

Executive Summary



BACKGROUND

For over 30 years, state law (PRC 4789) has mandated periodic assessments of California's forest and rangeland resources. To meet this mandate assessments were produced in 1979, 1988, 1996 (Fire Plan), and 2003. In 2008, the Federal Farm Bill added a provision to federal law that required states to do assessments of forest resources. These assessments are to identify key issues and define the status and trends across all forest lands in each state. To the extent possible, spatial areas (called priority landscapes) are to be delineated that help focus investments and other programs to deal with associated issues. A separate document must also be prepared that presents strategies to address issues and priority landscapes identified in the assessment. The intent of the 2010 Forest and Range Assessment is to meet both the state and federal mandates, hence it covers both forest and rangeland resources, on private as well as publically managed lands.

In many ways, this assessment portrays a continuation of past trends of impacts from wildfire, development, forest pests, and exotic invasive species. However, there are also relatively new or markedly increasing potential threats from renewable energy infrastructure, off highway vehicle use, and climate change. Finally, traditional as well as new

opportunities exist for shaping future conditions through emerging markets for biomass and other renewable energy sources; carbon, niche markets, and ecosystem services; innovative regional and local partnerships and strategies to conserve and manage open space and working landscapes for both commodity production and non-market benefits; and various tools, policies, programs and incentives to positively influence land management and use decisions.

PRESENTATION OF THE 2010 ASSESSMENT

As required by the 2008 Farm Bill, this assessment presents an analysis of trends, conditions, and the development of priority landscapes. Unlike previous assessments done to meet the state mandate, it is organized around three themes presented in related federal assessment and strategy Redesign guidance documents (<http://www.fs.fed.us/spf/redesign/index.shtml>). The three themes and eleven related sub-themes are covered in both this assessment and the strategies document. Each of the eleven subthemes constitutes a unique assessment chapter:

1. *Conserve Working Forest and Range Landscapes*

1.1 Population Growth and Development

Impacts

1.2 Sustainable Working Forests and

Rangelands

2. *Protect Forests and Rangelands from Harm*

2.1 Wildfire Threat to Ecosystem Health and
Community Safety

2.2 Forest Pests and Other Threats to Ecosystem
Health and Community Safety

3. *Enhance Public Benefits from Trees, Forests and
Rangelands*

3.1 Water Quality and Quantity Protection and
Enhancement

3.2 Urban Forestry for Energy Conservation and
Air Quality

3.3 Planning for and Reducing Wildfire Risks to
Communities

3.4 Emerging Markets for Forest and Rangeland
Products and Services

3.5 Plant, Wildlife and Fish Habitat Protection,
Conservation and Enhancement

3.6 Green Infrastructure for Connecting People
to the Natural Environment

3.7 Climate Change: Threats and Opportunities

There is an additional chapter relating to issues in Bordering States, and an Appendix that describes Data and Analytical Needs. The FRAP website has supporting information regarding assessment methodologies and other background material.

The eleven assessment chapters contain 23 unique spatial analyses and their resultant priority landscapes and generate 150 key findings, found at the beginning of each chapter. The number of priority landscapes reflects the diversity of issues, ecosystems, and values at work in California. Resultant

priority landscapes are purposefully kept separate to focus on those particular assets and threats being modeled. While attempting to cover a broad range of issues, they may not be exhaustive due to factors such as data limitations and availability, and constraints on time and personnel, or other challenges.

OVERARCHING FINDINGS

From this assessment's key findings, six overarching issues emerged that unite disparate chapter results:

1. *Forest and rangelands, and urban forests, remain valued assets, critical to the economic, social, and environmental well-being of California.*

Forests, rangelands, and urban forests clearly are among the major factors contributing to the quality of life enjoyed by Californians. These lands serve as high quality habitat for fish and wildlife species, sequester carbon to mitigate climate change, capture vital runoff for agricultural and domestic water supply, and provide a variety of outdoor recreation and education opportunities. Many rural communities depend on working landscapes for timber and rangeland livestock industries, or for amenity values to attract new residents seeking a better lifestyle, such as retirees. Finally, in metropolitan areas urban forests contribute to improved air quality, cooling of heat islands for energy conservation, and local employment.

2. *California's forest and rangelands face a variety of threats, and trends indicate that these are increasing in number, extent, and severity.*

For a variety of reasons, pressure to convert forest and rangeland to more developed land uses continues. In addition, wildfire

trends point to increasing acres of forests and rangelands burned statewide, particularly in conifer forests. Impacts are likely to increase in the future, based on climate change research indicating increased fire activity and severity. Forest pests cause major damage, resulting in significant public and private costs and losses. Increased prevalence of exotic invasive forest pest species is a major concern.

Since California (1984) and Federal Endangered Species Acts (1973) were passed, the general trend has been an increase in the number of both animals and plants listed as threatened or endangered. California's native fish are having great difficulty adapting to human induced changes, such as introduction of exotic species and in and near-stream habitat degradation. The California Wildlife Action Plan (2007) presents at least 20 main threats to plant, wildlife and fish populations and their habitats across the state.

Finally, climate change poses a major new challenge across all forest and range landscapes, with temperatures likely to increase and large uncertainty in future precipitation amounts and distribution patterns. Over the long-term, climate change is likely to shift plant and animal species distributions, and cause unknown impacts on forest and rangelands.

3. *Demands on forest and rangeland resources are increasing, especially for ecosystem services. Emerging markets are placing new demands on these lands.*

The state's already large population continues to increase, particularly in Southern California, and an estimated 3.9 million residents will be added over the next decade. This trend places increasing pressure on land

development and natural ecosystems in the state. The demand for clean water from forest and rangeland watersheds will keep growing, while the supply remains static or uncertain. In addition, the development of renewable energy sources from forest and rangelands potentially will affect all bioregions, given the increased infrastructure required. Finally, the increasing popularity of specific recreation activities such as off highway vehicle use creates a significant challenge to provide adequate recreation opportunities in locations where best management practices can be applied and impacts minimized.

4. *A significant portion of forest and rangelands, urban forests, and the infrastructure required to meet demands from these lands, is in a degraded or undesirable condition.*

The analyses in this assessment showed that much of the state's forest and rangeland has been compromised by disturbance and past uses. At least 2.35 million acres were found to be impacted from past wildfires statewide, and over 6 million acres by pests, mostly on U.S. Forest Service lands. The 2002 list of impaired waterbodies estimated that California has over 26,000 miles of impaired streams, about 14 percent of the total miles of streams and rivers in California. Twenty-eight fish taxa are listed as state or federally threatened or endangered, and at least 45 percent of California's 62 native fish species are considered by the California Department of Fish and Game (DFG) as those of greatest conservation need.

The infrastructure required to meet demands from these lands and provide opportunities for treatment of impacted areas is similarly in an unfavorable condition. The softwood sawmill capacity in California shrank by 25 percent

in the last few years, indicating an overall contraction of the sector in jobs, capacity and economic activity. The ranching industry has also been in steady long-term contraction, and large ranching operations must find means to remain economically viable to avoid conversion, abandonment or fragmentation.

Agencies that provide recreation opportunities are struggling to meet demand for diverse, safe, high-quality recreation opportunities with smaller budgets, which is resulting in instances of reduced hours of operation and deferred maintenance. In metropolitan areas, about 800,000 densely populated acres, or 15 percent of the state's urban area, has been identified with high threat from air pollution and urban heat islands. Close to 28 percent of the state's population (9.5 million people) live in these areas.

5. *Opportunities exist to improve the quality and quantity of benefits from these lands. There are management options leading to desired future conditions to sequester more carbon, improve water quality, foster more vibrant rural economies, and make natural landscapes more resistant to threats. Reaching desired future conditions will require surmounting numerous political, social, and economic challenges.*

Emerging markets for renewable energy, carbon, niche products, and ecosystem services are already having an impact on how forest and rangelands are managed. Developing appropriate policies will require a better understanding of the benefits and environmental impacts of these emerging markets, and how society values the various market and non-market products and services provided by forests and rangelands. Emerging markets for ecosystem services have the

potential to not only provide incentives to sustain forest and rangelands in the face of development pressures, but also influence how they are managed. Many policies, programs, agencies and stakeholders are involved with making decisions over where to make investments that affect ecosystem services. This typically involves protecting areas that provide unique or high levels of desired services, or restoring areas impacted by past events. Augmenting this with emerging market-based solutions could enhance our ability to sustain these important services into the future.

For example, carbon markets could provide incentives for longer rotation ages, maintaining fully stocked conifer stands, and conducting treatments to minimize risk from wildfire and forest pests. California has large acreages of forests that, with additional management and investment, could provide larger future benefits in terms of forest products, jobs, and carbon storage and sequestration. Similarly, biomass energy from forestlands can provide a financial incentive for reducing wildfire and forest pest risk, and for treatment of impacted areas.

6. *One of California's great strengths is its human capital. The potential to reach desired future conditions across forest and rangelands will depend in large part on taking advantage of and augmenting existing collaborative efforts and groups, initiatives, strategies, and success stories.*

At the state, regional, and local level, there are many examples of innovative, collaborative, successful efforts to develop and implement policies and strategies to improve current conditions.

At the state level, a number of strategic planning documents, programs and initiatives have been drafted that have bearing on forest and rangelands, such as the California Wildlife Action Plan, the Water Plan, the Renewables Portfolio Standard, Bioenergy Action Plan, California Outdoor Recreation Plan and the Off Highway Vehicle Strategic Plan, and Assembly Bill 32 Scoping Plan. Each has a particular focus on one or more key resources. While touched on in this assessment, they are covered in more detail in the strategy document.

A large amount of work has been completed or is underway in California to identify, preserve and protect important wildlife, plant, and fish habitat. For example, nearly \$200 million in grant monies has been awarded by DFG alone for fish habitat restoration in 26 counties since 1981. A recently released DFG study on essential wildlife corridors connecting areas of core habitat gives a regional scale view of areas which should be looked at in more detail for conservation. Similarly, federal and state funding promote water quality through efforts such as CALFED, and recreation opportunities through the Land and Water Conservation Fund.

At the region level, there are excellent examples of efforts to develop and implement strategies to protect and manage green infrastructure for both commodity production and ecosystem services. These efforts are typically cross-jurisdictional, involve stakeholders, and address multiple issues such as recreation, water, wildlife habitat and economic development. For example, counties in the Bay/Delta bioregion have achieved a significant level of green infrastructure protection despite the absence of large federal landholdings by developing a shared strategy

and adopting a wide range of complementary public-private programs.

At a more local level, the number of Firesafe Councils and watershed groups is testament to the value of public involvement, as are the various organizations that serve to educate local residents in the value of care of local landscapes, and involve them in stewardship and volunteer efforts.

Finally, many private companies, non-profit organizations, and governmental programs have worked hard to sustain and improve California's urban forest. This strong network of organizations provides many public benefits by improving the urban forest, and the public awareness of the importance of urban forests is growing. The Urban Forest Protocols were approved to benefit local governments and provide incentive to others through offset carbon credits for planting trees in urban settings.

SUMMARY OF CHAPTER RESULTS

Key findings and highlights from each topic covered in this assessment are supplied in this section, organized according to the guidance given by the Forest Service's Redesign program. These highlights do not cover the topics in detail, but provide a quick review of topic coverage to serve as a supplement to the strategy report.

