaten the health of the people gathering, handling or ingesting recently treated plants, fish or wildlife that are contaminated with herbicides (California Indian Basketweavers' Association, 2007).

Some of these impacts can be helpful to the resources. For example, fire can be used to combat the recent invasion of forest or chaparral vegetation into original grassland settings of a region or remove overgrown brush from historic trails. For traditional Native American practices, fire and burning can be essential to the growth of native plants used for food, medicine or craft manufacture.

Cultural and historical resources are managed and protected by various governmental agencies for their cultural, historical, scientific, educational, recreational, and other values in response to a variety of state and federal mandates. For example, CAL FIRE is mandated to identify and protect archaeological, historical and other cultural resources located within its jurisdiction by applicable sections of the Public Resources Code, California Forest Practice Rules, the Government Code, and Health and Safety Code, as well as those of the California Environmental Quality Act (CEQA) Statutes, CEQA Guidelines, and California Executive Order W-26-92 mandate (Foster, 2006).

To varying degrees, governmental agencies collaborate and consult with native peoples and others interested in protection of cultural or historical sites. This outreach is especially critical for understanding needs and in helping to identify and protect key sites. A number of approaches are involved, such as training, education, development of management plans, on-the-ground surveys, specific consultation or notification, pre-field research, development of protective measures, recording of sites, and completion of archaeological reconnaissance reports. Recognition and protection of historic and cultural sites, as well as maintenance and strengthening of associated programs is a key element of sustainable landscapes.

Management activities (or lack of them) can affect (positive, neutral or negative) land cover condition, productivity, and protection of special sites or qualities, such as habitat, scenic views or cultural resources. All of these things are elements that can relate to sustainability.

Forest and Rangeland Herbicide Use

Herbicides are a variety of chemicals used to control brush and grasses and are primarily used for maintenance of areas that have been previously cleared of vegetation. The periodic application of herbicides inhibits or slows the re-growth of vegetation. Herbicides are often used on forests and rangelands to control competing and undesirable plant species and to allow commercially valuable species the opportunity to maximize growth. Pre-emergent herbicides are used to inhibit seed germination or reduce seedling survival. Post-emergent herbicides kill established plants, so that a sufficient dose applied to a part of the plant will kill, or inhibit growth in the entire plant. Aerial herbicide application is sometimes used where broadcast treatment is required to control competition from brush and undesirable species over large areas. Commonly used herbicides in forest and rangeland management include: Glyphosate, Triclopyr, 2,4-Dichlorophenoxyacetic Acid (2,4-D), Atrazine, Hexazinone, Imazapyr and Clopyralid.

Public concern about the toxicity of herbicides and other chemicals potentially used in forest and rangeland applications centers on the effects on non-target organisms. The range of potential impacts and toxicity from herbicide use in forests and rangelands is quite varied. Concerns relate to potential impacts of chemical constituents on: surface water or groundwater; synergistic effects of herbicide mixtures where toxicity of chemicals and additives combine; toxicity of surfactants (additives that increase absorption and adherence to plant material) especially with respect to aquatic organisms; chemical-induced impairment of the nervous system; and disruption of the endocrine systems of organisms. There is also concern over impacts of herbicides on gathering and use of plants for traditional uses by Native Americans.

Concerns over the impact of chemical constituents have been especially at issue in the case of threatened and endangered species. In the last decade, several lawsuits have been filed in California and elsewhere against the U.S. Environmental Protection Agency that raise issues about failure to consult with appropriate agencies over the impacts of pesticides on listed species. Courts have acted to place restrictions on the use of specified pesticides in relationship to species of special concern. For example, in 2004, the U.S. District Court for the Western District of Washington at Seattle imposed no-use buffer zones around salmon-supporting waters in Washington, Oregon, and California for certain pesticides (http://www.cdpr.ca.gov/docs/endspec/salmonid.htm). In 2006, the U.S. District Court for the Northern District of California imposed no-use buffer zones around California red-legged frog upland and aquatic habitats for certain pesticides (http://www.cdpr.ca.gov/docs/endspec/rl_frog/index.htm). In both cases, restrictions and buffer zones applied to some areas with forest and rangeland.

Current herbicide use represents the environmental baseline for forests and rangelands in California. The following paragraphs discuss the extent of herbicide use statewide and by bioregion. The information presented is this section was obtained through the DPR website (http://www.cdpr.ca.gov/docs/pur/purmain.htm). The USFS also provides summaries of pesticide use on national forest lands (http://www.fs.fed.us/r5/spf/publications/pesticide). The amount of herbicide use reported in Tables 1.2.1 and 1.2.2 are in pounds of Active Ingredients (AI). The AI represents the portion of the herbicide that is being applied to vegetation to remove weeds or undesired vegetation.

Commercial pesticide use in California has been estimated by California Department of Pesticide Regulation (DPR) at 150 million pounds in 2008. Agriculture accounts for the predominate use of pesticides, but pesticides are also applied to forests and rangelands and other areas requiring vegetation management. Overall pesticide use varies from year to year; the amount is influenced by current pest problems, weather, types of crops grown, and what new chemicals become available (DPR, 1997).

In 2008, forestry on private lands accounted for 359,147 pounds applied, representing less than one percent of total use statewide. Rangeland use was very small. Year to year variation in herbicide use is shown in Table 1.2.1.

Data on herbicide use was further summarized using county-based bioregions for the entire state (Table 1.2.2). With over 100 million pounds of herbicides applied to predominately agricultural lands (non-forest and range), the San Joaquin Valley bioregion had the highest concentration of herbicide use among all bioregions. Herbicide use on forestlands

Table 1.2.1. Trends in pesticide use from 2005 to 2008

Year	Forestland (lbs)	Rangeland (lbs)	Total Statewide (lbs)	Forestland (Percent)	Rangeland (Percent)
2005	209,672	16,633	136,929,825	0.15	0.01
2006	348,576	12,286	110,100,422	0.32	0.01
2007	1,411,534	19,476	161,362,646	0.87	0.01
2008	359,147	20,764	149,566,938	0.24	0.01
Data Source: California Department of Pesticide Regulation, 2008					

Table 1.2.2. Pesticide use on private lands summarized by bioregion based on county data

Bioregion	Forestland (lbs)	Rangeland (lbs)	Region Total (lbs)	Forestland (Percent)	Rangeland (Percent)	Region Total (Percent)
Bay/Delta	633	1,132	6,531,690	0.01	0.02	4.37
Klamath/North Coast	256,401	206	2,976,390	8.61	0.01	1.99
Central Coast	42	5,153	22,765,030	0.00	0.02	15.22
South Coast	575	144	4,598,151	0.01	0.00	3.07
Modoc	3,172	2,818	500,309	0.63	0.56	0.33
Sacramento Valley	40,026	855	14,581,711	0.27	0.01	9.75
San Joaquin Valley	255	2,887	91,171,557	0.00	0.00	60.96
Sierra	57,790	59	531,456	10.87	0.01	0.36
Mojave	252	1,704	2,391,062	0.01	0.07	1.60
Colorado Desert	0	5,806	3,519,582	0.00	0.16	2.35
Total	359,147	20,764	149,566,938	0.24	0.01	100.00
Data Source: California Department of Pesticide Regulation, 2008						

was concentrated mainly in the North Coast, Sierra, and Sacramento Valley bioregions. These three bioregions collectively accounted for over 98 percent of all herbicide use associated with forestry in 2008. Within the North Coast bioregion 256,401 pounds of pesticides were used in 2008. The Sierra bioregion also had significant herbicide usage with 57,790 pounds applied. The Sacramento Valley bioregion accounted for 11 percent of the pesticide usage in forestry.

The U.S. Forest Service annually reports data on pesticide and herbicide use on national forests and rangelands. However, the most recent estimate compiled by CAL FIRE was for 2004. In this year, the U.S. Forest Service reported that herbicides totaling 17,247 pounds of active ingredients were applied on 4,419 acres of forests and rangeland. The most commonly used herbicide was Glyphosate (99 percent of herbicides applied) comprising 93 percent of the area treated. The most common herbicide treatment on national forests in California in 2004 was for conifer release (70 percent) aquatic weed control (13 percent) and site preparation (11 percent).

The Bureau of Land Management also uses herbicide for vegetation management on public lands in California. Between 2002 and 2005 BLM treated an average of 2,245 acres annually using an average 2,079 pounds of herbicides.

FORESTS AND WOODLANDS

Forestland Condition

Ownership and Net Volume

The basic source of information on forests and woodlands is the Forest Inventory and Analysis Program (FIA) of the U.S. Forest Service. This program has been fundamentally restructured and this complicates decadal trend analysis. However, FIA has published information (Christensen et al., 2008) on the first five years of annual plot measurements done under the restructure.

The estimated area of forestland by ownership class is shown in Table 1.2.3 based on 2001–2007 FIA data. Timberland is a subset of forestland and is defined as lands capable of producing in excess of 20 cubic feet/acre/year at its maximum production. Non-industrial private forestland is about two-thirds of the private forestland, or about 8.5 million acres.

Adding two additional years of plots in the 10-year inventory cycle of FIA (Forest Inventory Data Online (FIDO)) caused a revised estimate of net cubic volume of 99,203 million cubic feet from 95,547 million cubic feet (Christensen et al., 2008). Using the online FIDO query with two more years of data, the standard error improved from 2.1 percent of the estimate to 1.7 percent. Table 1.2.4 shows the net cubic volume estimates by ownership class and reserve status. About two-thirds of the volume is on public lands, mostly federal.

Table 1.2.3. Estimated area of forestland, by owner class and forestland status, 2001–2007 (acres in thousands)

	Unreserved Forests			Reserved	
Owner Class	Timberland	Other Forest	Total	Forests	Total
National Forest	9,794	2,516	12,310	3,611	15,921
National Parks	0	0	0	1,312	1,312
BLM	471	892	1,363	277	1,640
Other Federal	44	143	187	111	298
Total Federal	10,309	3,551	13,860	5,311	19,171
State	138	118	202	509	711
Local	110	156	266	108	374
Total Private	8,780	4,351	13,131	0	13,131
All Owners	19,337	8,122	27,459	5,928	33,387

Data Source: USFS Forest Inventory and Analysis, 2001–2007

Table 1.2.4. Net tree volume (in millions of cubic feet) on forestland by ownership and reserve status

Ownership	Not Reserved	Reserved	Total
National Forest	41,817	13,041	54,858
National Parks	0	5,907	5,907
BLM	1,308	196	1,504
Other Federal	116	355	471
Total Federal	43,241	19,499	62,740
State	898	3,532	4,429
Local (county, municipal, etc)	579	388	967
Total Private	31,066	0	31,066
All Owners	75,784	23,419	99,203
Data Source: USFS Forest Inventory and Analysis, 2001–2007			

Estimated Carbon

A 100-year projection of alternative carbon inventory scenarios, assuming various management inputs, was conducted for U.S. Forest Service lands in California (Goines and Nechodom, 2009). Results from this report provide estimates of expected and potential carbon sequestration and storage on U.S. Forest Service lands in California. The carbon analysis conducted on Forest Service lands in California (Goines and Nechodom, 2009) estimates that in 2007, 20.2 million acres held nearly 620 million tons of carbon in live tree biomass. The standing stocks in 2100 could be lower or higher than current levels depending on policy alternatives (Figure 1.2.1). In most cases there is active sequestration over the next 50 years before a decline to near current levels.

To estimate the current carbon storage and sequestration on forestlands in California, the following analysis was conducted. FIA plots (USFS, 2008) from seven years of annual inventories (2001–2007) were processed to calculate current carbon storage and sequestration on all forestlands, both private and public, and private non-reserved timberlands. The four variants of the Forest Vegetation Simulator (FVS) were used to estimate growth and mortality of plots (Ritchie, 1999). The plots were grown for the standard 10-year increment. Carbon storage and change were calculated for live tree, above and below ground portions for trees greater than or equal to five inches diameter at breast height using the FIA regional volume and biomass functions (USFS, 2009a and 2009b). While this analysis contains many of the key elements, this analysis is not a full forestry sector inventory.