1.1: Population Growth and Development Impacts

CHAPTER OVERVIEW

Many of the same ecosystems that have been hard hit by historical development are projected to be further impacted by development in the near future, particularly in and around the largest urban areas. The state's already large population is still growing, particularly in Southern California, and an estimated 3.9 million residents will be added over the next decade. This ongoing trend will maintain or increase pressure for land development that can increasingly compromise ecosystems across the state.

Tools to address development threat to ecosystems, include land acquisition, easements, zoning policies, and policies to promote in-filling of existing developed areas.

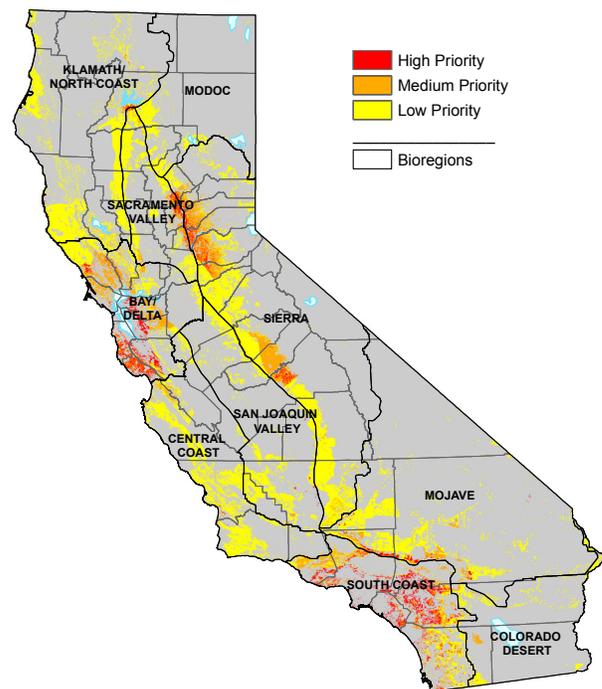
This chapter has a single spatial analysis which examines the threat of near-term development to ecosystems.

ANALYSIS: POPULATION GROWTH AND DEVELOPMENT IMPACTS

Key Findings

- The habitat types in California with the most acres at risk from development statewide are Annual Grassland, followed by Coastal Scrub, Montane Hardwood and Blue Oak Woodland.
- The bioregions with the highest proportion of acres at risk are the South Coast, Bay/Delta, and the central and northern foothill areas of the Sierra. Types found to be most at risk in these regions:
 - South Coast: Coastal Scrub, Annual Grassland and Mixed Chaparral.
 - Bay/Delta: Annual Grassland, Coastal Oak Woodland, Montane Hardwood and Redwood.
 - Sierra: Montane Hardwood, Blue Oak Woodland, Annual Grassland and Montane Hardwood-Conifer.
- Other habitat types of much smaller extent show up as threatened in local areas of other bioregions, such as the Blue Oak - Foothill Pine in the northern Sacramento Valley bioregion.

Priority Landscapes



This analysis identifies California landscapes of high ecosystem values that are currently facing significant threats from development. High ecosystem value landscapes are defined as areas where specific wildlife habitat types are at significant risk from regional development over the next ten to 30 years.

1.2: Sustainable Working Forests and Rangelands

CHAPTER OVERVIEW

The concept of “working landscapes” was developed to encompass the idea that lands used for commodity production also provide crucial ecosystem services and that future demands make it essential that these systems are managed for joint production of ecosystem services as well as food, fiber, energy, and other economic values.

Current condition and trends of working landscapes and the industries that depend on them, as well as threats to their sustainability from various land use practices are discussed in chapter sections related to: Land Use and Land Cover Impacts, Forests and Woodlands, Forest Products Sector, and Rangelands and Range Industry.

The final chapter section addresses opportunities for landowner assistance to enhance productivity and health of working landscapes. This includes three unique spatial analyses, each identifying priority landscapes where additional investments have both the potential to enhance commodity production and the capacity to provide ecosystem services:

1. **Risk Reduction on Forestlands:** identifies areas with timber and biomass energy assets that are threatened by wildfire and forest pests.
2. **Risk Reduction on Rangelands:** identifies areas where rangeland productivity is threatened by wildfire.
3. **Restoring Impacted Timberlands:** identifies areas with timber and biomass energy assets that have been impacted by past wildfires or forest pest outbreaks.

A fourth non-spatial statistical analysis is included to quantify opportunities for improving stocking levels on timberlands. The landowner assistance section concludes with a discussion of the various state and federal programs that exist to provide technical, financial and other assistance to forest and range landowners.

Land Use and Land Cover Impacts Key Findings

- 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.
- 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.

Forests and Woodlands Key Findings

- Both private and public forestlands appear to continue to build inventory volume.
- A 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 annual net sequestration is estimated to be about 5 million metric tons per year on private forestlands and about 25 million metric tons per year on public forestlands.
- 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 Key Findings

- The forest products infrastructure of California is declining in terms of jobs, capacity and overall economic activity. Softwood sawmill capacity shrank by 25 percent in the last few years. Climate change adaptation, biomass energy production, and risk reduction and restoration activities depend on that infrastructure, as do many of the rural economies of California.
- Industrial ownership patterns have shifted from publicly held corporations to privately held firms.
- Individual Timber Harvesting Plans (THPs) have been increasing in size. Their total acreage was fairly steady before 2009. 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.

Rangelands and Range Industry Key Findings

- Rangeland productivity is highly variable across space and time. Climate change impacts 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; these must be economically viable operations 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

ANALYSIS: RISK REDUCTION ON FORESTLANDS

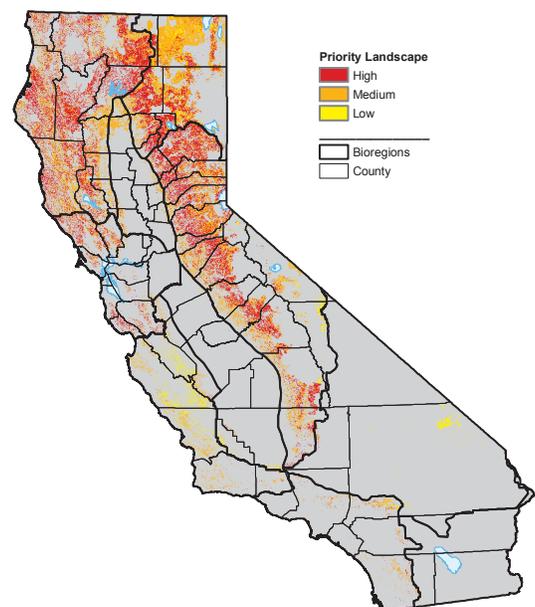
Key Findings

- High priority landscapes were found primarily in the Klamath/North Coast, Modoc and Sierra bioregions.

For this analysis, economic assets include timber and forest biomass. High priority landscapes represent areas with important economic assets that face significant threat from wildfire and forest pests.

| High priority landscape acres by ownership | |
|--|-----------|
| USFS | 3,940,000 |
| BLM | 140,000 |
| DOD | <10,000 |
| Tribal | 50,000 |
| NPS | <10,000 |
| Other Federal | 10,000 |
| Other Gov. | 90,000 |
| Private | 3,570,000 |
| NGO | 10,000 |

Priority Landscapes



ANALYSIS: RISK REDUCTION ON RANGELANDS

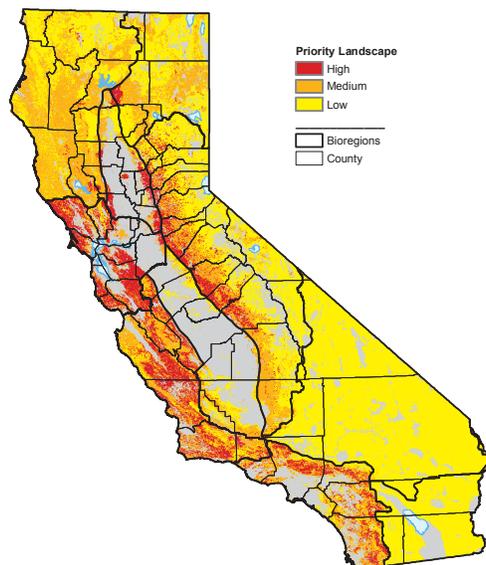
Key Findings

- High priority landscapes 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.

This analysis identifies areas where rangeland productivity asset that is threatened by wildfire.

| High priority landscape acres by ownership | |
|--|-----------|
| USFS | 1,520,000 |
| BLM | 270,000 |
| DOD | 160,000 |
| Tribal | 70,000 |
| NPS | 130,000 |
| Other Federal | 40,000 |
| Other Gov. | 620,000 |
| Private | 6,420,000 |
| NGO | 60,000 |

Priority Landscapes



ANALYSIS: RESTORING IMPACTED TIMBERLANDS

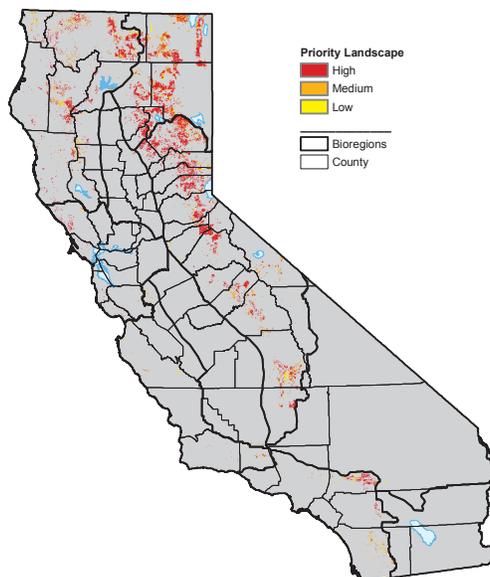
Key Findings

- Extensive areas of high and medium priority landscapes were 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.

For this analysis, economic assets include timber and forest biomass. Threats were derived from areas impacted by past wildfires and forest pest outbreaks. High priority landscapes represent areas with important economic assets that have already been significantly damaged by past wildfires or forest pest outbreaks.

| High priority landscape acres by ownership | |
|--|-----------|
| USFS | 2,050,000 |
| BLM | 20,000 |
| DOD | <10,000 |
| Tribal | <10,000 |
| NPS | <10,000 |
| Other Federal | <10,000 |
| Other Gov. | 10,000 |
| Private | 570,000 |
| NGO | <10,000 |

Priority Landscapes



ANALYSIS: STAND IMPROVEMENT

A clear opportunity exists to implement strategies for improving forest stands 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.

2.1 Wildfire Threats to Ecosystem Health and Community Safety

CHAPTER OVERVIEW

California is a complex wildfire-prone and fire-adapted landscape. Natural wildfire has supported and is critical to maintaining the structure and function of California's ecosystems. As such, the ability to use wildfire, or to mimic its impact by other management techniques, is a critical management tool and policy issue. Simultaneously, wildfire poses a significant threat to life, public health, infrastructure and other property, and natural resources.

Data suggests a trend of increasing acres burned statewide, with particular increases in conifer vegetation types. This is supported in part by the fact that the three largest fire years since 1950 have all occurred this decade. Wildfire related impacts are likely to increase in the future based on trends in increased investment in fire protection, increased fire severity, fire costs and losses, and research indicating the influence of climate change on wildfire activity.