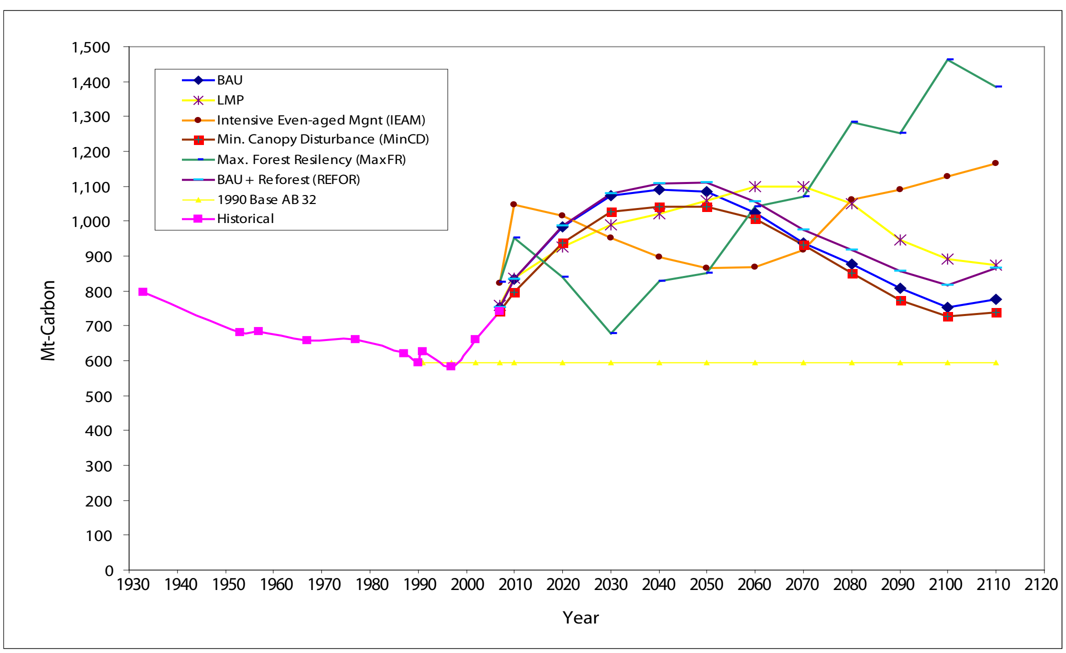


Figure 1.2.1.
Results from U.S. Forest Service analysis of projected carbon stocks on national forests in California.
Source: Goines and Nechodom, 2009

Emissions were estimated for mortality, wildfire, and harvest. Wildfire emission estimates were based on California Air Resources Board (ARB) emissions estimates that were prorated to private/public and forest/non-forest categories using 10-year fire history data. A CO2/CO ratio of 13 was used (Klaus Scott, personal communication). Harvest emissions from bole wood were estimated from 10-year average Board of Equalization data and U.S. Department of Energy (DOE) 1605(b) conversion factors. Non-merchantable emissions were estimated using harvest efficiency along with top, stump and root relationships to the bole (Cairns et al., 1997; Christensen et al., 2008). Storage due to wood products in-use and landfill were calculated based on the 10-year average storage from the DOE 1605(b) emission inventory technical guidelines for voluntary reporting of greenhouse gases (DOE, 2007 Part I). The results of the carbon stocks and sequestration analysis are presented by land base type in Tables 1.2.5 through 1.2.8.

Tables 1.2.9 and 1.2.10 show the total and per acre values of carbon dioxide equivalent (CO2e) and other measures, respectively, of storage and net annual change from tree growth and mortality (Table 1.2.10).

This analysis is an inventory compilation and modeling exercise with unknown error. Christensen et al. (2008) estimated the aboveground live tree carbon per acre as 33.7 tons (30.6 metric tons). The estimate of aboveground live tree carbon from this analysis is 31.1 metric tons of carbon per acre, which compares favorably as a check on the analysis. Hudiburg et al. (2009) estimate average stocks of 6.5 to 19 kilograms per square meter across Northern California and Oregon, which equates to 96.5 to 282.2 metric tons CO2e per acre. This estimate brackets the values in this report. The FVS growth models used in this analysis were developed primarily from data on national forests and are used for long-term planning on national forests. Intensively managed forests, as found on many private timberlands, will likely have growth underestimated and mortality overestimated. Coast redwood, which is primarily

Table 1.2.5. Carbon sequestration analysis results for all forestlands (32,114,317 acres)

Source	Type	Carbon (metric tons)	CO2e (metric tons)
Growth	Storage	-16,367,285	-60,067,936
Model Mortality	Emission	5,455,351	20,021,137
Wildfire	Emission	1,719,915	6,312,087
Harvest (merch)*	Emission	565,315	2,074,706
Harvest (non-merch)	Emission	791,776	2,905,819
WP (in-use)	Pool	-389,436	-1,429,231
WP (landfill)	Pool	-48,796	-179,081
Net		-8,273,161	-30,362,499
*Reduced by 22.8% for salvage (10-yr avg) duplication			

Table 1.2.6. Carbon sequestration analysis results for public forestlands (19,467,566 acres)

Source	Type	Carbon (metric tons)	CO2e (metric tons)
Growth	Storage	-12,660,007	-46,462,226
Model Mortality	Emission	4,319,121	15,851,175
Wildfire	Emission	1,415,436	5,194,651
Harvest (merch)*	Emission	40,703	149,379
Harvest (non-merch)	Emission	57,008	209,219
WP (in-use)	Pool	-28,039	-102,905
WP (landfill)	Pool	-3,513	-12,894
Net		-6,859,292	-25,173,600
*Reduced by 22.8% for salvage (10-year average) duplication			

Table 1.2.7. Carbon sequestration analysis results for private forestlands (12,646,761 acres)

Source	Type	Carbon (metric tons)	CO2e (metric tons)
Growth	Storage	-3,708,104	-13,608,743
Model Mortality	Emission	1,136,233	4,169,977
Wildfire	Emission	304,478	1,117,436
Harvest (merch)*	Emission	524,612	1,925,327
Harvest (non-merch)	Emission	734,768	2,696,600
WP (in-use)	Pool	-361,397	-1,326,326
WP (landfill)	Pool	-45,283	-166,188
Net		-1,414,691	-5,191,917
*Reduced by 22.8% for salvage (10-year average) duplication			

Table 1.2.8. Carbon sequestration analysis results for private timberlands (7,647,009 acres)

Source	Type	Carbon (metric tons)	CO2e (metric tons)
Growth	Storage	-3,603,556	-13,225,049
Model Mortality	Emission	1,010,508	3,708,564
Wildfire	Emission	184,106	675,670
Harvest (merch)*	Emission	524,612	1,925,327
Harvest (non-merch)	Emission	734,768	2,696,600
WP (in-use)	Pool	-361,397	-1,326,326
WP (landfill)	Pool	-45,283	-166,188
Net		-1,556,240	-5,711,402
*Reduced by 22.8% for salvage (10-year average) duplication			

Table 1.2.9 Total live tree stocks and estimated annual change from tree growth and mortality

		Stocks				Change, Net of Mortality			
Landbase	Acres	CO2e (metric tons)	Cubic Feet (thousands)	Board Feet (thousands)	Number of Trees	CO2e (metric tons)	Cubic Feet (thousands)	Board Feet (thousands)	Number of Trees
All Forestlands	32,114,317	5,099,162,048	113,695,755	447,709,621	10,058,521,955	40,046,799	1,419,806	5,764,470	-58,328,612
Public Forestland	19,467,566	3,343,515,541	76,368,749	340,794,682	5,685,834,310	30,611,051	751,107	3,438,690	-38,089,971
Private Forestland	12,646,761	1,755,647,124	37,327,502	106,914,068	4,372,687,646	9,438,766	668,726	2,325,853	-20,237,568
Private Timberland	7,647,009	1,418,463,058	31,054,447	103,118,272	4,364,675,374	9,516,486	591,411	2,242,743	-17,094,787

Table 1.2.10. Per acre live tree stocks and estimated annual change from tree growth and mortality

	Stocks					Change, Net of Mortality				
Landbase	CO2e (metric tons)	Cubic Feet (thousands)	Board Feet (thousands)	Number of Trees	Stand Density Index	CO2e (metric tons)	Cubic Feet (thousands)	Board Feet (thousands)	Number of Trees	Stand Density Index
All Forestlands	158.8	3.5	13.9	313.2	214.1	1.247	0.044	0.179	-1.816	2.422
Public Forestland	171.7	3.9	17.5	292.1	225.1	1.572	0.039	0.177	-1.957	2.015
Private Forestland	138.8	3	8.5	345.8	197.1	0.746	0.053	0.184	-1.6	3.05
Private Timberland	185.5	4.1	13.5	570.8	258	1.244	0.077	0.293	-2.235	4.189

privately owned, is missing from FVS; the other softwoods category was used as a surrogate. Therefore, the private lands estimates should be considered a lower range of possible results, particularly for the coast redwood region and for plantations.

The differences in the public and private lands may be a function of stand age as well as productivity. Hudiburg et al. (2009) showed that there are marked differences in stand age distributions, with private lands having substantially younger stands. A recent U.S. Forest Service analysis (Goines and Nechodom, 2009) showed that while national forests are currently sequestering a substantial amount of carbon, there are long-term risks associated with storage given disturbance and management assumptions. Consideration should be given to both the amounts of carbon sequestered and the probability of long-term storage. Potential long-term sustainable carbon storage on private lands needs further analysis. Hudiburg et al. (2009) estimates that total landscape stocks in Oregon and Northern California could theoretically be increased by 46 percent. The relative amount of currents stocks to long-term sustainable stocks is of considerable policy interest and needs further study.

Growth and Harvest

One key indicator of forest sustainability is the growing stock and removals relative to growth over time. Estimates of growth, mortality and removal based on FIA data collected from 2001 to 2005 showed that growth was statistically the same or exceeded mortality and removals for public and private landowner classes (Christensen et al., 2008). The largest increase in inventory was on national forest lands although on the average they tend to be less productive. Improved estimates of changes in growth, mortality and removal will be available in the next few years as remeasurements of plots are completed and analyzed.

While only a partial measure, another possible indicator is the amount and type of timber harvesting occurring. Relatively little harvesting has taken place on federal lands. Table 1.2.11 shows the average annual acres of even-aged, intermediate, uneven-aged, and total silviculture by county. The groupings of silviculture are done to be consistent with the classifications in the California Forest Practice Rules. Counties with total harvesting over three percent included Glenn, Modoc and Sierra Counties, which had mostly intermediate harvest types in aggregate. Overall, the average annual harvest covered 1.64 percent of private timberland acres with even-aged, intermediate and uneven-aged silvicultural practices

Table 1.2.11. Acres and percent of silvicultural type by county for private timberland harvest averaged over 10 years (2000–2009).

	Acres of Timberland					Percent of Timberland			
County	Even-Aged	Intermediate	Uneven-Aged	Total	Private	Even-Aged	Intermediate	Uneven-Aged	Total
Alpine		10	18	28	11,678	0.00	0.09	0.15	0.24
Amador	669	243	176	1,088	120,344	0.56	0.20	0.15	0.90
Butte	2,404	677	441	3,523	265,310	0.91	0.26	0.17	1.33
Calaveras	1,373	350	818	2,541	210,304	0.65	0.17	0.39	1.21
Del Norte	880	216	234	1,329	106,023	0.83	0.20	0.22	1.25
El Dorado	3,618	863	732	5,213	369,048	0.98	0.23	0.20	1.41
Fresno		110	1,683	1,792	95,663	0.00	0.11	1.76	1.87
Glenn	320		16	336	5,381	5.95	0.00	0.30	6.24
Humboldt	8,965	2,611	4,226	15,802	1,234,885	0.73	0.21	0.34	1.28
Kern		267	767	1,034	149,044	0.00	0.18	0.51	0.69
Lake	278	104	282	664	100,104	0.28	0.10	0.28	0.66
Lassen	4,262	1,681	5,001	10,944	369,109	1.15	0.46	1.35	2.97
Madera		10	164	174	88,006	0.00	0.01	0.19	0.20
Marin	200	93	372	664	35,850	0.56	0.26	1.04	1.85
Mendocino	6,031	2,611	7,463	16,105	1,408,582	0.43	0.19	0.53	1.14
Modoc	2,320	5,732	2,755	10,807	224,758	1.03	2.55	1.23	4.81
Napa	2	64	29	95	108,598	0.00	0.06	0.03	0.09
Nevada	1,268	766	1,553	3,586	288,256	0.44	0.27	0.54	1.24
Placer	1,619	1,193	1,457	4,269	239,259	0.68	0.50	0.61	1.78
Plumas	1,301	1,600	2,463	5,364	309,628	0.42	0.52	0.80	1.73
San Bernardino		16		16	48,325	0.00	0.03	0.00	0.03
San Mateo		5	496	501	40,342	0.00	0.01	1.23	1.24
Santa Clara			261	261	43,223	0.00	0.00	0.60	0.60
Santa Cruz		15	1,047	1,062	114,380	0.00	0.01	0.92	0.93
Shasta	9,295	4,026	8,982	22,304	832,702	1.12	0.48	1.08	2.68
Sierra	834	1,077	1,746	3,657	110,625	0.75	0.97	1.58	3.31
Siskiyou	8,867	5,483	5,431	19,780	836,828	1.06	0.66	0.65	2.36
Sonoma	399	213	828	1,440	433,352	0.09	0.05	0.19	0.33
Tehama	3,400	575	1,407	5,382	259,027	1.31	0.22	0.54	2.08
Trinity	5,414	760	871	7,045	428,952	1.26	0.18	0.20	1.64
Tulare		227	182	409	94,992	0.00	0.24	0.19	0.43
Tuolumne	934	407	1,010	2,351	159,905	0.58	0.25	0.63	1.47
Yuba	955	576	575	2,107	85,066	1.12	0.68	0.68	2.48
Total	65,608	32,580	53,487	151,675	9,227,549	0.71	0.35	0.58	1.64

Data Source: CAL FIRE Forest Practice Database, 2009

accounting for 0.71, 0.35 and 0.58 percent respectively. 1.64 percent harvest coverage approximately equates to an average 61-year return interval.

Stand Condition

The 2001–2007 FIA data for California was queried (FIDO, 2010) to produce a graph (Figure 1.2.2) of forest biomass by landowner and stand age classes and a table on snag density by landowner and diameter classes (Table 1.2.12). This information is presented in a statewide aggregated form across reserve status, ecological types and management history, which is useful for general use and is not specific to individual ownership.

Private forestlands have an age distribution that is generally younger than public lands. This is a function of historic logging, forest types, productivity and current management objectives. Correlation of stand structural elements and stand age is expected, resulting in lower densities in more intensively managed forests. This generalization is confirmed in Table 1.2.12. Private forestlands have on average about half the snag density as Forest Service lands. The relative distribution of snags across tree sizes is similar

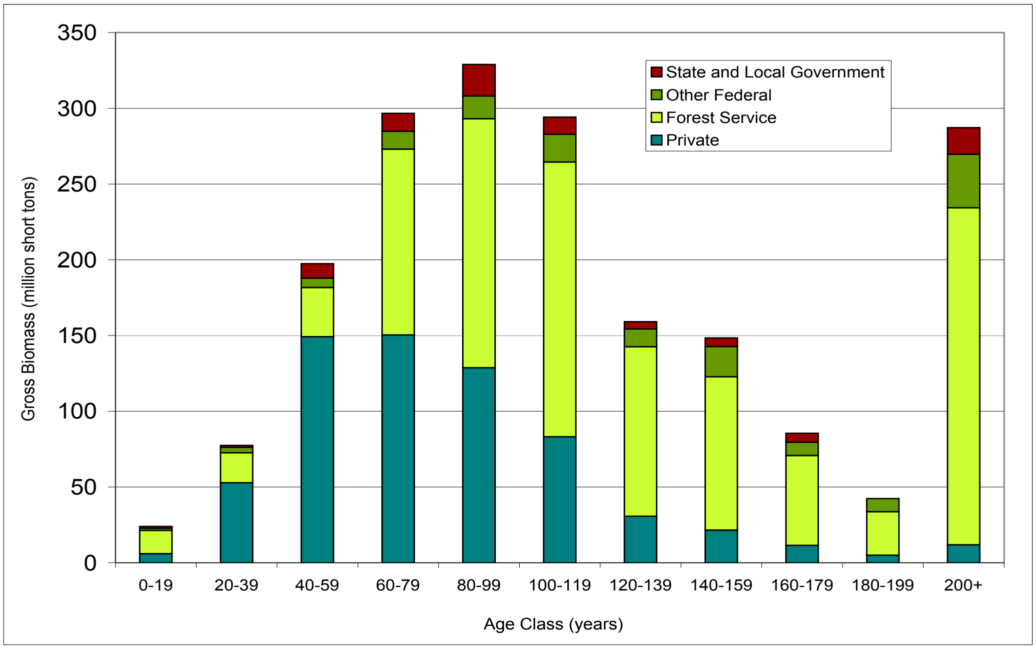


Figure 1.2.2.
Gross tree biomass by stand age class and ownership group.
Data Source: USFS Forest Inventory and Analysis, 2001–2007

across all ownership categories. Snags and other dead wood perform as both an asset (e.g., nutrient cycling, habitat) and as a risk factor (e.g., fuel, brood material) to a particular stand. Reconciling these competing functions with landowner objectives presents a management and regulatory challenge at the landscape planning and project levels.

Condition of the Forest Products Sector

Timber production in California had stabilized in the early part of the last decade but has experienced a significant decline in the last few years (Table 1.2.13, Figure 1.2.3). This trend is expected to continue into 2010 due to the economic slowdown. The proportion of volume from public lands appears to have stabilized at a relatively low level (Figure 1.2.4).

The bankruptcy and transfer of the Pacific Lumber Company (PALCO) to the Mendocino Redwood Company in 2008 marked the end of a change in ownership configuration of large industrial forestlands in California from publicly traded to privately held companies. A national trend has been for integrated forest products companies to divest of their timberlands, often selling to timberland investment management organizations (TIMOs) or real estate investment trusts (REITs). These organizations manage the lands as an investment rather than as a raw material source for sawmills and may therefore have a higher propensity to subdivide and sell parcels for development. About 10 percent of private corporate forestlands, or 344,000 acres, in California are held by TIMOs or REITs (Christensen et al., 2008).

The National Woodland Owner Survey, which is a mail-in form-based survey by FIA, was last conducted in 2004. A summary of results is presented on page 18 of Christensen et al. (2008). For landowners with 500 acres or less, which fits many recent Non-Industrial Timber Management Plan (NTMP) sizes, timber, firewood or other forest product harvests were a significant activity for many. Three-quarters use their land as part of their primary residence and have lived there for many years. Significantly, 84 percent were over 55 years of age and were concerned with passing the land to their heirs. Fire, trespassing, exotic plants and property taxes were the other top concerns.

Table 1.2.12. Snag density (trees per acre) by tree diameter class and ownership group

Tree Diameter Classification	Ownership Group				Average of all Ownerships
	U.S. Forest Service	Other Federal	State and Local Government	Private	
5.0–6.9	11.4	9.6	9.8	7.2	9.5
7.0–8.9	10.0	9.9	6.0	5.1	7.8
9–10.9	2.6	1.8	1.8	1.4	2.0
11–12.9	1.9	1.5	1.6	0.9	1.5
13–14.9	1.5	1.3	0.9	0.6	1.1
15–16.9	1.2	1.1	1.3	0.6	0.9
17–18.9	1.0	0.9	0.5	0.3	0.7
19–20.9	1.0	0.7	0.5	0.3	0.7
21–28.9	2.5	2.2	1.4	0.9	1.8
29+	2.3	2.3	1.9	1.3	2.0
Total	17.8	12.4	12.5	9.3	13.7

Data Source: USFS Forest Inventory and Analysis, 2001–2007

Table 1.2.13. Volume (million board feet) and value from timber production in California

Species	2000	2001	2002	2003	2004	2005	2006	2007	2008
Douglas-fir and Larch	1,080	922	825	761	889	871	770	630	545
Hemlock-Fir	774	650	685	753	781	713	709	682	532
Other Mixed Softwood	741	672	570	609	545	628	557	565	553
Redwood	578	488	554	532	548	476	554	433	290
WWPA Volume	3,173	2,732	2,634	2,655	2,763	2,688	2,590	2,310	1,920
BOE Volume	1,966	1,603	1,690	1,663	1,706	1,725	1,631	1,626	1,372
WWPA Value (wholesale)	$1,362	$1,128	$1,114	$1,015	$1,287	$1,248	$1,186	$1,040	$508
BOE Value (stumpage)	$909	$575	$452	$448	$501	$547	$534	$475	$323

Data Sources: 2008 Statistical Yearbook of the Western Lumber Industry (WWPA) and California State Board of Equalization, 2009.

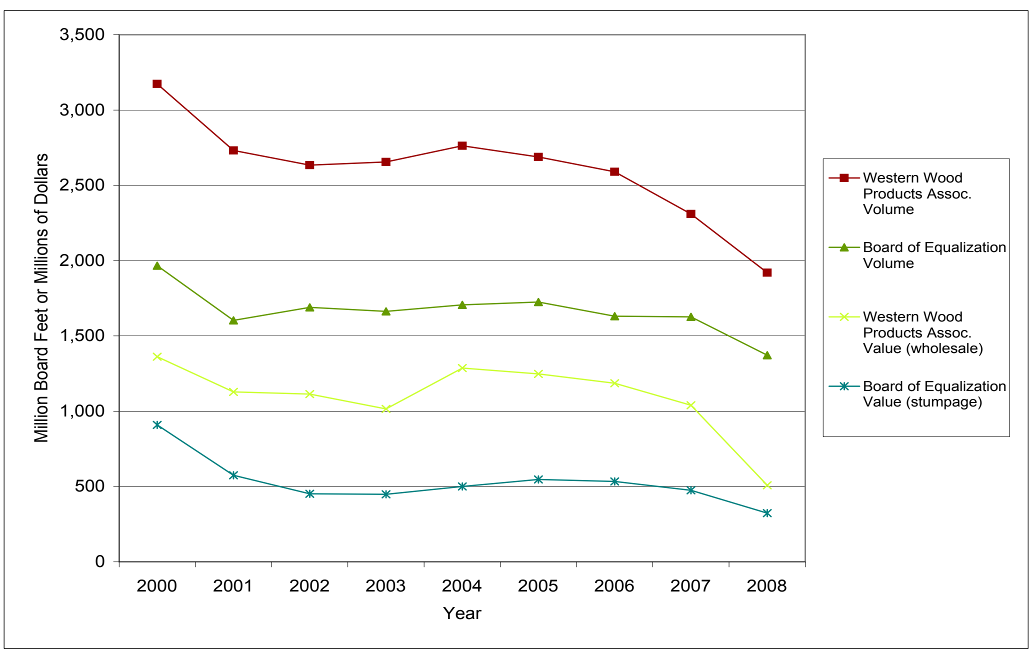


Figure 1.2.3.
Volume and value trends for California timber products.
Data Sources: Western Wood Products Association, 2009; California State Board of Equalization, 2009