Developing coherent strategies involves collaborative planning, given the unique and disparate audience for dealing with the threat (i.e., numerous individual landowners). In terms of protecting communities, this is discussed in detail in Chapter 3.3: Planning for and Reducing Wildfire Risks to Communities.

This chapter contains three unique spatial analyses that generate priority landscapes:

1. Preventing Wildfire Threats to Maintain Ecosystem Health
2. Restoring Wildfire-Impacted Areas to Maintain Ecosystem Health
3. Preventing Wildfire Threats for Community Safety

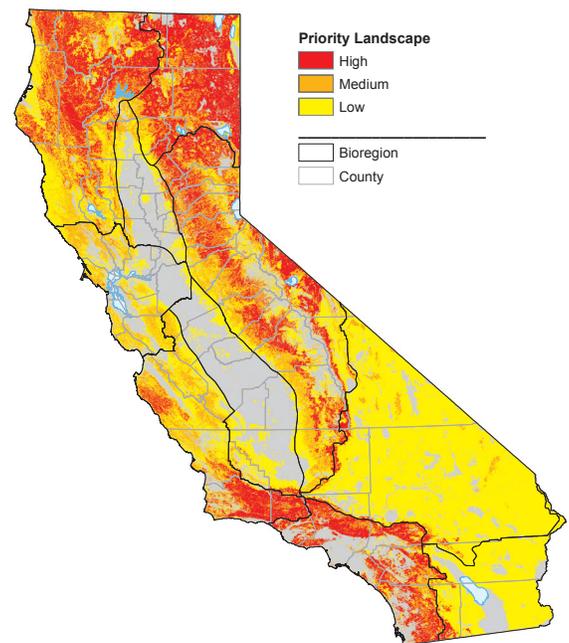
ANALYSIS: PREVENTING WILDFIRE THREATS TO MAINTAIN ECOSYSTEM HEALTH

Key Findings

- Over 21 million acres statewide are viewed as high priority ecosystems for protection from threats from wildfires, with large concentrations in the South Coast, Sierra, and Modoc bioregions, and the northern interior portions of the Klamath/North Coast.
- Key ecosystems at risk include conifer types such as Klamath and Sierran Mixed Conifer and Douglas-fir; shrub systems at risk include Sagebrush, Mixed Chaparral, and Coastal Scrub.
- Managing these risks requires understanding the specific mechanisms of disruption of the natural fire regimes that once formed the ecological stability of the ecosystem, and determining actions that best mimic and or restore these natural processes in manners that are appropriate for different types of land ownership and management. As such, tools must be tailored to the specific ecosystem.

| High priority landscape acres by ownership | |
|--|------------|
| USFS | 10,980,000 |
| BLM | 1,980,000 |
| DOD | 130,000 |
| Tribal | 230,000 |
| NPS | 370,000 |
| Other Federal | 60,000 |
| Other Gov. | 640,000 |
| Private | 6,890,000 |
| NGO | 50,000 |

Priority Landscapes



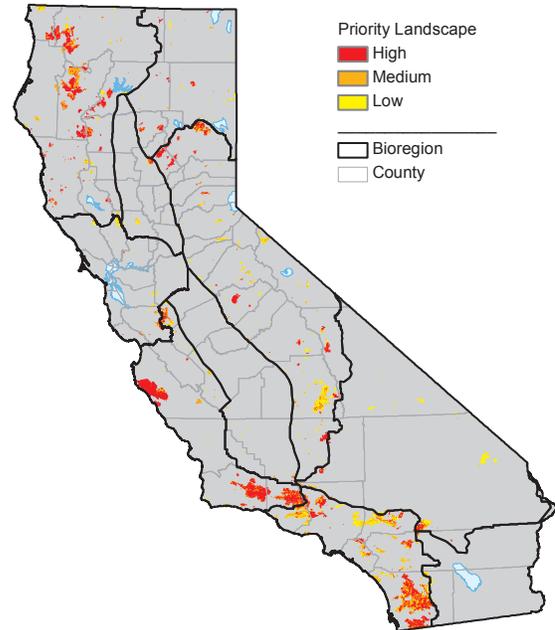
This analysis identifies priority landscapes where unique ecosystems have high levels of threat of damage from future fires, and should be viewed as a basic assessment of need for strategies and adoption of tools to protect these key areas in the future.

ANALYSIS: RESTORING WILDFIRE-IMPACTED AREAS TO MAINTAIN ECOSYSTEM HEALTH

Key Findings

- A total of 2.35 million acres are in high priority for restoration statewide.
- In the northern portion of the state, high priority landscapes include the Klamath, Trinity, and Feather River water basins, and highlight the fire-restoration issue in conifer ecosystems adapted to a frequent, low-severity fire regime, but burning under a less-frequent, more severe modern era regime.
- A total of 445,000 acres in Douglas-fir, Klamath Mixed Conifer, and Sierran Mixed Conifer are in high priority for restoration.
- In the southern portion of the state, a large area of Mixed Chaparral is in high priority status (over 700,000 acres) highlighting direct impacts on soils and watersheds due to fire’s typical high intensity/high severity nature in this habitat type, as well as some areas suffering repeated burning and associated type-conversion.
- Similarly, the 200,000 acres of Coastal Scrub in high priority landscapes deserve special attention due to loss of key ecosystem components, and the apparent trend in increased fire frequency, increased non-native invasive dominance, and loss of ecosystems due to land use practices.
- Priority for restoration efforts reflect areas recently burned in wildfire, and will require more resources than have historically been available due to the large area burned in recent fires.

Priority Landscapes



This analysis focuses on restoring fire damaged lands by prioritizing areas that have recently burned in wildfires, especially where a majority of entire ecosystems are impacted. The objective is to define areas in need of activities designed to facilitate recovery of key ecosystem components.

| High priority landscape acres by ownership | |
|--|-----------|
| USFS | 1,440,000 |
| BLM | 120,000 |
| DOD | 20,000 |
| Tribal | 40,000 |
| NPS | 30,000 |
| Other Federal | 20,000 |
| Other Gov. | 150,000 |
| Private | 530,000 |
| NGO | 10,000 |

ANALYSIS: PREVENTING WILDFIRE THREATS FOR COMMUNITY SAFETY

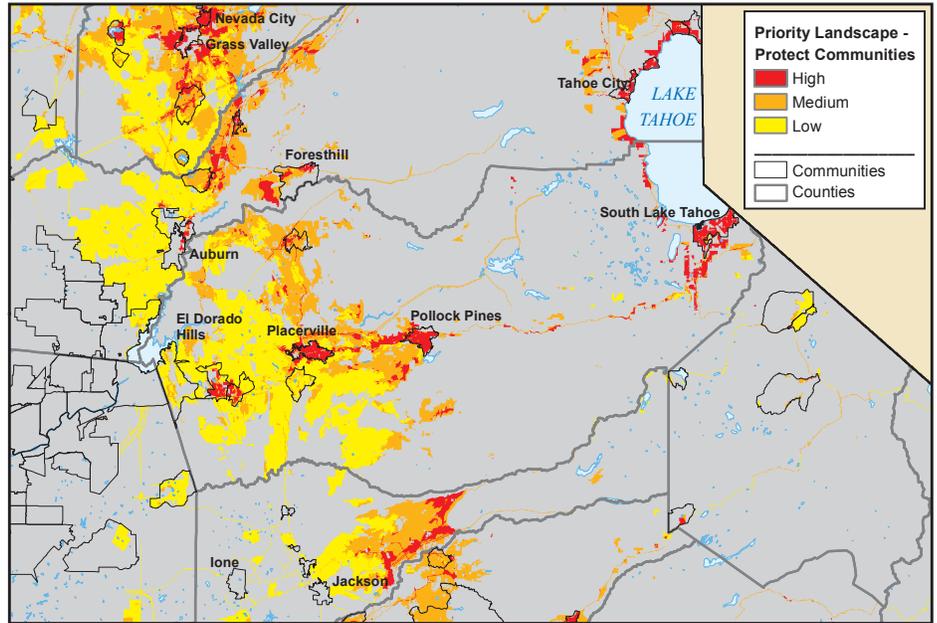
Key Findings

- Community areas of high and medium priority are scattered throughout the state, occurring in at least modest (500 acres) abundance in 46 of 58 counties statewide.
- Areas of high priority landscape concentration occur in the South Coast and Sierra bioregions, and other isolated urban areas near significant wildfire high threat areas, such as the East Bay and Redding.
- The cities of San Diego and Los Angeles are by far the largest communities in terms of high priority landscapes.

Urban populations of San Bernardino, Riverside, Orange and Ventura counties also have extensive high priority areas. Many of these densely populated areas require coordinated fuel management across significant amounts of adjacent areas to be effective.

- Many rural counties have significant numbers of communities and acreage in medium priority landscapes – a result of extensive low density housing areas in high threat landscapes. These are areas where individual homeowner vegetation management can make a large difference.
- A total of 404 communities meet a basic asset-area threshold for significance, and many more lands not captured within the community layer represent significant areas of risk from wildfires.

Priority Landscapes



This analysis derives priority landscapes as the convergence of areas with high wildfire threat and human infrastructure assets. This is summarized using indicators for prioritizing communities in terms of investments to prevent likely wildfire events that would create the most severe public safety hazards.

Map depicts an example priority landscape for the western Sierra Nevada/Lake Tahoe region, where high wildfire threat converges with high infrastructure assets. Priority landscapes were derived for the entire state.

| Population of top counties with high priority landscapes | |
|--|---------|
| Los Angeles | 813,000 |
| San Diego | 432,000 |
| Orange | 235,000 |
| Ventura | 174,000 |
| San Bernardino | 120,000 |
| Riverside | 93,000 |
| El Dorado | 67,000 |
| Alameda | 65,000 |
| Contra Costa | 42,000 |
| Nevada | 39,000 |
| Butte | 38,000 |
| Shasta | 37,000 |

2.2: Forest Pests and Other Threats to Ecosystem Health and Community Safety

CHAPTER OVERVIEW

The term forest pest, as used in this assessment, refers to both forest insects and diseases. In California, they cause widespread damage to forest economic values and ecosystem services. Bark beetles and wood boring insects have undergone periodic outbreaks nearly every decade, often related to several years of drought. For example, in 2003 Congress provided over \$225 million over three years to address hazards from bark beetle killed trees in Southern California, allowing agencies to remove over 1.5 million dead trees to address a potential public safety hazard. Other examples of past widespread damage are numerous, including sudden oak death in the San Francisco Bay Area and the north coast, and bark beetles and wood borers in the south coast and Sierra. Areas of attack tend to be in stands under extreme stress due to root disease, other insect and disease impacts, drought, or overstocking.

While native forest pests are expected to continue to cause extensive problems, the ratio of exotic (non-native) pests to native pests has been increasing over time. Currently, up to one-third of the total number of significant pests are now non-native to California. These risks are increasing rapidly and additional resources that can work across all lands are needed. The potential for spread and impact of gypsy moths, light brown apple moths, the goldspotted oak borers and exotic bark beetles is a major concern for forest management agencies. Pitch canker disease, sudden oak death, white pine blister rust and Port-Orford-Cedar root disease are examples of exotic diseases of major concern.