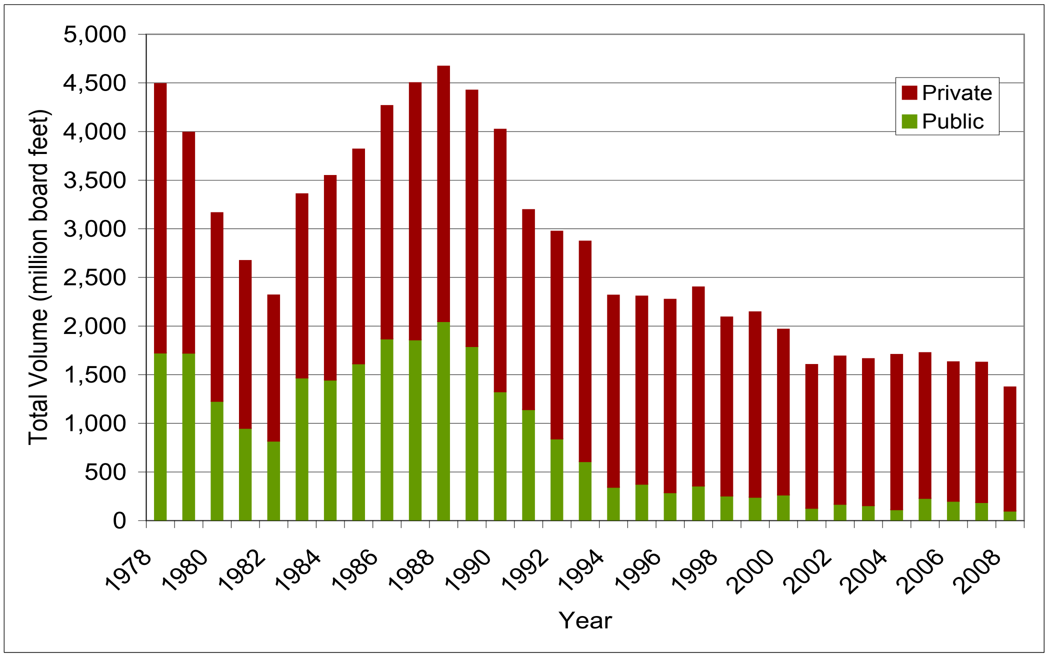


Figure 1.2.4.
Annual timber volume from private and public lands.
Data Source: Timber Tax Program, California State Board of Equalization, 2009

On non-federal lands, harvesting permits are tied to the approval of a harvesting plan. The most common plan is the Timber Harvesting Plan (THP). The other plan, that is used by ownerships of 2,500 acres or less and is more long term, is the NTMP. Costs of preparing both of these kinds of plans have risen dramatically in the last decade. At the same time, both THP and NTMP numbers have been decreasing. The size of THPs has been increasing with a fairly constant number of acres under plan, although 2009 has seen a dramatic drop-off in THPs due to the economic recession. NTMP average size has been decreasing over the last decade.

Data is available that shows what silvicultural prescriptions have been used in THPs over time in the state by CAL FIRE forest region. There are standard silvicultural prescriptions and alternative prescriptions, which are defined to be closest to a given standard prescription. Table 1.2.14 shows the statewide trend in use of standard silvicultural prescriptions over the last decade. Standard prescriptions show a relatively constant level of clearcutting, group selection, single tree selection and conversion. Commercial thinning acres dropped significantly in 2005 and have stayed low. Rehabilitation, sanitation/salvage, seed tree removal, shelterwood removal, and transition have declined in acreage over time. Variable retention, which was a newly adopted practice in 2000, has recently been around 1,100 acres per year.

Jobs associated with the forest products industry are tied to economic cycles and also show a downward trend (Figure 1.2.5) associated with a decline in capacity and increases in mill and logging efficiency. Softwood sawmill capacity in the western United States declined approximately eight percent from 2007–2009 with the permanent loss of 25 sawmills and the opening of three large sawmills in the Pacific Northwest (Spelter et al., 2009). In California, the loss in capacity during this time was 25 percent.

Discussion

California's forests are as diverse as their ecosystems. These forests include coastal rainforests, oak savannas, mixed conifer, high elevation fir, dry pine, and unique communities including pigmy forests on coastal terraces, giant sequoias in the Sierras (the largest trees on earth), subalpine bristlecone pine (the oldest trees), and coast redwoods (the tallest trees). The forests of California are relied upon for a vast array of ecological services and commodities. California is one of the top wood products producing states (Adams et al., 2006). Non-reserved private and public forestlands are about equally represented at 13 million acres each. Most of the wood supply from California forestlands, however, is from private lands.

California forests produce relatively high quality softwood products, such as dimensional lumber, molding and decking. Many of the large forestland ownerships are part of integrated operations that include sawmills and sometimes secondary manufacturing, although timberlands may be held by separate companies than mills. The national trend of the disposition of timberlands from formerly integrated forest products companies is not as common in California. Large industrial timberland ownership in California is concentrated in long-term family oriented corporations, which appears beneficial to long-term forest and rural economic sustainability. The concentration of milling facilities and general reduction in production capacity, however, will continue to limit the economic feasibility of operations over increasing geographic areas of the state. This may in turn affect the ability to conduct beneficial treatments, increasing risk over landscapes. Revenue reductions to landowners may impact working landscapes by increasing the economic attractiveness, or necessity, of alternative uses.

Private non-corporate forest landowners control a quarter of the state's timberlands. The size of these properties makes them particularly sensitive to costs and geographically dependent on local revenue opportunities. The stabilization of the existing wood products infrastructure, increased opportunities from emerging ecosystem services markets, regulatory compliance costs, and

Table 1.2.14. Acres of standard silvicultural prescriptions on private timberlands in THPs by year

Year	Clearcut	Commercial Thin	Conversion	Fuelbreak/ Defensible Space	Group Selection	Rehabilitation	Right-of-Way (Road Construction)	Sanitation-Salvage	Seed Tree Removal	Seed Tree Seed Step	Selection	Shelterwood Prep Step	Shelterwood Removal	Shelterwood Seed Step	Special Treatment Area Prescription	Substantially Damaged Timberland	Transition	Variable Retention	Total
1990	14,279	18,079	0	0	0	11,458	0	14,710	8,764	1,117	41,173	1,810	77,224	1,449	155	0	66,722	0	256,940
1991	7,751	28,761	163	0	0	4,614	0	6,824	5,976	1,317	50,099	1,970	42,415	2,819	120	0	53,358	0	206,187
1992	10,578	40,728	0	0	0	7,520	0	14,171	5,357	791	86,941	2,874	25,353	1,075	111	0	51,161	0	246,660
1993	11,303	28,225	54	0	0	7,510	0	48,171	7,877	1,873	70,612	1,769	28,690	3,093	284	0	27,589	0	237,050
1994	11,892	20,729	1,347	0	47	6,977	59	10,838	6,638	1,849	71,326	1,924	27,218	1,059	355	0	11,078	0	173,336
1995	13,025	25,923	833	270	1,530	16,681	84	11,218	16,076	2,207	63,881	1,098	24,411	79	476	0	5,038	0	182,830
1996	20,468	61,336	1,169	0	4,205	18,082	18	18,158	20,840	1,666	106,103	1,241	40,979	479	970	114	4,049	0	299,877
1997	23,236	28,734	1,044	716	5,908	12,739	101	11,849	15,087	1,133	68,338	302	27,772	262	144	0	5,243	0	202,608
1998	25,287	33,009	1,201	474	8,002	5,261	303	12,854	10,709	906	55,951	1,440	32,466	267	162	198	2,454	0	190,944
1999	37,316	27,322	689	2,838	15,789	7,553	559	14,932	12,597	783	52,059	1,718	42,409	382	277	444	3,471	0	221,138
2000	23,628	9,878	2,075	257	5,303	6,299	403	10,603	9,934	707	42,790	1,257	19,737	65	737	3	2,927	38	136,603
2001	22,307	25,253	376	1,057	7,241	8,013	466	3,816	7,826	260	33,135	755	13,082	73	352	2,705	5,209	0	131,926
2002	26,090	20,488	2,286	1,625	15,613	3,787	542	4,122	4,326	810	45,781	230	15,982	10	157	19	2,759	0	144,627
2003	23,561	20,093	365	1,192	16,510	1,513	592	4,990	7,971	357	41,064	355	12,785	68	163	127	2,003	0	133,709
2004	26,301	24,946	1,082	2,543	16,595	1,739	481	9,421	4,668	541	53,404	99	16,915	7	307	0	2,225	2,003	161,274
2005	24,319	6,825	646	841	15,086	1,837	508	5,138	5,808	636	19,772	348	11,574	6	558	0	1,527	743	95,429
2006	21,320	9,299	1,460	1,094	13,773	1,689	353	6,689	1,567	226	34,987	166	7,765	8	236	0	1,908	1,231	102,540
2007	22,840	8,450	1,101	152	12,807	2,140	368	5,613	5,169	159	32,004	236	6,950	68	524	0	3,310	1,132	101,891
2008	21,919	4,934	556	3,273	22,390	1,717	469	6,963	2,664	67	41,225	220	6,987	30	260	0	5,500	1,128	119,174
Total	387,420	443,012	16,447	16,332	160,799	127,129	5,306	221,080	159,854	17,405	1,010,645	19,812	480,714	11,299	6,348	3,610	257,531	6,275	3,344,743

Data Source: CAL FIRE Forest Practice Database http://www.fire.ca.gov/resource_mgt/resource_mgt_forestpractice_thpstatus.php

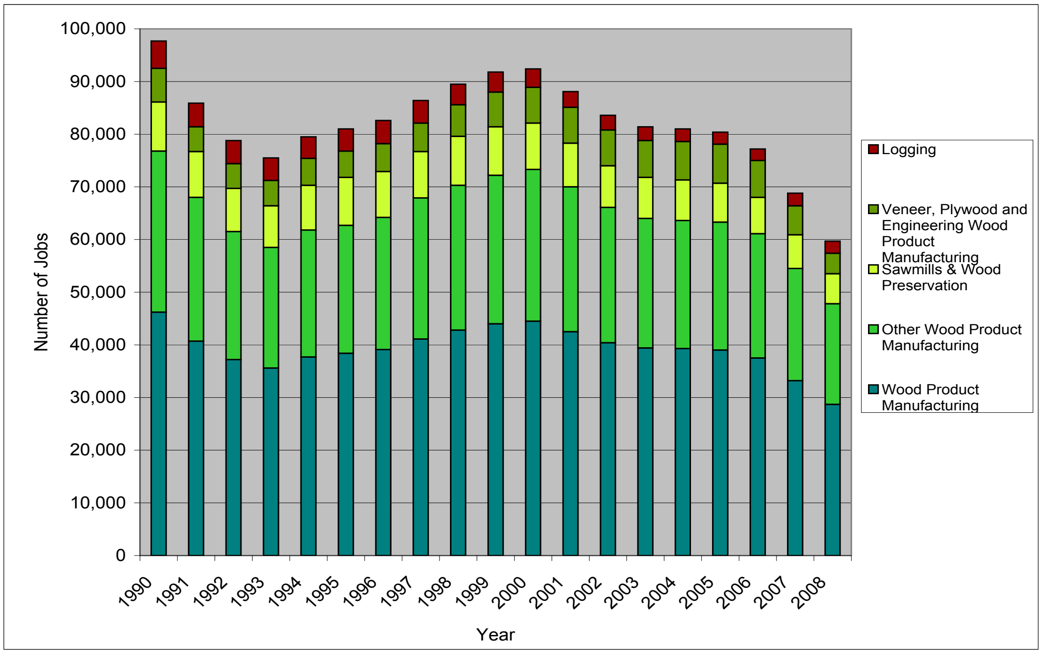


Figure 1.2.5.
Jobs associated with the forest products industry in California.
Data Source: California Employment Development Department, 2009

estate planning factors such as the federal estate tax, will all affect the ability of these owners to retain their lands as working landscapes. Woodlands, in particular, are affected by this class of landowner and may intersect both forest and rangeland ownerships.

Statewide, the best estimates are that standing stocks of trees are stable or increasing. Estimates are problematic due to changes in design of the national FIA inventory, but will improve in time. Carbon stock change estimates indicate that the AB32 Scoping Plan 2020 objective of no net loss in sequestration, which is estimated to be five million metric tons of CO2e a year, will likely be met and exceeded. This assumes that current sequestration rates will continue for the next ten years and that no catastrophic changes occur in that time frame.

RANGE

Rangelands are defined as lands on which existing vegetation, whether it grows naturally or through management, is suitable for grazing or browsing of domestic livestock for at least a portion of the year. Rangeland vegetation types in California include any natural grasslands, savannas, shrublands, deserts, wetlands, or woodlands that support a vegetative cover of native and non-native grasses, grass-like plants, forbs and shrub species. Rangelands may also include forested land that contains grazing resources, although these are viewed as secondary to the primary rangeland base. At 57 million acres, primary rangelands make up 57 percent of the lands of California, providing ecological, economic and other services. Approximately 34.1 million acres or 34 percent of California is actually grazed and most of this is on private lands. The BLM leases 1.8 million acres for grazing in California (BLM, 2009). In California, the U.S. Forest Service has 8.3 million acres within active grazing allotments, which includes waived private lands (Anne Yost, personal communication).

Based on work done under contract by researchers at the University of California, Berkeley (UCB), Department of Environmental Science, Policy and Management (Huntsinger and Romanek, 2009), the following section is primarily a summary of their work and uses the language from their report, including imbedded draft papers.

Rangeland status was considered by examining rangeland productivity, management, environmental services and wildland urban interface issues. The status of rangeland enterprises was examined by focusing on what constitutes working landscapes, considering trends in oak woodland use and management, a rangeland enterprise risk analysis, ownership considerations on livestock production, the role of amenity values and a livestock inventory.

Rangeland Condition

Rangeland status was examined a variety of ways, starting with an analysis of statewide rangeland productivity and capacity for modeling change. A nonparametric regression modeling technique (CART) was used to construct a means to predict forage productivity from simple climate, habitat and bioregion inputs. Using climate variables including temperature and precipitation, the model facilitates predicting low and high production years from recent climate conditions. The projected impact of climate change on forage productivity was also examined by inputting future temperature and precipitation estimates into the forage productivity model.

Figure 1.2.6 shows the average forage productivity for California, which ranged from zero to 5,200 pounds per acre per year. A draft climate change scenario indicated that forage productivity impacts may be positive or negative, depending on geographic location.

Rangelands provide a wide variety of ecosystem services. Fragmentation and poor management can reduce the capacity of rangelands to produce clean water, habitat, viewshed and livestock products. Ranches tend to be on watered sites with better soil and have less human disturbance to wildlife, relative to land preserves (Lenth et al., 2006; Maestas et al., 2001; Maestas et al., 2003). The avoidance of conversion appears to be influenced by the ability to bolster the amenities of ranching with the income to maintain working landscapes. Clustering rural development does not appear to reduce impacts (Lenth et al., 2006). Grazing in California is seen as a more socially preferable alternative to reducing fuel loads in some areas.

While some impacts of grazing may be negative, they should be taken in the context of alternative land uses and their impacts. Avoided conversion through conservation easements and fee title acquisitions by conservation groups has been increasing, which keeps working landscapes contributing to local economies while protecting ecosystem values. A study by the California Rangeland Conservation Coalition of the Central Valley and surrounding foothills (Kroeger et al., 2009,) identified high priority landscapes for conservation. The linking of private ranches to public land leases has the benefits of habitat linkages and discouraging development adjacent to public lands.

Over 100,000 acres of grazing lands were lost to urbanization between 1990 and 2004 with an estimate of 750,000 additional acres by 2040 (Kroeger et al., 2009). Conserving the ecological integrity of

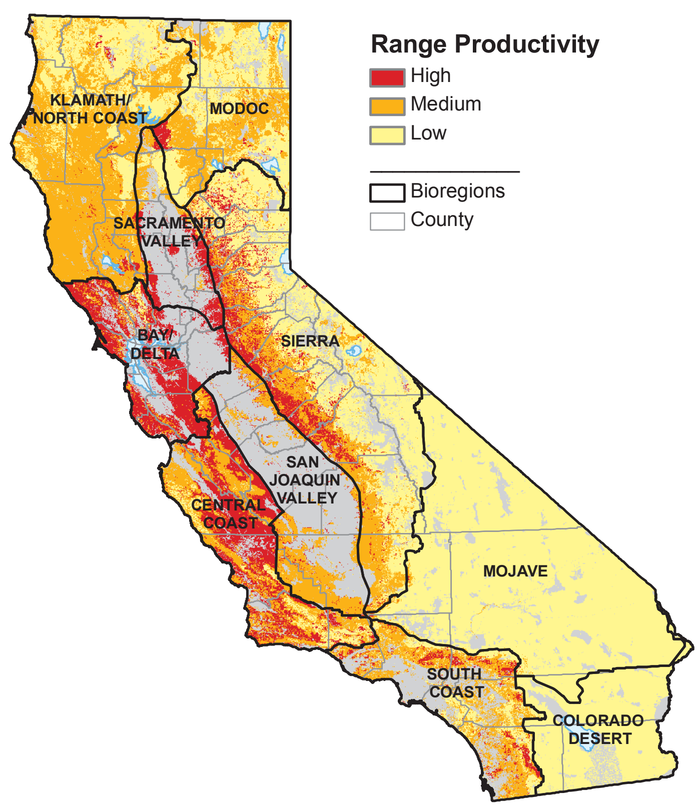


Figure 1.2.6.
Estimated average forage productivity.
Data Sources: Forage Productivity (derived from NRCS Forage Production and Soil Survey (SSURGO) data), UC Berkeley (2009 v1)

an ecosystem means maintaining the processes that create structural and biological diversity and enable plant communities to persist. These processes include the way that plants, animals and the environment interact and influence one another. Exurban development changes plant habitats profoundly by introducing new species or changing habitat, adding barriers to movement or dispersal, introducing new herbivores and changing competitive dynamics among species. Exurban developments favor species that are adapted to human-altered environments so that exotic and weedy species generally increase (Hansen et al., 2005). Effects on biodiversity are cumulative and often nonlinear, and continue to emerge for decades after the development occurs.

A study of ranching in the Sierra Nevada found that while adjacent public forests were profoundly changed by fire suppression, ranchers had maintained relatively fire resilient open woodlands through grazing, brush control, prescribed burning and tree thinning. Once houses are introduced into the mix, vegetation management priorities and options are changed forever. Prescribed burning and grazing are often lost as management options.

Condition of the Range Industry

The concept of "working landscapes" encompasses the idea that lands used for commodity production also produce crucial ecosystem goods and services, and that future demands make it essential that we learn to manage these systems for joint production of ecosystem services and food and fiber (Huntsinger and Sayre, 2007). In addition to open space and habitat provided by rangeland, livestock grazing can be used as a tool to reduce exotic plants and manipulate vegetation in a now-changed ecosystem that cannot return to its original state. In the course of 200 years of livestock grazing, some wildlife species, even some endangered ones, have adapted to and may to some extent be dependent on the landscape characteristics and management practices of livestock producers, for example in the construction and maintenance of stock ponds.

Ranches require access to veterinarians, packing houses, processing facilities and agricultural advisory services (Huntsinger and Hopkinson, 1996). As lands are developed, there are fewer rural enterprises to support this infrastructure. In one study of exurbanizing communities, ranchers had seen an average of 10 neighboring ranches sold for development, and stated that this was an important reason they might sell their ranch (Sulak and Huntsinger, 2002). Exurban residents may quickly outnumber rural residents and change the economics and politics of a region (Gosnell and Travis, 2005; Sheridan, 2007). In-migrants may bring with them particular 'aesthetic' or 'consumption' views of landscape that long-time residents with continuing ties to the production landscape view as political threats.

Public rangelands often support private ranch operations and when access to public lands is lost an enterprise often becomes unsustainable. This can encourage development adjacent to public lands, diminishing ecological values across the landscape.

California has millions of acres of privately owned rangelands that are crucial reservoirs of biodiversity. Ranchers are in large part motivated by their enjoyment of the environment and ranching as a way of life. Outside income is often required to maintain ranching enterprises. There is growing interest among ranchers in potential markets for ecosystem services from ranch lands. Because land conservation on private lands relies to a certain extent on landowner choice, it is important to understand landowner motivations for participation. Landscape level conservation strategies on private rangelands must consider public land and development linkages and pressure.

Ecosystem services that can be marketed, such as carbon, may benefit both landowners and society without significant direct subsidy. Range management practices that may provide carbon benefits are shown by Kroeger, et al. (2009). Support of market development, such as protocol development, and the dissemination of technical information may be the most useful role for government agencies and universities in these cases. Ecosystem services that do not lend themselves to markets, such as threatened and endangered species habitat conservation, may best be addressed through payment programs (Kroeger et al., 2009).

A longitudinal study of California hardwood rangeland owners indicated significant change in landowner characteristics and goals. The three surveys, from 1985 to 2004, showed a significant reduction in oak cutting and an increase in oak planting. This time period coincided with the creation of the Integrated Hardwood Range Management Program, cosponsored by UCB and CAL FIRE. Unfortunately, the program was disbanded in 2009 due to budget cuts. The number of oak woodland landowners engaged in the production of crops or livestock continues to decline. Recent changes include the increased use of land trusts for consultation by landowners and an increased number of landowners, including ranchers, reporting they live in the oak woodland to benefit from environmental services such as natural beauty, recreation and lifestyle. Property size remained significantly related to landowner goals, values and practices, with those producing livestock owning most of the larger properties.

Oviedo and Huntsinger (2009) conclude that woodland owners in California are willing to pay for the amenities derived from living there, but that each additional acre in property size saw a reduction in willingness to pay, approaching a saturation point. Conversely, commodity production was constant per acre. Sustainably retaining larger ranch sizes on the landscape requires both an amenity and a commercial production component.

An economic simulation of three cow-calf ranches in California found low market risk and a low cost of capital approximately equal to the risk-free rate of return, which averaged 4.8 percent over the last 20 years, but ranged from 0.9 to 9.7 percent (Brownsey et al., 2009). This was much like other agricultural enterprises. However, this cost of capital was still significantly greater than the historical return on cow-calf ranching in the western United States of two to three percent, implying that ranchers are receiving benefits from their business beyond financial returns.

More than 60 percent of oak woodlands are owned by those who produce livestock for sale, and another 10 percent of owners produce livestock only for their own use. Another 10 percent of oak woodland owners graze stock on their property by leasing out their land to ranchers. County tax assessor data shows that many acres of California oak woodlands and annual grasslands are owned by corporations and investment groups. A significant portion of these are holding land as an investment, anticipating continued rising land values. Maintaining grazing on these properties reduces fire hazard, and qualifies the land for tax benefits based on agricultural use. The great majority of livestock producers live on their properties and manage the land themselves. What ranchers say makes ranching worthwhile is experiencing the lifestyle, raising a family on a ranch, working with livestock and enjoying the natural environment. On the other hand, most consider land appreciation an important, long-term financial asset, and have planned retirements and estates accordingly. As a result they strongly defend their right to market their land at a good price.

California livestock production is not diverse, with the vast majority of ranchers producing cattle only. About 720 thousand beef cows grazed California rangelands in 2005, down from a million in 1985, with half a million to a million weaned calves, known as "stockers", also using rangeland resources, depending on markets, rainfall and other factors (Figure 1.2.7). In 2005, there were 275,000 ewes in California, the mature female sheep of the kind likely to use rangelands, down from 776,000 in 1985. Dairy cattle are rarely grassland-based, except in parts of the northern coastal counties.