In California, responsibility for the control of forest pest outbreaks often falls to the California Department of Forestry and Fire Protection (CAL FIRE) on state and privately owned lands and the U.S. Forest Service on federal lands. CAL FIRE, with the approval of the California Board of Forestry and Fire Protection (BOF) can declare a Zone of Infestation for native and exotic insect and disease pests. Within a Zone of Infestation CAL FIRE employees may go on private lands to attempt eradication or control in a manner approved by the BOF.

Forest management tools include the removal of dead, dying and diseased trees, thinning of small and medium live trees, replanting multiple species, and other techniques used to remove hazards and improve ecosystem health. Lack of mills in some areas and historically low wood prices have left many spot infestations untreated and growing rapidly.

This chapter includes four unique spatial analyses that identify priority areas where forest management practices are most likely to prevent and mitigate impacts;

1. Restoring Forest Pest Impacted Areas to Maintain Ecosystem Health
2. Restoring Forest Pest Impacted Communities for Public Safety
3. Preventing Forest Pest Outbreaks to Maintain Ecosystem Health
4. Preventing Forest Pest Outbreaks for Community Safety

Finally, other threats from invasive non-native plants and air pollution could not be analyzed spatially due to data limitations, and are discussed by narrative. Invasive non-native plants damage ecosystems in California by displacing native species, out-competing native plants, changing plant communities and structure, altering natural processes related to water and fire, and reducing wildlife habitat value. This chapter also addresses regional air pollution impacts that can adversely affect natural ecosystems and working landscapes in California.

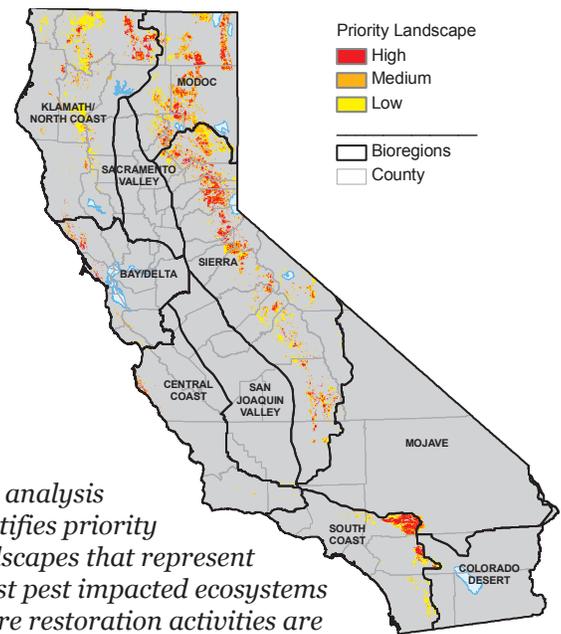
ANALYSIS: RESTORING FOREST PEST IMPACTED AREAS TO MAINTAIN ECOSYSTEM HEALTH

Key Findings

- There are over six million acres of priority landscapes that are impacted by forest pests in California, with 31 percent of these ranked high. Seventy-five percent of priority landscapes are on lands managed by the U.S. Forest Service (USFS), only 18 percent are on privately owned lands.
- Sierra Mixed Conifer (SMC), Eastside Pine (EPN), Red Fir (RFR) and White Fir (WFR) are the habitat types with the most priority acres.
- White Fir had the largest proportion of its habitat identified as a priority landscape (43 percent), and almost 240,000 acres (26 percent) designated as high priority. Twenty-eight percent of Red Fir was designated as high.

| High priority landscape acres by ownership | |
|--|-----------|
| USFS | 1,430,000 |
| BLM | 10,000 |
| DOD | 0 |
| Tribal | <10,000 |
| NPS | 60,000 |
| Other Federal | <10,000 |
| Other Gov. | 30,000 |
| Private | 340,000 |
| NGO | 10,000 |

Priority Landscapes



This analysis identifies priority landscapes that represent forest pest impacted ecosystems where restoration activities are most needed.

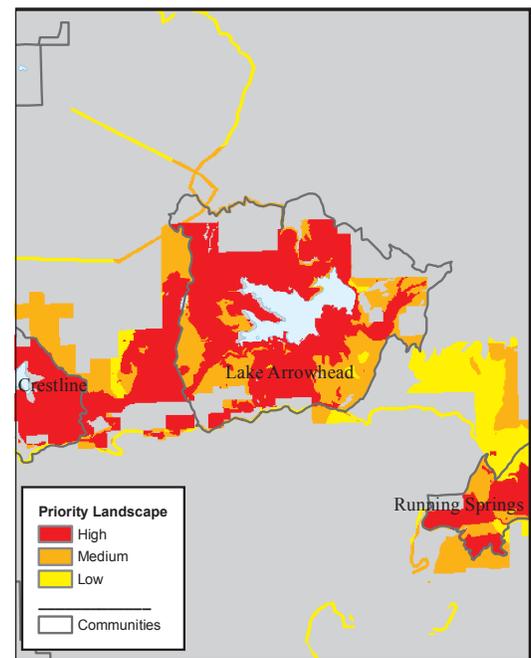
ANALYSIS: RESTORING FOREST PEST IMPACTED COMMUNITIES FOR PUBLIC SAFETY

Key Findings

- Restoration priorities were identified in 13 communities with at least 20 percent of their area in priority landscapes. Eight of these are in the South Coast bioregion and are covered by state and county level declared emergencies. Four of the remaining five priority communities are in the Bay/Delta bioregion and are covered under a Zone of Infestation order, which has been declared by CAL FIRE to address sudden oak death.
- The South Coast, Bay/Delta and Sierra bioregions comprise 98 percent of high priority areas and 83 percent of priority landscapes. Bark beetles in the South Coast and Sierra bioregions and sudden oak death in the Bay Area are major issues; Zones of Infestation have been declared to address many of these concerns.
- San Bernardino, Sonoma, San Diego, Riverside and Placer Counties have over half of the priority landscapes. San Bernardino County alone has almost 60 percent of the highest priority acres.

| High priority landscape acres by county | |
|---|--------|
| San Bernardino | 17,709 |
| Riverside | 4,371 |
| Sonoma | 1,801 |
| Marin | 913 |
| Nevada | 720 |
| Placer | 624 |
| San Mateo | 546 |
| San Diego | 536 |
| Tulare | 472 |
| Kern | 328 |

Priority Landscapes



This analysis identifies priority landscapes that represent areas of tree mortality coincident with human infrastructure such as houses, roads, and transmission lines where falling trees are a public safety issue, and restoration activities are most needed.

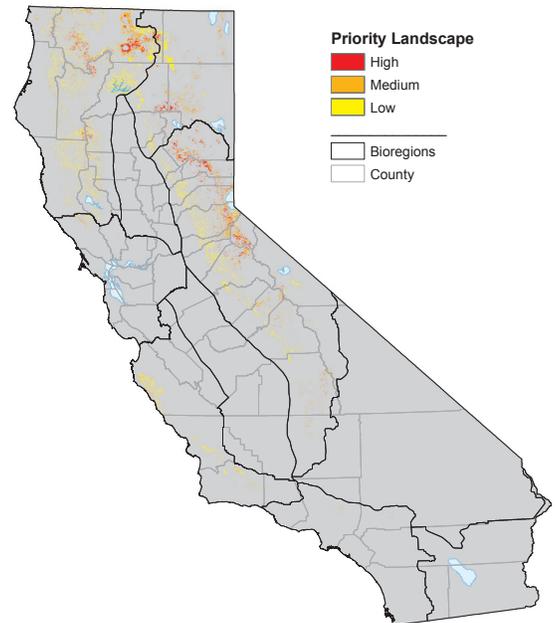
ANALYSIS: PREVENTING FOREST PEST OUTBREAKS TO MAINTAIN ECOSYSTEM HEALTH

Key Findings

- The Klamath/North Coast (48 percent), Sierra (33 percent), and Modoc (13 percent) bioregions comprise almost 95 percent of priority landscape acres.
- Two-thirds of areas at risk are U.S. Forest Service lands, one-third are private.
- White Fir (30 percent), Red Fir (29 percent), and Lodgepole Pine (16 percent) are the habitat types most at risk (high plus moderate priorities) from future tree mortality. These results are partially supported by findings from the previous analysis, which identifies these types as having significant pest activity over the last 15 years.
- Montane Hardwood is the habitat with the most total priority landscape acres in the Klamath/North Coast Bioregion. Red Fir, Ponderosa Pine, and White Fir are the most at risk habitat types in the Sierra bioregion.

| High priority landscape acres by ownership | |
|--|---------|
| USFS | 310,000 |
| BLM | <10,000 |
| DOD | 0 |
| Tribal | 0 |
| NPS | 20,000 |
| Other Federal | <10,000 |
| Other Gov. | <10,000 |
| Private | 70,000 |
| NGO | <10,000 |

Priority Landscapes



This analysis identifies priority landscapes that represent ecosystems most at risk from damage from future outbreaks.

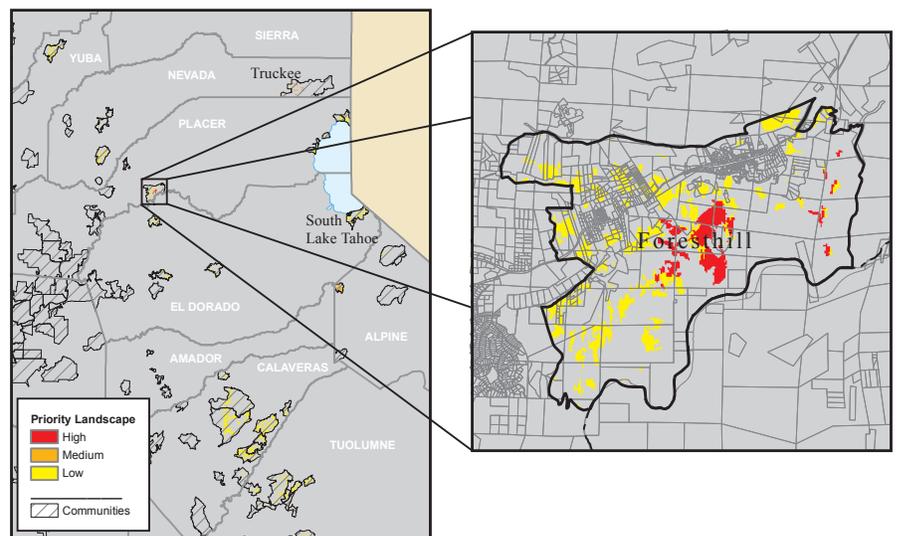
ANALYSIS: PREVENTING FOREST PEST OUTBREAKS FOR COMMUNITY SAFETY

Key Findings

- Over 82,000 acres of community infrastructure are found to be at risk from future forest pest outbreaks.
- Magalia, South Lake Tahoe, Paradise and Truckee are the largest communities identified as priorities for forest pest prevention activities.

| High priority landscape acres by county | |
|---|------|
| Placer | 300 |
| Mono | 200 |
| Alpine | 100 |
| Plumas | 100 |
| Nevada | 100 |
| Nevada | 100 |
| Humboldt | 100 |
| Tehama | 100 |
| El Dorado | <100 |
| Shasta | <100 |
| Siskiyou | <100 |

Priority Landscapes



This analysis identifies priority landscapes that represent communities most at risk from damage from future outbreaks.