The majority of ranchers voluntarily participate in a land conservation incentive program through the California Land Conservation Act (CLCA, Williamson Act) of 1965, which allows them to pay property taxes at a rate based on the land's agricultural value as

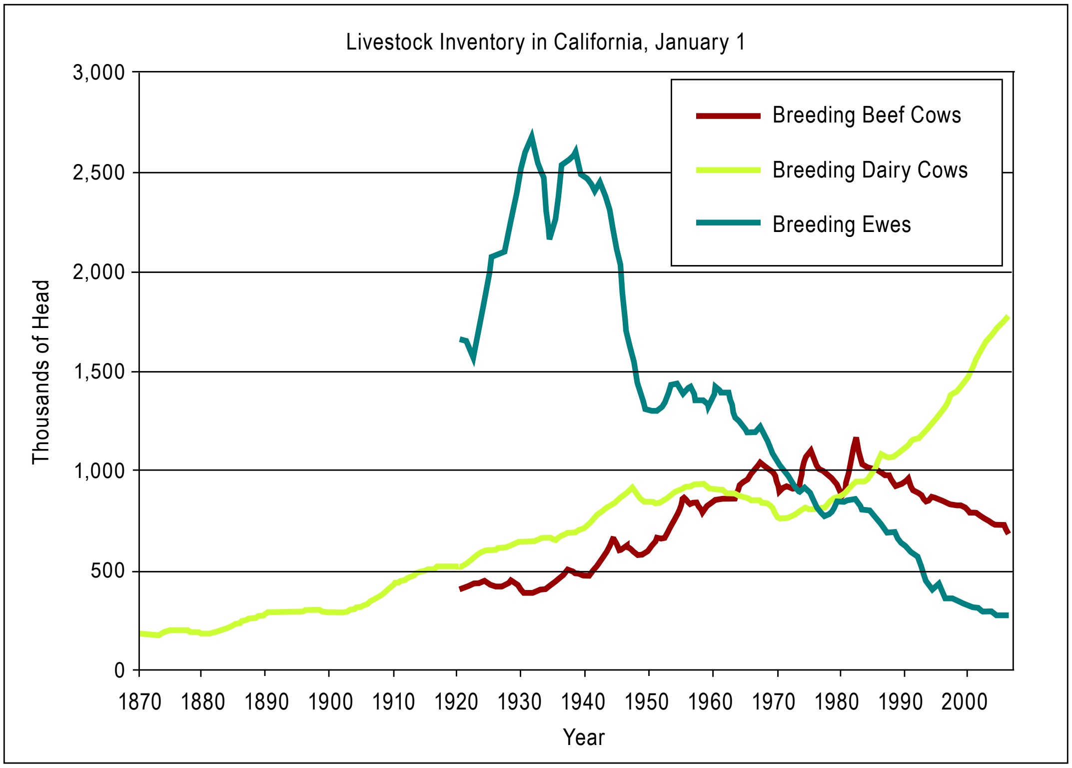


Figure 1.2.7.
Inventory of breeding beef cows, dairy cows and ewes over time.
Data Source: USDA National Agricultural Statistics Service, 2009

long as they commit to keep the land in agriculture for ten years into the future. In exchange for much needed cash, or tax relief, a small but growing number of ranchers have acquired conservation easements, which in general puts a restriction on the title regarding development.

A diverse array of public agencies lease public rangelands for grazing, including the BLM, Department of Defense, U.S. Forest Service, water districts and local and regional parks. Competition for grazing leases has been augmented by the administrative withdrawal of millions of acres of federal lands from grazing, and the continued decline in grazing permit issuance. Declining public forage supply puts stress on the industry, and on the private lands associated with public leases (Sulak and Huntsinger, 2002). In California, in the last decade, although "permitted use" has not changed much, the amount of authorized grazing, or the amount actually allowed, has been lower on both U.S. Forest Service and BLM land.

Traditionally in California, calves are produced on rangelands in cow-calf operations, spending their early life on these rangelands. However, as the current breeding beef cow inventory is about 700,000 head and the current breeding diary cow inventory is 1.1 million (as of January 1, 2006, USDA-NASS), the majority of calves entering the beef production process in California are coming from dairies. As these calves become stockers, they may then stay on rangelands, move to pasture, get shipped to the Intermountain West to graze on rangelands or pasture or get shipped to feedlots in the Midwest or California, depending on the supply and cost of forage from each source. Stockers also enter into California from the Intermountain West, Hawaii and Mexico. Table 1.2.15 lists the top six trading states with California for cattle leaving and entering the state. The stockers that are in California may be finished on feedlots in California or the Midwest. A small but growing number of stockers remain on rangelands or pasture to be finished and marketed as "grassfed beef", a niche market that can produce value-added profits for ranchers.

The sheep ranching industry in California (and the entire U.S.) has seen even more dramatic declines in inventories as the beef ranching industry. The drop in sheep ranching is likely due to the higher labor costs for grazing sheep and a decline in consumer preference for lamb meat. Increasing immigration of people from non-Western cultures with stronger preferences for lamb meat into the U.S. may help to offset this trend.

Discussion

Over one-half of California is classified as rangelands, including substantial amounts of woodlands. The amenities that these lands provide the people of California rely on working landscapes to finance their management. Biodiversity is especially enhanced by the larger tracts. Larger tracts of rangelands require economically viable livestock operations to remain in an undeveloped condition.

Maintaining rangelands as working landscapes is challenging due to the relatively low economic returns of livestock production, a shrinking industry, and the proximity of some rangelands to developed areas. The loss of tax incentives, such as funding of the CLCA and federal estate tax limits, may have a substantial impact on long-term ranching viability. Opportunities may exist to retain viable operations with public-private partnerships where the objectives of fuels management, open space and management costs converge. Programs that monetize the ecosystem services of rangelands may provide the incomes necessary to retain some working landscapes that will otherwise be lost.

Table 1.2.15. Number of cattle imported and exported between California and top six trading states, 2001

State	Leaving California	Entering California
Idaho	109,781	39,682
Colorado	101,452	14,242
Oregon	92,455	22,026
Kansas	597,892	2,997
Nevada	50,638	44,703
Arizona	0	16,836
Total	481,032	247,852
Data Source: Shields and Matthews, 2003		

LANDOWNER ASSISTANCE

The potential for various landowner assistance programs to contribute to forest and rangeland production and sustainability was analyzed. Four unique categories for private landowner assistance were identified in order to more specifically target unique landowner needs and opportunities for improving current conditions:

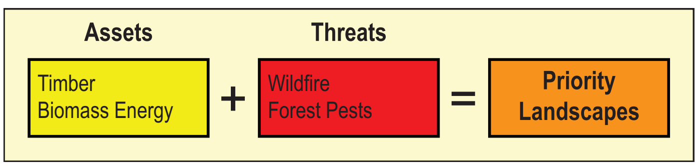
- Risk reduction: Forests and rangelands face a variety of threats that can impact production and sustainability, including wildfire, insects and disease and forest pests. Landowner assistance can facilitate application of various pre-fire management tools to reduce threats to the priority landscapes.
- Restoration: Extensive areas of forest and rangelands have already been impacted by past wildfire events, insect outbreaks or diseases. This has a direct impact on production and sustainability and can also increase the threat of future impacts. Landowner assistance can facilitate application of tools such as reforestation to restore impacted areas, improve productivity, and reduce susceptibility to future threats. Lack of spatial data related to impacted rangelands precluded a spatial analysis to determine priority rangeland landscapes for restoration. However, there are notable areas that should be prioritized for restoration such as riparian areas or oak vegetation or eradication of exotic invasive species.
- Stand improvement: California has extensive areas of suboptimal stands in terms of current timber and carbon growth versus what is possible optimally stocked conditions. This represents unutilized capacity – sites capable of fast-growing valuable coniferous species are currently dominated by non-commercial hardwoods, shrubs or slow-growing overstocked conifers. These are the areas where landowner assistance could facilitate application of stand

improvement tools such as reforestation, species conversion, and thinning to improve growth, species composition, and thus future timber and carbon yields.

- Technical and financial assistance: This includes various forms of assistance that could be particularly beneficial to nonindustrial landowners. Technical assistance can be important for developing management plans or timber harvest plans, meeting compliance with various regulations, forming multi-landowner cooperatives for more effective marketing, and providing estate planning tools.

Analysis: Risk Reduction on Forestlands

The diagram below shows the analytical model for risk reduction on forestlands, which includes the economic values timber and biomass energy that are threatened by wildfire and forest pests.



Assets

Two assets are included in this analysis.

Timber
Areas were ranked based on standing volume of commercial species. Counties without a viable timber processing capacity were excluded (counties south of Santa Cruz on the west and Kern on the east).

Biomass Energy
Areas were ranked based on the biomass, exclusive of merchantable timber, that is potentially available (see Chapter 3.4 for more detail). For non-timber counties, we assumed all material from trees is potentially available for biomass energy.

The composite asset was derived by combining the assets with a weight of two for timber, given its economic value relative to biomass energy.

Threats

Two threats are included in this analysis, wildfire and forest pests. These correspond to the "stand-level" threats described in detail in following chapters. The composite threat was derived by combining the two threats with a weight of two for wildfire, given the severity of the damage it can cause to forest economic assets.

Results

Combining the composite asset and threat with equal weights creates the priority landscape (Figure 1.2.8). Almost all of the high priority landscape areas are a result of high timber assets coinciding with medium threat.

Analysis: Risk Reduction on Rangelands

The diagram below shows the analytical model for risk reduction on rangelands, which includes the

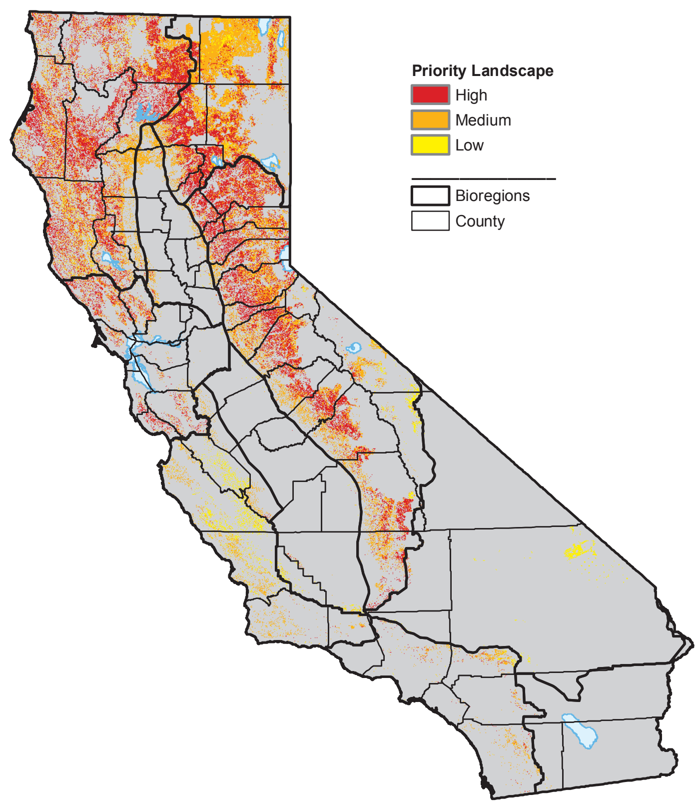
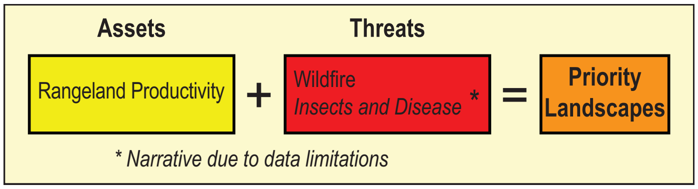


Figure 1.2.8.
Priority landscape for risk reduction on forestlands.
Data Sources: Fire Threat, FRAP (2005); Forest Biomass and Biomass Potentials, FRAP (2005); Statewide Land Use / Land Cover Mosaic, FRAP (2002); Forest Inventory and Analysis, USFS (2000); Forest Pest Risk, USFS FHP (2006 v1)

rangeland productivity asset that is threatened by wildfire and insects and disease.



Assets

The rangeland productivity asset (UC Berkeley, 2009) is shown in Figure 1.2.6.

Threats

The wildfire threat is described in Chapter 2.1, where it is called "stand-level wildfire threat."

Results

Combining the rangeland productivity asset and wildfire threat with equal weights creates the priority landscape (Figure 1.2.9).