3.1: Water Quality and Quantity Protection and Enhancement

CHAPTER OVERVIEW

Forested watersheds in California provide an abundant supply of clean water that supports a broad range of downstream uses. The major watersheds across California differ distinctly in climate, geology, ecosystems, and land use; each of which has an affect on the availability of water resources. This has resulted in different water resource conflicts and constraints that vary regionally across the state. To account for this tremendous variation, flexible water management tools and policies are needed. In addition, public education is needed to increase awareness of the role forests play in protecting critical water resource assets and the threats that exist to water resources in headwater regions.

Protecting and managing forests in source watersheds is an essential part of future strategies for providing a sustainable supply of clean water for a broad range of beneficial uses. Tools to address threats to water supply include: water conservation, restoration of riparian forests, restoration of mountain meadows, and protection of groundwater. Tools to address water quality concerns include: reduction of soil erosion through Best Management Practices for forest roads and timber harvesting, additional protection for riparian areas in salmonid watersheds, road maintenance and fuel reduction treatments designed to reduce high severity wildfires. Urban forests have also been shown to improve water quality by filtering stormwater runoff.

This chapter includes an analysis of threats to water supply and a second analysis that includes an evaluation of threats to water quality.

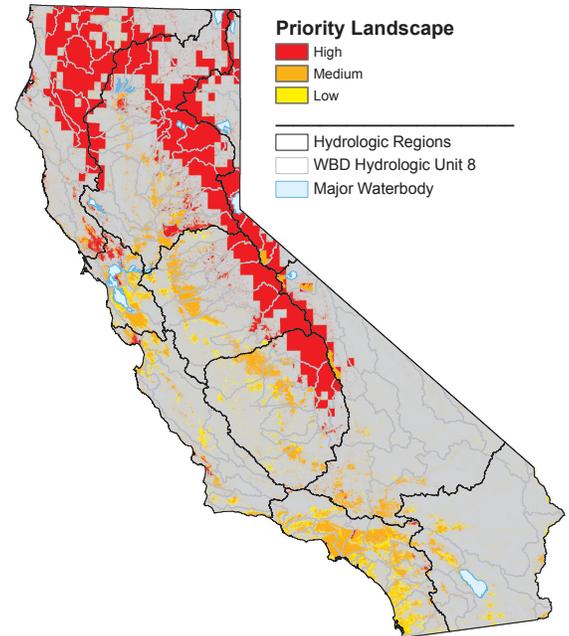
ANALYSIS: WATER SUPPLY

Key Findings

- High Priority Landscape (HPL) is concentrated in watersheds across the Sierra, Cascade, Klamath and Siskiyou Ranges.
- Projected decreases in snowpack from climate change are expected to affect the timing and distribution of runoff in watersheds throughout the Sierra Nevada.
- Restoration of mountain meadows offers an opportunity to improve the storage, groundwater recharge and the timing of runoff in Sierra Nevada upper elevation watersheds.
- The Klamath/North Coast bioregion also has substantial water supply assets, but little storage capacity. These watersheds are predominately rain fed; the water supply impacts from climate change will likely be less dramatic than in the Sierra Nevada. Impacts in the Klamath Mountains are expected to be between those in the Sierra Nevada and those in the Coast Ranges.
- Groundwater basins in the two Central Valley bioregions are an abundant resource heavily threatened due to over pumping.
- Watersheds in the South Coast bioregion mountain ranges contribute to local municipality water supplies which reduces dependence on imported water from northern portions of the state.

| High priority landscape acres by ownership | |
|--|------------|
| USFS | 10,563,902 |
| BLM | 510,189 |
| DOD | 2,354 |
| Tribal | 59,719 |
| NPS | 1,617,618 |
| Other Federal | 15,983 |
| Other Gov. | 148,109 |
| Private | 5,277,503 |
| NGO | 6,951 |

Priority Landscapes



The high priority landscape (HPL) identifies locations where high value water supply coincides with high threats and thus represents areas where stewardship projects are most needed.

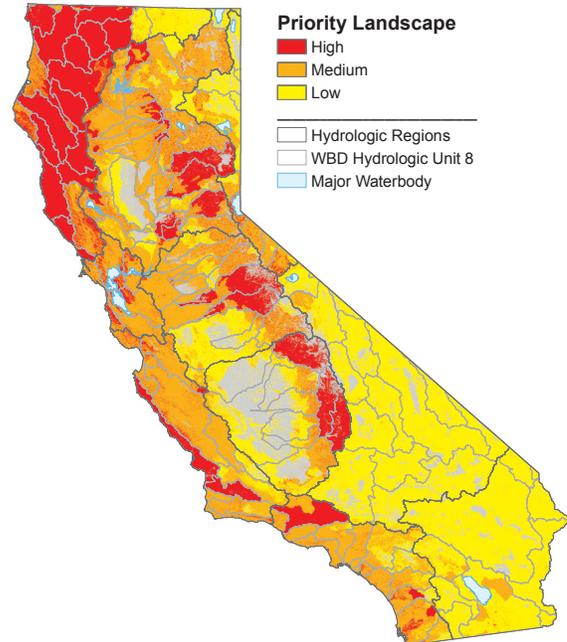
ANALYSIS: WATER QUALITY

Key Findings

- Water quality impairments from forests and rangelands are most pronounced in watersheds in the North Coast/Klamath bioregion. These watersheds are critical for recovery of state and federally listed anadromous salmonids.
- The watersheds in the Sierra Nevada Mountains include a mix of medium and high priority landscape. The Lake Tahoe basin has the highest priority for the watersheds in this region.
- The watersheds of the Central Coast and South Coast bioregions are mostly ranked as medium priorities. Forest health (see Forest Pests Chapter 2.2) and fire management (see Wildfire threats Chapter 2.1) greatly influence water quality conditions in these watersheds.

| High priority landscape acres by ownership | |
|--|------------|
| USFS | 8,840,000 |
| BLM | 1,200,000 |
| DOD | <10,000 |
| Tribal | 40,000 |
| NPS | 1,700,000 |
| Other Federal | 400,000 |
| Other Gov. | 380,000 |
| Private | 53,330,000 |
| NGO | 10,000 |

Priority Landscapes



The analysis presented identifies locations where high value water assets in watersheds supporting a broad range of beneficial uses coincide with high risks that threaten water quality. For this analysis the threat of water quality in watersheds was assumed to increase with the number of water quality stressors that are present.

3.2: Urban Forestry for Energy Conservation and Air Quality

CHAPTER OVERVIEW

The California urban forest is concentrated in metropolitan areas and encompasses about five percent (7,944 square miles, or approximately 5 million acres) of land and supports 94 percent of the population. Urban areas are the most populated areas in the state as defined by the U.S. Census.

Many private companies, non-profit organizations and governmental programs have worked hard to sustain and improve California's urban forest. This strong network of organizations provides many public benefits by improving the urban forest and by increasing public awareness of the importance of urban forests.

Urban forests provide recreation, pollution reduction, carbon storage, heat island mitigation, storm water control, noise reduction, wildlife habitat, energy conservation and increased property values. Benefits vary with tree size and location and increase in hotter climates and as urban population grows. In addition, urban forestry adds jobs and economic value to the California economy.

Many daily activities, such as driving, mowing lawns, dry-cleaning clothes and natural occurrences such as wind blown dust and fires pollute the air. California has some of the most polluted areas in the nation. Urban forests help filter out air pollutants by depositing pollutants in the canopy, sequestration of CO₂ in woody biomass and reduce air temperatures. The value of these benefits is considerable across the state, and maximum results achieved when the efforts and benefits are focused in highly populated areas.

Population growth and hotter summers have increased the need for electricity in California. Energy shortages and urban heat potential increase with urban development which adds impervious surfaces such as asphalt, concrete and roofs to urban areas. Urban trees reduce summer air temperatures by absorbing water through their roots and evaporating it through their leaves in a process called evapotranspiration and by providing shade. Urban trees can help conserve energy by providing shade in hot summer months.

This chapter includes two analyses:

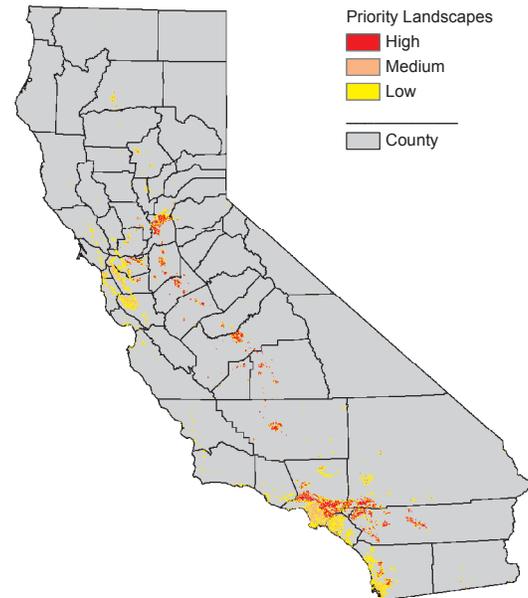
1. **Urban Tree Planting:** identifies priority areas where tree planting can provide the greatest benefit to urban populations in terms of mitigating air pollution and urban heat islands.
2. **Urban Tree Maintenance:** identifies priority areas where maintaining existing tree canopy can provide the greatest benefit to urban populations in terms of mitigating air pollution and conserving energy.

ANALYSIS: URBAN FORESTRY TREE PLANTING

Key Findings

- Close to 800,000 densely populated urban acres, or 15.1 percent of the state’s urban area, has been identified with high threat for air pollution and urban heat islands.
- Close to 28 percent of the state’s population (9.5 million people) live in high threat areas for air quality and urban heat.
- 372 communities have been identified as high priority planting areas.

Priority Landscapes



| Percent county population in high priority landscape | |
|--|------|
| Stanislaus | 74.2 |
| Fresno | 73.9 |
| Sacramento | 73.7 |
| Riverside | 72.1 |
| Merced | 67.2 |
| Tulare | 65.0 |
| Kings | 65.0 |
| Kern | 64.1 |
| San Joaquin | 62.2 |
| San Bernardino | 56.7 |

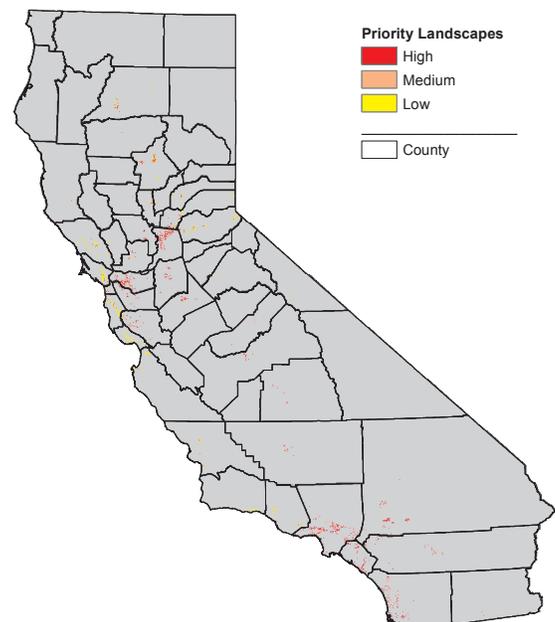
This analysis identifies densely populated areas with considerable air pollution and urban heat islands. Planting efforts can reduce the amount of energy consumption due to cooling needs and filter air pollutants.

ANALYSIS: URBAN FORESTRY MAINTENANCE

Key Findings

- Close to 217,000 urban acres, about 4.3 percent of the state’s urban area, has been identified as densely populated areas with substantial existing tree canopy assets.
- Activities and projects to maintain and protect overall tree canopy would benefit the close to two million people living in these areas.
- A community may be identified as a priority landscape in both maintenance and planting because results are calculated at about 10,000 square feet, approximately one-quarter acre, but reported at a community level.

Priority Landscapes



| Percent county population in high priority landscape | |
|--|------|
| Sacramento | 30.7 |
| Butte | 26.2 |
| Yolo | 25.9 |
| San Joaquin | 21.9 |
| El Dorado | 16.6 |
| Sutter | 15.9 |
| Imperial | 14.1 |
| Placer | 13.5 |
| Shasta | 12.0 |
| Contra Costa | 11.8 |

This analysis identifies areas in California that are densely populated with people and trees, with many days over 90° F and exceeding air pollution standards. Protecting the existing tree canopy in these areas provides public benefit.

3.3: Planning for and Reducing Wildfire Risks to Communities

CHAPTER OVERVIEW

This chapter looks at the current status of collaborative, community-based wildfire planning and the extent of available planning resources relevant to community wildfire safety and protection.

In California, community involvement in wildfire planning is extensive, as evidenced, for example, by community wildfire protection plans (CWPP, as defined under the Healthy Forests Restoration Act of 2003), local and regional Fire Safe Councils, Resource Conservation Districts and community participation in the federal Firewise Communities/USA program. State laws requiring ‘defensible space’ around structures, building codes, and other responsibilities are aimed at helping communities reduce their risk of loss when wildfire strikes. Federal programs, such as the National Fire Plan, also help with funding for fire hazard reduction.

This chapter contains a single analysis that identifies priority communities where wildfire threat coincides with human infrastructure such as houses, transmission lines and major roads. These priority communities are then summarized in terms of the presence of a CWPP, and Firewise Communities/USA recognition. The availability of community planning resources is also examined.

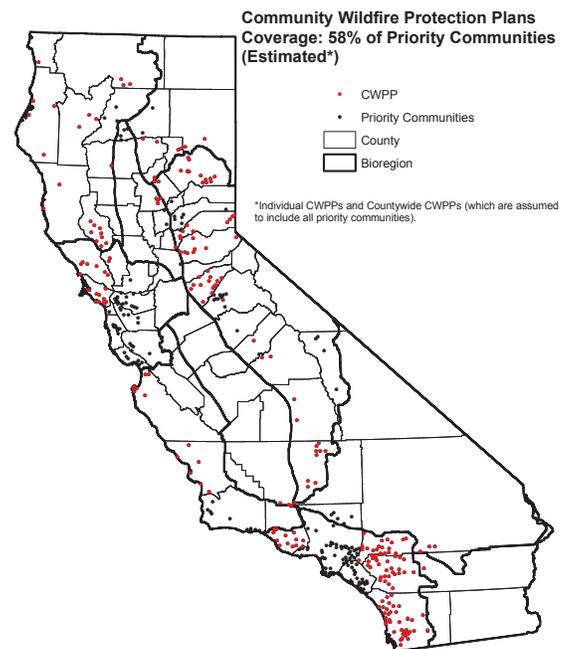
ANALYSIS: COMMUNITY WILDFIRE PLANNING

Key Findings

- It is estimated there are at least 317 communities protected by Community Wildfire Protection Plans throughout the state. Even more are covered by a countywide CWPP.
- A total of 404 priority communities were identified, representing about 2.6 million people living on about 1.1 million acres in high or medium priority landscapes. With the assumption that all priority communities in a county or countywide CWPP are covered by that CWPP, at least 234 (or about 58 percent) of the priority communities are covered by a Community Wildfire Protection Plan.
- About 250 Fire Safe Councils or their equivalent were identified (which included homeowner associations, resource and fire protection districts, local government organizations, advisory groups, CAL FIRE units, Indian Tribes and others). Of these, 47 are countywide in geographic scope. Others are community-centric or regional. There are 38 recognized Firewise Communities. These numbers are growing.
- Priority communities were present in all bioregions, with 62 percent occurring in the South Coast and Sierra bioregions.

| Priority communities by bioregion | |
|-----------------------------------|-----|
| South Coast | 168 |
| Sierra | 83 |
| Bay/Delta | 67 |
| Klamath/North Coast | 28 |
| Central Coast | 24 |
| Sacramento Valley | 12 |
| Modoc | 9 |
| Mojave | 9 |
| San Joaquin Valley | 3 |
| Colorado Desert | 1 |

Priority Landscapes



The analysis in Wildfire Threats to Ecosystem Health and Community Safety identifies priority communities at risk from wildfire. In this chapter, an analysis examines which of these priority communities have CWPPs, or are Firewise communities and several other criteria that can suggest the presence of community planning resources and experience.

3.4: Emerging Markets for Forests and Rangeland Products and Services

CHAPTER OVERVIEW

Emerging markets for renewable energy, ecosystem services and niche products are impacting how forest and rangelands are managed. Developing appropriate policies will require a better understanding of the benefits and environmental impacts of these emerging markets and how society values the various market and non-market products and services provided by forests and rangelands.

California Renewables Portfolio Standards (RPS), established by SB 1078 (2002) and accelerated under SB 107 (2006) and Executive Order S-14-08 (2008), creates a target of 33 percent of electricity from renewable energy sources by 2020. Reaching this target will require a significant expansion of energy facilities and related infrastructure on forest and rangelands. In the Mojave and Colorado Desert bioregions the number and size of proposed solar and wind power generation sites has engendered controversy over potential impacts to wildlife habitat.

Biomass energy provides a financial incentive for treating areas for risk reduction or restoration related to wildfire and forest pests. Biomass energy from forestlands provides about one percent of California's electricity use, while having the potential to provide nearly eight times this amount. Biomass also has unutilized potential for heating homes, businesses and schools, and for conversion to liquid transportation fuels. Questions of long-term biomass supply, as well as possible ecological and other impacts of biomass removal on forest sustainability, are key issues in California. The California Energy Commission, working through the California Biomass Collaborative and various stakeholders, has produced a comprehensive strategy for sustainable development of biomass in the state.

California's forests and rangelands provide a variety of ecosystem services, for which landowners are generally not compensated. In many cases, market mechanisms for exchange of values from ecosystem services in California are still limited. Despite this, substantial investments have been made that support ecosystem services. Typically, these investments involve protecting areas that provide unique or high levels of desired services, or restoring areas impacted by past events. These investments come through a variety of programs, agencies and stakeholders. Augmenting this with emerging market-based solutions could enhance the ability to sustain these important services into the future. One example of an emerging market for an ecosystem service, carbon sequestration, is discussed in detail.

Finally, there is a substantial potential for niche markets to stimulate rural economies, for example through certified products, micro-biomass, or landowner collaboratives to produce and market timber using small scale or portable milling technologies.

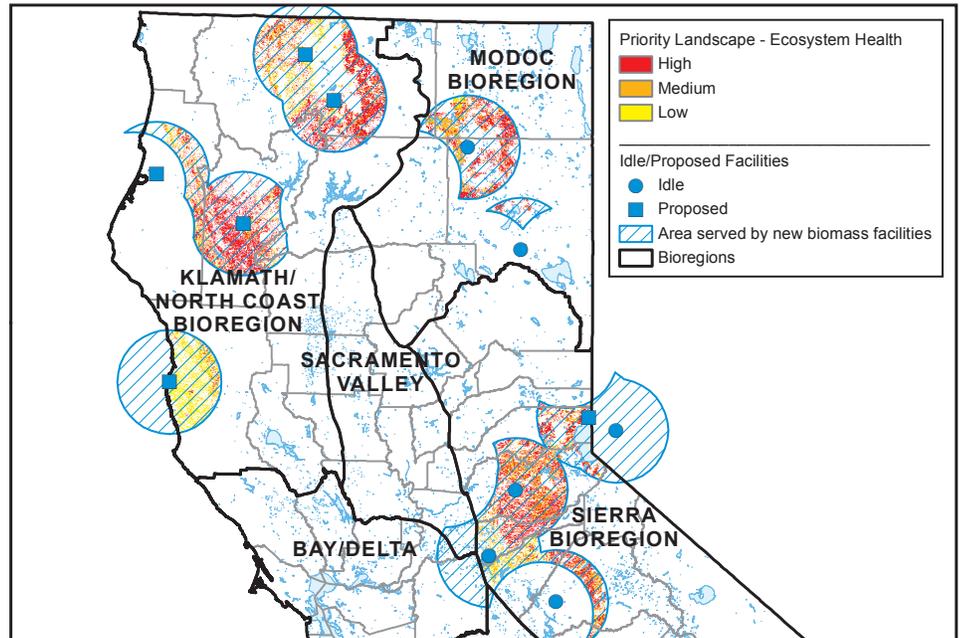
This chapter includes two unique spatial analyses, which explore the potential for treating priority landscapes for risk reduction and restoration related to wildfire and forest pests from previous chapters, if six idle and six proposed biomass facilities are made operational. The first analysis is for ecosystem health, the second for community safety.

ANALYSIS: BIOMASS ENERGY - ECOSYSTEM HEALTH

Key Findings

- Currently, only 22 percent of high priority landscapes are within 25 miles of an operational biomass facility. Adding 12 facilities would increase this number to 39 percent, and primarily benefit the Klamath/North Coast, Modoc and Sierra bioregions.
- Even with the additional facilities, 61 percent of high priority landscapes are not within the 25 mile distance. Since 57 percent of these high priority landscapes are on U.S. Forest Service lands, coordination across agency boundaries will be critical.

Priority Landscapes



This analysis determines the benefits of making six idle and six proposed facilities operational, in terms of facilitating fuel reduction or restoration projects for treating priority landscapes for ecosystem health from the wildfire and forest pests analyses in previous chapters.

ANALYSIS: BIOMASS ENERGY – COMMUNITY SAFETY

Key Findings

This analysis determines the benefits of making six idle and six proposed facilities operational, in terms of treating priority communities from the wildfire and forest pests community safety analyses in previous chapters.

- Currently, only 14 of the 66 priority communities are within 25 miles of an operational biomass facility. Adding the new facilities would reach 11 additional priority communities. Of the remaining 41 priority communities, 31 are in the South Coast bioregion.
- Developing a biomass industry in the South Coast bioregion that addresses the significant wildfire and forest pest threats will be challenging, since there are large acreages in shrub species that are difficult to utilize as biomass, and much of the forestland is in public ownership.

CARBON HIGHLIGHTS

Carbon sequestration is an emerging market that actually quantifies and helps pay for an ecosystem service. This section discusses how terrestrial carbon sequestration is considered in policy and at the project level, the role of carbon in compliance markets, the economics of carbon and the opportunities in California for forest and rangeland carbon.