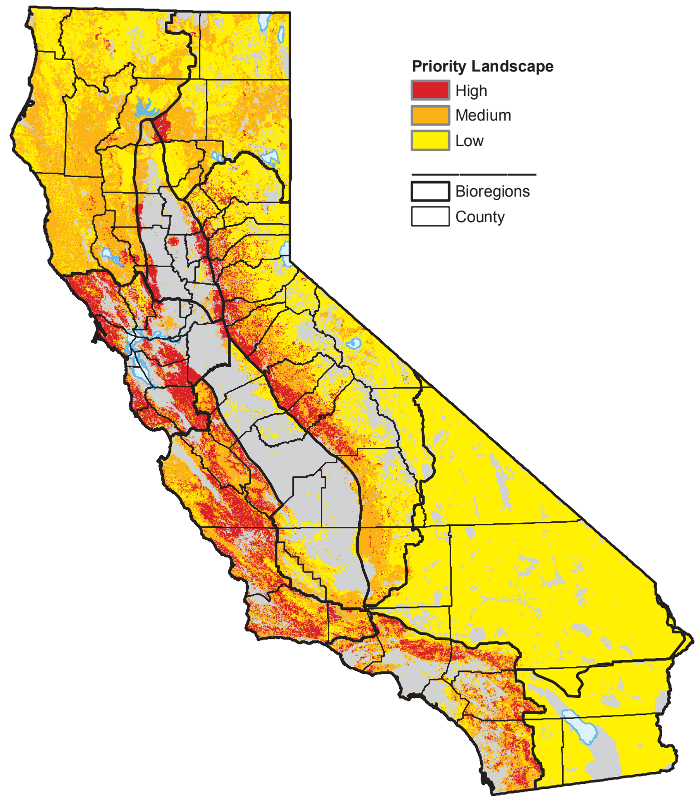
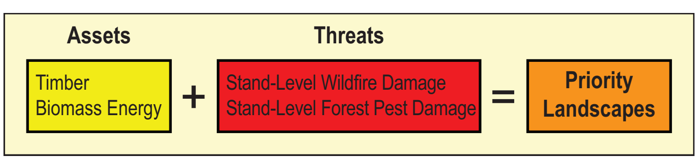


Figure 1.2.9.
Priority landscape for risk reduction on rangelands.
Data Sources: Fire Threat, FRAP (2005); Forage Productivity (derived from NRCS Forage Production and Soil Survey (SSURGO) data), UC Berkeley (2009 v1)

Analysis: Restoring Impacted Timberlands

The diagram below shows the analytical model for restoring impacted timberlands. This includes the same economic assets as the first analysis. The threats represent areas impacted by past wildfires or forest pest outbreaks.



Assets

The forest economic assets were described in the first analysis.

Threats

This analysis includes two threats.

Stand-Level Wildfire Damage
Areas are ranked based on how recent the wildfire event occurred, and the burn severity, which affects the degree of economic loss.

Stand-Level Wildfire Damage
Areas are ranked based on the level of mortality due to past forest pest outbreaks.

The composite threat was derived by combining the two threats, and assigning the highest threat rank from the two threat inputs. This ensures that an area heavily impacted by either type of past event receives a high composite threat rank.

Results

Combining the composite asset and threat using equal weights creates the priority landscape (Figure 1.2.10).

Analysis: Stand Improvement

An analysis was conducted on private and public forestlands in non-reserve status to identify gross opportunities for stand improvement. FIA data (2001–2007 annual inventory) was used to:

Step I: Screen plots without trees to determine if they could potentially support forestland and identify potential productivity from site class.

Step II: Identify understocked stands that might benefit from improved stocking from inter-planting or treatments to encourage natural regeneration.

Step III: Identify overstocked stands that would benefit from thinning to improve forest health and resilience.

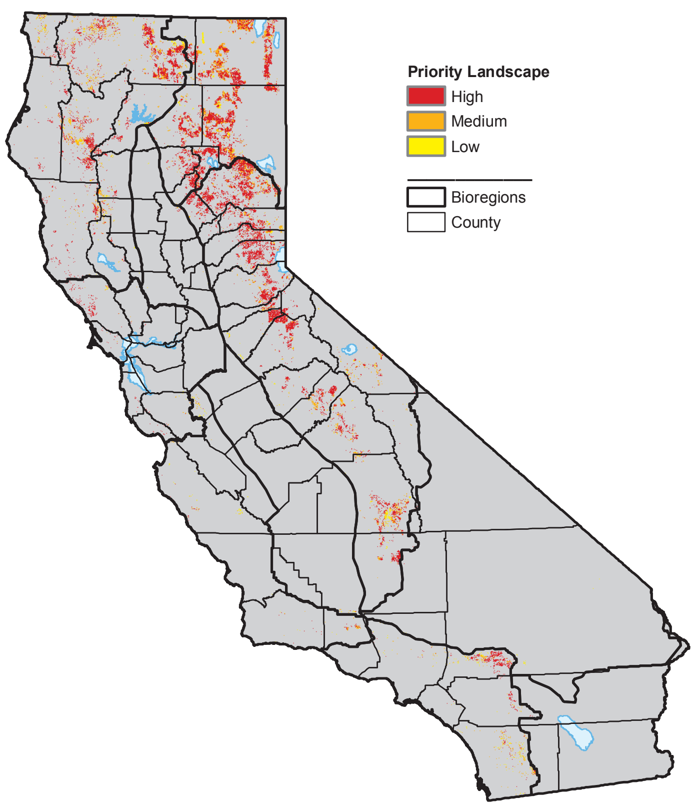


Figure 1.2.10.
Priority landscape for restoring impacted timberlands.
Data Sources: Fire Perimeters, FRAP (2005); Forest Biomass and Biomass Potentials, FRAP (2005); Statewide Land Use / Land Cover Mosaic, FRAP (2002); USFS Forest Inventory and Analysis (2000); Burn Severity, USFS (2009); Aerial Detection Surveys, USFS FHP (2008 v1)

The results are summarized for public and private forestlands by acres showing FIA site class (1=highest, 7=lowest) and other factors.

Results

These results indicate possible opportunities for stand improvement, that would need to be evaluated on the ground in the context of multiple objectives and constraints. The reforestation results are provided in Table 1.2.16 for non-reserved public forestlands and Table 1.2.17 for private forestlands. The relatively small number of stands makes it likely that significantly more acreage may exist suitable for reforestation that is associated with recent wildfires. These stands are devoid of trees entirely; understocked stands (Table 1.2.18) shows that considerable acres exist for improving stocking and the overall growth of trees statewide. The site classes of un- and understocked stands tend to be medium to low site quality, reflecting the difficulty to realize a return on investment from slower growing stands. This presents opportunities where public benefits might be enhanced through public investments and ecosystem service markets.

Table 1.2.19 shows that there is over one million acres of overstocked forests that may benefit from thinning. These stands tend to be on mid-site quality where prior management has occurred. Opportunity exists to use treatments to improve forest health and protect existing stocks from damage by wildfire and pests. Given that these stands already contain significant carbon and timber stocks and that they are productive sites, investments in these stands may provide a high return on investment for both public and private good.

Technical and Financial Assistance

A variety of state and federal programs exist to assist forest and range landowners. These programs provide both technical or financial assistance to landowners and are offered through University extensions, and state and federal programs. In addition, Resource Conservation Districts (RCDs) are local non-governmental organizations that work between

Table 1.2.16 Acres of reforestation opportunities on non-reserved public forestlands (78 plots)

	FIA Site Class							
Slope Class	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
0–30	1,810	0	19,858	6,747	15,356	48,082	92,444	184,296
31–60	0	0	12,471	4,343	3,318	15,455	38,971	74,558
>60	0	0	0	0	8,679	0	10,067	18,746
Total	1,810	0	32,329	11,090	27,353	63,537	141,482	277,600
Data Source: USFS Forest Inventory and Analysis, 2001–2007								

Table 1.2.17. Acres of reforestation opportunities on private forestlands (57 plots)

	FIA Site Class							
Slope Class	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
0–30	3,983	2,924	41,891	18,644	47,271	2,623	107,496	224,831
31–60	0	589	7,898	192	3,012	9,341	4,368	25,401
>60	0	0	0	0	0	273	2,159	2,432
Total	3,983	3,513	49,790	18,836	50,283	12,237	114,023	252,664
Data Source: USFS Forest Inventory and Analysis, 2001–2007								

landowners and government programs, facilitating the delivery of technical assistance to landowners. Assistance to communities is addressed in the next section of this chapter.

Cooperative Extension

Land grant colleges and the U.S. Department of Agriculture cooperate in agricultural and forestry extension services to landowners going back to the Hatch Act of 1887, but formalized by the Smith-Lever Act in 1918. The University of California, as the land grant institution in California, manages a cooperative extension service (UCCE) that serves forest and range landowners. UCCE is part of the Division of Agriculture and Natural Resources within the University of California. Extension agents may be found in county offices and at the campuses of Berkeley, Davis and Riverside. UCCE outreach includes web-based publications, meetings, conferences, workshops, demonstrations, field days, video programs, newsletters and manuals. Forestry subjects covered by UCCE include maintaining healthy forests, woodlands and rangelands, reducing fuels and fire hazard, restoration following wildfire, and estate and financial planning.

California Department of Forestry and Fire Protection Programs

Pest Management Program

Forest pests (insects and diseases) annually destroy 10 times the volume of timber lost due to forest fires. Native bark beetles took hold in Southern California forests following severe drought years and caused unprecedented tree mortality. The introduced pitch canker disease has attacked Monterey pine along the coast. Sudden oak death (SOD), caused by Phytophthora ramorum (a fungus), has been found in 14 counties in California and has killed millions of oaks and tanoaks. CAL FIRE's forest pest specialists (four statewide) help protect the state's forest resources from native and introduced pests, conduct surveys and provide technical assistance to private forest landowners and promote forest health on all forestlands throughout the state.

Annual aerial surveys are conducted by the U.S. Forest Service over the entire forest landscape of California. Outbreaks of bark beetles and defoliating insects are reported to the landowners and assistance offered for identification and control. Potential spots of SOD are ground checked. Control and suppression of SOD sites outside of the general infestation are conducted in cooperation with multiple landowners to attempt to slow the spread of the disease. Cooperative programs exist for suppression of bark

Table 1.2.18. Understocked stands with regeneration opportunities on non-reserved public (371 plots) and private (167 plots) forestlands

Ownership	Condition	Structure	Managed	Average FIA Site Class	Acres
			Y	4.6	41,982
		Even-aged	N	4.8	36,115
		Two-storied	Y	3.0	8,062
	Grass-forb	Uneven-aged	Y	4.2	19,690
			Y	4.5	38,150
		Even-aged	N	4.4	32,074
		Two-storied	N	7.0	5,674
	Shrub	Uneven-aged	N	3.0	9,525
			Y	4.6	382,282
		Even-aged	N	5.0	205,521
			Y	4.9	143,064
		Two-storied	N	5.5	92,252
			Y	5.0	503,873
	Sapling to Sawtimber	Uneven-aged	N	5.7	378,864
Public	Subtotal				1,897,127
		Even-aged	Y	3.8	43,465
		Two-storied	N	5.0	9,840
			Y	3.0	7,509
	Grass-forb	Uneven-aged	N	7.0	15,283
		Even-aged	Y	2.3	13,405
			Y	3.0	3,944
	Shrub	Uneven-aged	N	4.0	9,514
			Y	4.3	321,130
		Even-aged	N	4.7	93,151
			Y	4.4	173,014
		Two-storied	N	5.1	18,478
			Y	4.2	463,513
	Sapling to Sawtimber	Uneven-aged	N	4.0	54,489
Private	Subtotal				1,226,734
Total					3,123,862
Data Source: USFS Forest Inventory and Analysis, 2001–2007					

Table 1.2.19. Overstocked stands with thinning opportunities on non-reserved public (144 plots) and private (83 plots) forestlands

Ownership	Condition	Structure	Managed	Average FIA Site Class	Acres
	Grass-forb	Even-aged	N	7.0	5,681
			Y	3.0	4,044
	Shrub	Even-aged	N	3.0	4,517
			Y	3.4	103,209
		Even-aged	N	4.0	102,128
			Y	3.6	37,274
		Two-storied	N	4.0	87,133
			Y	3.9	101,096
	Sapling to Sawtimber	Uneven-aged	N	4.4	209,522
Public	Subtotal				654,605
	Grass-forb	Even-aged	Y	2.0	3,575
	Shrub	Even-aged	Y	3.0	9,840
			Y	3.5	197,871
		Even-aged	N	3.4	59,288
			Y	3.1	107,693
		Two-storied	N	4.5	18,467
			Y	3.9	131,447
	Sapling to Sawtimber	Uneven-aged	N	5.3	37,499
Private	Subtotal				565,681
Total					1,220,286
Data Source: USFS Forest Inventory and Analysis, 2001–2007					

beetles throughout the Southern California outbreak region. Zones of Infestation can be declared for both native and exotic insects and diseases to help in pest management, procurement of funds for control efforts and region-wide planning for management efforts. Landscape planning often occurs through the California Forest Pest Council, a volunteer cooperative organization that links together state, federal and local government agencies, universities, forest industry, non-profit organizations and concerned individuals on forest pest issues. Specific insect and disease issues covering large areas are often handled through task forces under the Pest Council, for example the Pine Pitch Canker Task Force and the Oak Mortality Task Force.