There are two kinds of carbon markets, voluntary and compliance. Voluntary carbon markets are generally unregulated by government, with transactions usually occurring directly between the buyer and seller. Specific systems, protocols and registries exist for the voluntary market. Compliance markets occur under regulatory schemes, usually cap-and-trade, where offsets are sold to emitters.

Carbon credits will be in demand for both the voluntary and compliance markets. Protocols are in place for many project types. The price of carbon, however, is generally low relative to the value for high quality timber products.

Key Findings

- Carbon sequestration is an ecosystem service for which markets are emerging. As part of these markets, the value of the service is quantified, prices determined and dollars generated for “carbon credits.” Markets are arising for both voluntary exchange between parties (voluntary markets) and in response to the need to reduce carbon impacts as part of regulatory requirements (compliance markets).
- Demand for forest and rangeland-related carbon in such markets or other venues appears to be very significant.
- Carbon credit supply is constrained by economics, risk and other factors. It is estimated that only one to two million tonnes a year will be available to the compliance market from California forests, which is only 10-25 percent of demand.
- “Protocols” have already been developed for both forest and range-related carbon. The development of additional project type protocols for forests and rangelands could promote activities with ecological and economic co-benefits and increase the supply of carbon credits.
- California has large acreages of forest stands that with additional investment could provide larger future benefits in terms of forest products, jobs, and carbon storage and sequestration. Opportunities also exist on rangeland, but the markets and necessary technologies to capture carbon are not sufficiently developed to quantify these opportunities.

3.5: Plant, Wildlife, and Fish Habitat Protection, Conservation and Enhancement

CHAPTER OVERVIEW

A wide variety of climates, geology, fire and ecological processes combine to make California a hotspot of plant, animal and ecosystem diversity. But for the past decades there has been a trend towards increasing numbers of both animal and plant taxa listed under federal and state laws as threatened or endangered. Native fish species, though well-adapted to natural disturbance regimes, are also generally in decline in the face of human-related changes across many watersheds.

The California Wildlife Action Plan (CWAP), the guiding document on state wildlife conservation issues and strategies, presented at least 20 different threats to plant, wildlife and fish populations and their habitats. Four occur statewide: growth and development, water management conflicts, invasive species and climate change. Others occurring in multiple regions include pollution and urban/agricultural runoff, excessive live-stock grazing, altered fire regimes (due to fire suppression and wildland-urban interface expansion), recreational pressure/ human disturbance, and other land management conflicts.

Numerous efforts in California are working towards identifying, preserving and protecting important wildlife, plant, and fish habitat. Tools for addressing wildlife habitat needs include the purchase of land and conservation easements, development planning, zoning, habitat mitigation banking, and habitat restoration, and polices, regulations and funding mechanisms that support these efforts.

This chapter has a single spatial analysis which ranks the threat to areas of important wildlife habitat from uncharacteristic and potentially catastrophic wildfire.

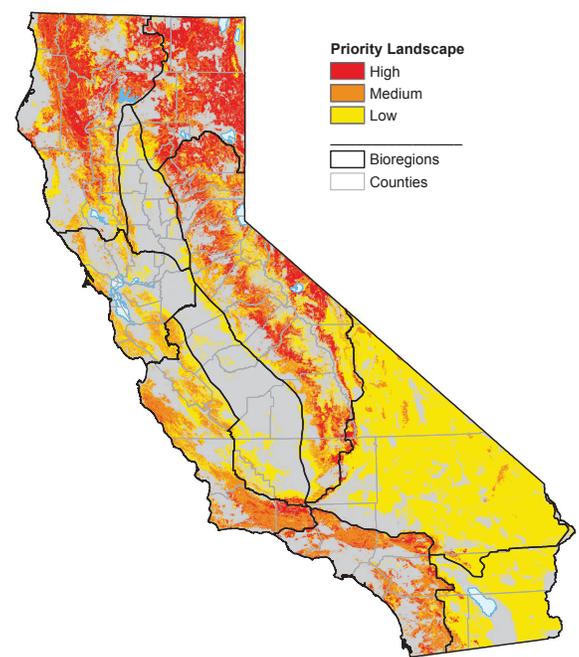
ANALYSIS: WILDFIRE THREAT TO AREAS PROTECTED FOR HABITAT

Key Findings

- Based upon an analysis of wildfire threat to areas that are protected or included in a recent study on corridors, over 14 percent of the state was determined to be in high priority landscapes and over 12 percent in medium priority landscapes.
- The medium and high priority landscapes are concentrated mostly in the Sierra, Klamath/North Coast, Modoc and Central Coast bioregions. Lands managed by federal agencies dominate the priority landscapes.
- At least 45 percent of California's 62 native fish species are considered by the California Department of Fish and Game (DFG) as those of greatest conservation need, and there are 28 fish taxa listed as state or federally threatened or endangered.
- Black bear, pronghorn antelope, bighorn sheep, deer and elk populations are generally stable, but are now at much lower numbers than in the pre-European settlement era.

| High priority landscape acres by ownership | |
|--|------------|
| USFS | 11,526,000 |
| BLM | 2,693,000 |
| DOD | 280,000 |
| Tribal | 355,000 |
| NPS | 995,000 |
| Other Federal | 110,000 |
| Other Gov. | 1,203,000 |
| Private | 6,946,000 |
| NGO | 127,000 |

Priority Landscapes



For this analysis the fire threat layer was used to estimate the potential for fire impacts on protected habitat.

3.6: Green Infrastructure for Connecting People to the Natural Environment

CHAPTER OVERVIEW

For the purposes of this assessment, green infrastructure refers to all public and private forest and rangeland landscapes which provide economic, social, cultural, and environmental services such as recreation, open space, watersheds, wildlife habitat, viewsheds, and working landscapes for commodity production. This definition ignores the vital importance of smaller urban parks, bikeways, and greenbelts – areas that are not mapped statewide. In addition, although agricultural lands provide open space and other values, they are also not included in this discussion.

Current trends identified in this chapter include:

- Given decreasing budgets, agencies are struggling with how to meet public demand for diverse, safe, high-quality recreation opportunities. Ongoing fiscal challenges have already resulted in instances of reduced hours of park operation, and deferred maintenance.
- Activities such as off-highway vehicle (OHV) recreation, mountain biking, boating, and adventure recreation have increased dramatically in recent years, while at the same time population growth, urbanization and alternative energy production compete for suitable lands. To meet these demands and minimize associated impacts, it is critical that opportunities are provided to the public in a responsibly managed environment, where it is possible to efficiently apply Best Management Practices, law enforcement and education efforts, monitoring of impacts, and restoration efforts.
- Effective regional and local efforts to protect and manage green infrastructure are found throughout California. These efforts are typically cross-jurisdictional, involve stakeholders, and address multiple issues such as recreation, water, wildlife habitat and economic development.
- Public involvement in supporting green infrastructure is critical in terms of advocacy, participation in the decision-making process, and involvement in local stewardship and program activities.

Tools for protecting green infrastructure from development include acquisition, easements, establishing reserves and various state and local zoning policies. Tools for managing green infrastructure for protection from wildfire and forest pests include control burning, thinning overstocked stands, biomass projects to reduce fuel loads, and various other stand improvement projects.

California's statewide outdoor recreation strategy is formulated through a combination of:

- the California Outdoor Recreation Plan (CORP), published every five years by the California Department of Parks and Recreation, which identifies various issues and needs of statewide importance;
- the Recreation Policy, developed by the State Park and Recreation Commission, which outlines the state's strategies, priorities, and actions based on issues and needs identified in the CORP; and
- the California Department of Parks and Recreation's Off-Highway Motor Vehicle Recreation Division legislatively mandated Strategic Plan which provides guidance for motorized recreation in the eight State Vehicular Recreation Areas (SVRAs).

This chapter includes two analyses:

- **Conserving green infrastructure:** this analysis identifies unprotected (buildable) green infrastructure that serves local communities that is at risk from near-term development.
- **Managing green infrastructure:** this analysis identifies important recreation areas and other green infrastructure that serves local communities that is at risk from wildfire and forest pests.

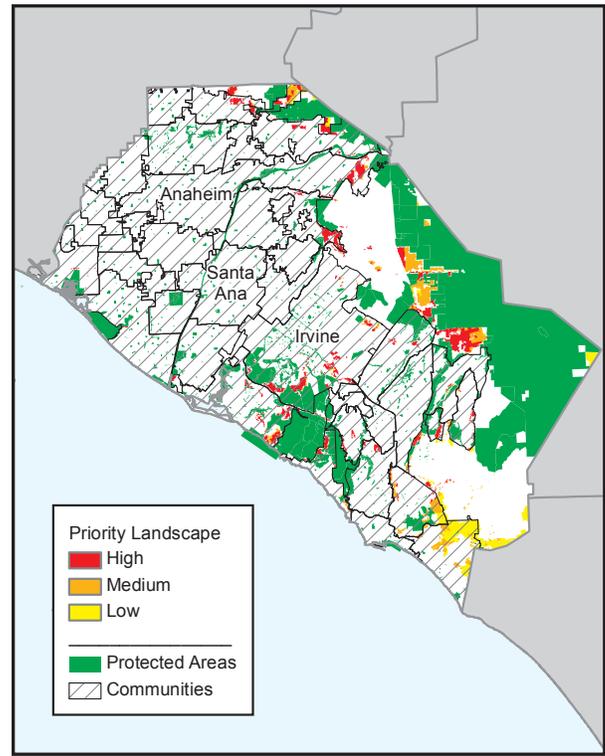
ANALYSIS: CONSERVING GREEN INFRASTRUCTURE

Key Findings

- The South Coast bioregion has by far the most high priority landscape acres since green infrastructure there serves large populations and faces high development pressures.
- In the Sacramento Valley and San Joaquin Valley bioregions, high development pressure is eliminating options for protecting remaining green infrastructure that serves local communities.
- In the Sierra bioregion, development is an emerging issue, and is mostly in the foothills.
- Counties in the Bay/Delta bioregion have achieved a significant level of green infrastructure protection despite the absence of large federal landholdings, by adopting a wide range of complementary public-private strategies and programs.

This analysis identifies priority landscapes which emphasize green infrastructure that serves larger communities and faces significant development threat. Map shows an example priority landscape for Orange County.

Priority Landscapes



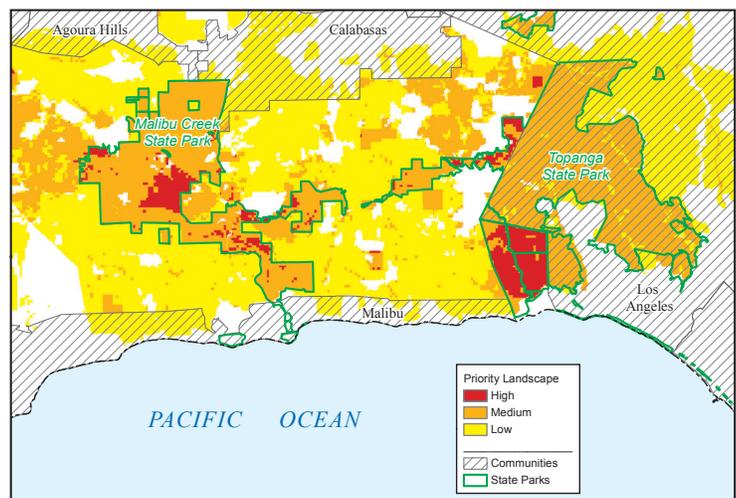
ANALYSIS: MANAGING GREEN INFRASTRUCTURE

Key Findings

- The densely populated and high wildfire threat South Coast bioregion has by far the most high priority landscapes.
- Bioregions such as the Bay/Delta, Sierra and Central Coast have large acreages of medium priority landscapes, which are typically high value areas at a medium threat, or medium value areas at a high threat.
- Although the threat from exotic invasive species has not been adequately mapped and ranked, they do pose a real threat in all bioregions. Similarly, the future impact from climate change cannot be analyzed given current knowledge and data, but will likely pose major challenges.

This analysis identifies priority landscapes that emphasize green infrastructure that serves larger communities or has recreation value, and faces significant threat from wildfire or forest pests. Map shows an example priority landscape for the Santa Monica Mountains above Malibu.

Priority Landscapes



3.7: Climate Change: Threats and Opportunities

CHAPTER OVERVIEW

Climate can greatly influence the dynamics of forest and range ecosystems, and result in changes to the type, mix and productivity of species. While forests and rangelands can be used to sequester carbon and offset greenhouse gas emissions, these same ecosystems may also become vulnerable to changes in climate. For example, under a warmer and drier climate water availability may be more limited with earlier snowmelt and declining snowpack; severity of drought may become more pronounced and the frequency of wildfires may increase.

While future climate scenarios differ in the expected changes to California's climate, there is general agreement that increases in both temperature and carbon dioxide are likely to result in significant changes in the composition of forests and rangelands throughout the state. In some cases, environmental effects from climate change have already been observed in California forest and rangelands. The effects from climate change are likely to include shifts in species ranges, changes in snowpack, changes in the frequency of wildfire and pest disturbance and forest productivity changes.

California's forests and rangelands can play an important role to mitigate the risk of global warming. In forestry this can include both actions that lead to additional carbon sequestration, as well as actions that reduce emissions associated with wildfires, land use conversions and other forms of disturbance. The California Department of Forestry and Fire Protection (CAL FIRE) has identified five strategies to mitigate against greenhouse gas (GHG) emissions: reforestation, forestland conservation, fuels reduction, urban forestry and forest management to improve carbon sequestration. In addition, strategies are being developed to address adaptation needs. The goal of adaptation planning is to reduce vulnerability and to increase the resiliency of forest and rangeland ecosystems to climate changes.

This chapter includes three analyses. To support the first two analyses existing vegetation data and projections from a vegetation dynamics model (MC1) were used to estimate changes in forest carbon stocks over key time periods: 2010, 2020, 2050 and 2100. The first analysis was then conducted to evaluate threats to forest carbon from wildfire, insects and disease. A second analysis was conducted to evaluate potential threats to forest carbon from development. A third analysis, using the computer software BIOMOVE, was conducted to evaluate potential shifts in species ranges from future climate scenarios.

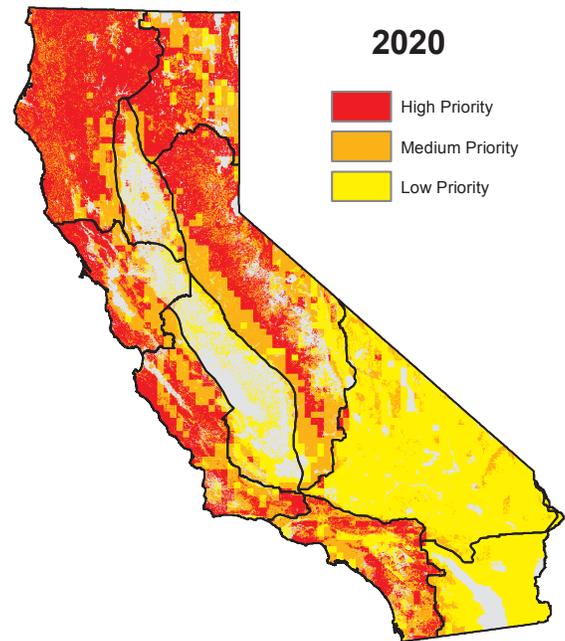
ANALYSIS: THREATS TO FOREST CARBON FROM WILDFIRE, INSECTS, AND DISEASE

Key Findings

- The evaluation of carbon stocks from the baseline conditions for 2020 showed limited gains or losses in priority areas compared to 2010. The priority areas remain relatively stable across all bioregions through 2050 and then declining substantially through 2100.
- Belowground carbon pools showed less variation than aboveground carbon pools; however, due to the relatively limited information on belowground carbon, additional research is needed.
- The expected loss of carbon sequestration from wildfire, insects and disease was much more extensive than loss from development.

| High priority landscape acres by ownership | |
|--|------------|
| USFS | 12,240,000 |
| BLM | 1,350,000 |
| DOD | 240,000 |
| Tribal | 310,000 |
| NPS | 800,000 |
| Other Federal | 70,000 |
| Other Gov. | 1,120,000 |
| Private | 13,390,000 |
| NGO | 100,000 |

Priority Landscapes



This analysis identifies landscapes for forest carbon assets that coincide with threats from wildfire, insects, and disease. The analysis resulted in priority landscapes for 2020, 2050, and 2100. The priority landscape for 2020 is shown as an example.

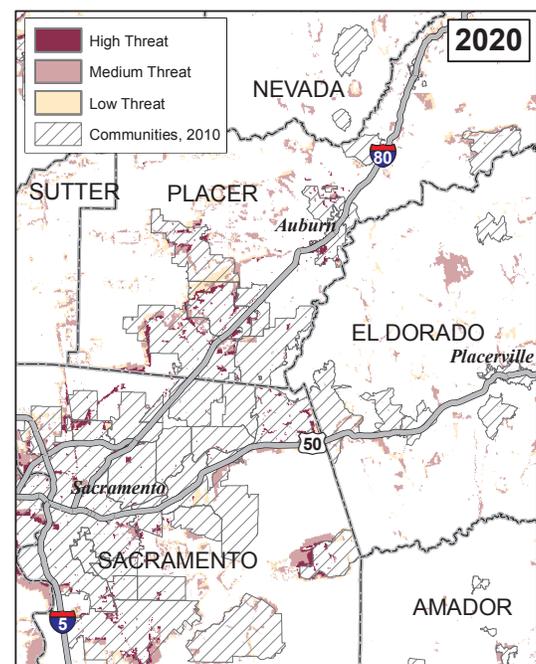
ANALYSIS: THREATS TO FOREST CARBON FROM DEVELOPMENT

Key Findings

- Threats to the loss of terrestrial carbon (forest and range) from development were greatest in Bay Area, South Coast and Sacramento Valley bioregions. The current amount of moderate and high priority landscape is two to three percent in 2010 and expands to ten to fourteen percent by 2100.
- For all other bioregions the amount of high priority landscape was less than five percent of the total land area in the bioregion.
- Threats from development cover a smaller area than threats from wildfire or forest pests, but the impact to forest carbon may be greater.

This analysis identifies priority landscapes for forest carbon assets that coincide with threats from development. The analysis resulted in priority landscapes for 2020, 2050, and 2100. The priority landscape for 2020 is shown as an example.

Priority Landscapes

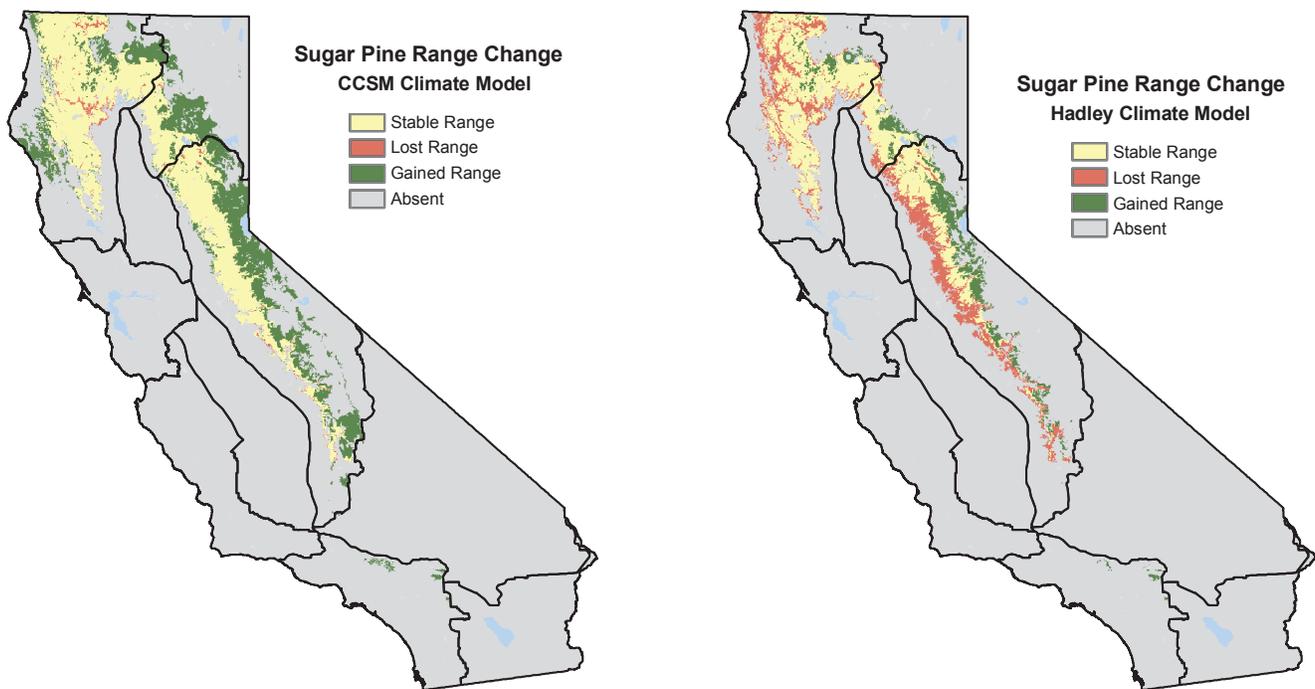


ANALYSIS: VEGETATION RESPONSE – BIOMOVE

Key Findings

- The results show a mixed response among tree species, with some species showing an expansion in range and some species contracting in range by 2080.
- The two climate models used to estimate future conditions were reasonably consistent in predicting the shift in a species range. For several of the indicator species both Global Climate Models (GCM) predicted gains or losses in range that were within 10 percent of each other. Although, for one species (*Sequoiadendron Giganteum*) the estimated extent of a gain in species range varied by 58 percent between the two climate models.
- Many tree species showed a shift toward higher elevations and towards northern latitudes.

Priority Landscapes



Predicted shift in species range for Sugar Pine. The map on the left shows an expanding range that is influenced by the warmer and wetter conditions predicted under the Community Climate Model (CCM). The map on the right predicts a contraction in species range that is influenced by the hotter and drier conditions forecasted by the Hadley climate model. Areas in green show an expansion in range, while areas in red show a reduction in range, and areas in yellow are considered stable.