Forest Stewardship Program (FSP)
The purpose of the Forest Stewardship Program (FSP) is to encourage the long-term stewardship of non-industrial private forestlands (NIPF). In achieving that purpose, the program helps California's NIPF landowners, either individually or collectively with their NIPF neighbors, to more actively manage their forests, watersheds and related resources, and keep those lands and watersheds in a productive and healthy condition for present and future generations. California's FSP is also designed to assist California communities to increase the economic and environmental benefits associated with their watershed resources through locally led programs with active participation of individual forestland owners.

The primary emphasis of the program is technical assistance, forest landowner education and assisting in developing multi-resource planning documents such as a Forest Stewardship Plan.

The State Forest Stewardship Coordinating Committee
Federal law requires that any state that wishes to participate in Farm Bill programs such as the FSP must have a State Forest Stewardship Coordinating Committee (SFSCC) to serve as an advisory group to that state's State Forester. The SFSCC must:

- provide advice and recommendations to the State Forester concerning implementation of the Forest Stewardship Program, and other associated landowner assistance and cost-share programs,
- provide assistance and recommendations concerning the development, implementation, and updating of the statewide assessment and resource strategy,
- make recommendations to the Secretary concerning those forestlands that should be given priority for inclusion in the Forest Legacy Program.

California Forest Improvement Program (CFIP)
The goal of the program is to improve the timber productivity of non-industrial private forestlands while also improving other forest resources, such as fish and wildlife habitat and soil resources; the overall effect is to improve the total forest resource system. Funded practices include management planning, reforestation, site preparation, thinning, land conservation (erosion control, forest road rehabilitation, revegetation), and fish and wildlife habitat improvement. Cost-share rate is generally 75 percent up to $50,000 per contract. Rehabilitation after natural disasters such as fire can qualify for up to 90 percent cost-share. Demand for CFIP funding always exceeds the funding available.

Forest Legacy Program (FLP)
The objective of the Forest Legacy Program (FLP) is to identify and protect environmentally important forestlands that are threatened by present or future conversion to non-forest uses by either purchasing the land or purchasing the development rights through deed restrictions such as a conservation easement. Priority is given to lands that can be effectively protected and managed and that have important scenic, recreational, timber, riparian, fish and wildlife, threatened and endangered species and other cultural and environmental values. In California, the program emphasizes purchasing conservation easements that restrict development and maintain the forests intact and provide such traditional forest benefits as timber production, wildlife habitat,

watershed protection or open space. These forests remain in private ownership.

The federal Forest Legacy Program was part of the 1990 Federal Farm Bill. It recognized that private forestland owners were facing increased pressure due to greater population densities and users' demands to convert their forestlands to other uses, such as housing subdivisions, rural lots and vineyards. In 2000, Governor Gray Davis signed into law the California Forest Legacy Act (SB 1832) which allows the California Department of Forestry and Fire Protection to acquire conservation easements, and permit federal and state agencies, local governments, and nonprofit land trust organizations to hold conservation easements acquired pursuant to the California Forest Legacy Program. An Assessment of Need (AON) was developed in 1995 and was amended in 2000. Specific program goals and objectives as well as Forest Legacy Areas (FLAs) are identified in the AON, which is incorporated by reference into this assessment.

Federal funds are limited to 75 percent of the value of the conservation easement with the remaining portion contributed by non-federal matching funds. Money to fund the program may come from a variety of sources: gifts, donations, federal grants and loans, other appropriate funding sources, and from the sale of bonds pursuant to the Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act of 2000.

Federal funding is allocated to potential Forest Legacy Program (FLP) projects based on a national ranking system. All project applications are ranked on Importance, Threat, Strategic and Readiness. The FLP uses owner aggregation to increase "strategic" value in applying for federal funding. For example, the Six Rivers to the Sea FLP Initiative seeks to recruit landowners in the southern Humboldt County area who are willing to sell a "working forest" conservation easement to the state. This approach has been extremely effective and California has garnered funding for projects in the Six Rivers to the Sea Initiative every year that requests were submitted. To date successful transactions have closed on four ranches, one small industrial property, and another ranch in December of 2009.

Cattle grazing can be an effective means of invasive weed control on grasslands.

Five CAL FIRE foresters supported the delivery of the FSP, CFIP and FLP programs in 2009.

California Department of Fish and Game

Two programs, the Fisheries Restoration Grant Program and the Private Lands Wildlife Habitat Enhancement and Management Program (PLM) are of particular importance. The Fisheries Restoration Grant Program assists with watershed planning and restoration including fish habitat improvement projects, watershed organization support, training and education. The PLM seeks to enhance and safeguard much-needed habitat for California wildlife while improving profits for landowners. A five-year commitment and habitat plan are required. Fishing, hunting and other recreational activities may be developed outside normal season and modified bag limits are allowed. Fees charged by the landowner can improve the sustainability of an enterprise.

Federal Programs

Many of federal programs are delivered by state agency programs or cooperative extension.

U.S. Forest Service

The U.S. Forest Service, State and Private Forestry, is composed of Forest Health Protection (FHP) and Cooperative Forestry programs. FHP is responsible for technical assistance for forest health activities and monitoring and reporting on the health of all forestlands in California. They have specialists in forest pathology, forest entomology, pesticide use and safety, remote sensing and GIS. They are active in the California Forest Pest Council and specific organizations that target individual pests.

Cooperative Forestry provides assistance in education, economic action, landowner assistance and urban and community forestry. Economic action has been implemented through community action plans to diversify local economies dependent on national forests. Landowner assistance is implemented through CAL FIRE. Forest Legacy, forest management and reforestation programs benefit from Cooperative Forestry investments. Chapter 3.2 addresses urban and community forestry.

USDA Natural Resources Conservation Service (NRCS)

The Natural Resources Conservation Service (NRCS) has two forest and range landowner assistance grants programs created by the 2008 Farm Bill. The Conservation Stewardship Program (CSP) targets agricultural, rangeland and non-industrial forestlands. Activities supported by CSP include conservation activities associated with erosion control and wildlife habitat. On rangeland, vegetation health and livestock watercourse access is managed. On forestland, certification is encouraged as are implementation of management plans (such as fuel breaks, thinning and Integrated Pest Management (IPM)) and native tree use. Payments are estimated to be $6 to $12 per acre for forestland and $5 to $10 for rangeland. Five year contracts are required under CSP. The other program, the 2009 Environmental Quality Incentives Program (EQIP), focuses on erosion control, IPM and forestry. The program assists, up to 75 percent, with the development of forest management or IPM plans. The 1996 Farm Bill created the Wildlife Habitat Incentives Program (WHIP) to improve habitat on private lands, which is still an ongoing program funded at about $1.3 million a year.

Community Assistance

Assistance to communities may include grants and technical assistance directly to local governments or non-profit organizations. Addressed here are fire prevention projects, payments to counties that include federal lands, and stream restoration activities. Urban forestry, which has area service foresters and community grants programs, is addressed in chapter 3.2. Green infrastructure programs are covered in chapter 3.6.

Projects to reduce wildland fire hazards by treating fuels may be funded through a variety of sources. The National Fire Plan, Healthy Forests Initiative and other related federal initiatives have treated (prescribed fire and mechanical) between 230,000 and 275,000 acres a year since 2004 in California. Firewise Communities is a multi-agency program to engage communities in planning for wildfires through design, emergency response and home design landscaping and maintenance. Rural Fire Assistance (RFA) was a pilot effort from 2001–2005 to augment rural fire department firefighter safety and wildland fire protective capabilities. Currently, direct assistance to communities near DOI-managed lands is delivered through firefighter training.

The federal State Fire Assistance (SFA) program assists states and local fire departments in developing preparedness and response capabilities for wildland fire management. SFA had private lands grant amounts of $2.3 million in 2007 and $3.2 million in 2008, with $23 million available in 2009. BLM Community Assistance grants had $3 million available in 2008 and $1.6 million in 2009. State funds were available from Proposition 40 for fuels reduction projects in the Sierra Nevada, but funding was suspended in 2009.

Payments in lieu of taxes (PILT) are federal payments to local governments that help offset losses in property taxes because of federal ownership within their boundaries. This includes federal parks, forests and other lands. The formula for PILT incorporates population, receipt sharing payments and the amount of federal land within an affected county. Annual PILT amounts in California were about $19 million in 2003–2005, $21 million in 2006–2007, $33 million in 2008, and $34 million n 2009.

In addition to PILT, the Secure Rural Schools and Community Self-Determination Act (SRS), which was authorized in 2000 and reauthorized in 2008, provides funding to counties with federal lands. Payments from SRS to 38 California counties were between $65 and $67 million from 2002 to 2005. Most of this funding was allocated to roads and schools (about $56 million) with the rest going to projects either supporting or on national forests. Fourteen resource advisory committees (RACs) have been established in California to assist with identifying funding priorities. The total SRS budget for California was $58 million in 2008 and $61 million for 2009. Funding is projected to decrease each year and be $40 million for California counties in 2011. The 2008 reauthorization changed some program structure including having RACs involved in project monitoring, use of funds for the Firewise Communities program, reimbursement for emergency services and development of community wildfire protection plans.

Urban, agricultural and wildland stream restoration activities are funded by a variety of agencies and programs. Propositions 13, 40 and 84, for example, have provided over $25 million for urban stream restoration grants. CALFED grants fund projects that affect the Sacramento River delta. These include Watershed Coordinator grants (Proposition 50) and Watershed Program grants to advance sustainable watershed-based management through community-based strategies, both managed by the Department of Conservation. The Department of Fish and Game manages the Fisheries Restoration Grant Program, which has invested over $180 million to support projects from sediment reduction to watershed education since 1980. A variety of federal grants are managed by the National Oceanic and Atmospheric Administration, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service and others. Non-profit organizations also fund stream restoration projects.

Discussion

The maintenance of working landscapes may be facilitated by landowner assistance programs. The analysis of risk reduction on forestlands highlighted much of the Klamath/North Coast and Sierra bioregions. Rangeland risk reduction highlighted lands bordering the Sacramento and San Joaquin Valleys, Bay/Delta, Central and South Coast bioregions. Measures that enhance forest and rangeland health may have multiple benefits in reducing risk. Biomass markets may assist by offsetting some treatment costs where appropriate.

The analysis on restoring impacted timberlands highlighted areas primarily in the Sierra bioregion with some in the Klamath area, a result of where fire activity has been recently. Post-fire restoration may mean speeding up the natural cycle of reforestation or retaining the site in forest where climate stress may cause a type conversion without intervention. This generally means preparing the site and planting locally sourced seedlings. Site preparation and potential soil impacts, may be minimized by replanting within a year of the fire before competing vegetation dominates the site.

The stand improvement analysis relied on FIA plot data, rather than a geospatial analysis, to get an estimate of the statewide potential for reforestation, increased forest site occupancy, and thinning opportunities in overstocked stands. Many of these acres will overlap with those identified in the spatial analyses. The acres identified in all analyses are potential acres before the consideration of site-specific aspects such as habitat use in a landscape context, or the feasibility of treatments either economically or due to logistical constraints. Substantial acres are available for consideration of landowner assistance treatments where public benefits would result.