

Chapter 9.5—Managing Forest Products for Community Benefit

Susan Charnley¹ and Jonathan Long²

Summary

Forest products harvesting and use from national forest lands remain important to local residents and communities in some parts of the Sierra Nevada science synthesis area. Managing national forests for the sustainable production of timber, biomass, nontimber forest products, and forage for livestock can help support forest-based livelihoods in parts of the region where they are socially and economically important, thereby contributing to social and economic sustainability and community resilience. This chapter provides context for understanding the social and economic dimensions of timber production, biomass utilization, nontimber forest product harvesting, and grazing in the synthesis area, and associated management issues. The chapter also points out ways in which managing forest products for community benefit may also benefit forest and rangeland ecosystems. At the end of each section is a “Management Implications” discussion that summarizes findings from the literature about the strategies forest managers might pursue to help maintain California’s wood products industry, increase biomass utilization from national forests, and support nontimber forest product harvesting and grazing on Sierra Nevada national forests.

Introduction

This chapter examines timber production, biomass removal, nontimber forest product (NTFP) harvesting, and grazing, synthesizing the scientific literature that addresses how these activities can be supported on Sierra Nevada national forests to help sustain the livelihoods of community residents who participate in them. Mining is not addressed because it is no longer considered to be a significant economic activity in the Sierra Nevada (Duane 1999, Stewart 1996), and because of a lack of recently published literature about mining in Sierra Nevada communities. Recreation and tourism are addressed in chapter 9.1, “Broader Context for Social, Economic, and Cultural Components.”

¹ Research social scientist, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 620 SW Main St., Suite 400, Portland, OR 97205.

² Research ecologist, U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station, 1731 Research Park Dr., Davis, CA 95618.

Traditional forms of commodity production (e.g., timber production, grazing, and mining) from national forests in the Sierra Nevada are no longer as prominent as they were in the past (Duane 1999, Erman and SNEP Science Team 1996). Nevertheless, timber production and grazing remain locally important. Stewart (1996) found that recreation, timber, and agriculture were the employment sectors most dependent on Sierra Nevada ecosystems, and that the natural resources from these ecosystems generating the highest revenues were water, timber, livestock, and other agricultural products, in that order.

The Sierra Nevada Ecosystem Project identified six distinct social and economic subregions in the Sierra Nevada (Doak and Kusel 1996, Stewart 1996). An analysis by Duane (1999) also identified six distinct subregions of the Sierra Nevada based on social criteria. Although the subregional boundaries differ slightly, their overall characterizations are consistent (Duane 1999). Timber production is most prevalent in the northern Sierra Nevada counties; grazing is found mainly in the eastern Sierra Nevada and in the oak woodland ecosystems of the western Sierra Nevada; agriculture occurs largely on the west side, in the central and southern portions of the synthesis area; and recreation and tourism dominate the economies of the greater Lake Tahoe basin and the eastern side of the Sierra Nevada. Nevertheless, many communities and counties in the Sierra Nevada subregions have mixed economies, as characterized by Doak and Kusel (1996) and Duane (1999). Some are still more natural resource dependent (timber, grazing); some have economies based largely on natural amenity values; and some are close to large urban areas that provide diverse economic opportunities. In addition, many counties contain communities that are highly variable in terms of socioeconomic well-being (Doak and Kusel 1996). Thus, the relevance of the forest products management strategies discussed in this chapter will vary by place across the region, depending upon the nature of forest-community relations in particular locations.

Current national forest management policy calls for approaches that both accomplish ecological restoration goals and produce forest products to benefit local communities and economies (USDA FS 2007, 2010). Such approaches can contribute to socioecological well-being and resilience in a number of ways: (1) supporting community residents who maintain forest-based livelihoods in rural areas where alternative job opportunities are limited; (2) helping to produce goods valued by society; (3) maintaining the workforce and physical infrastructure needed to accomplish forest restoration on federal lands; and (4) helping to conserve the biodiversity and ecosystem integrity of working forests and rangelands on the private and tribal lands that are ecologically and socioeconomically interdependent with federal lands (Charnley et al. 2014).

This chapter focuses first on timber production and the wood products industry. It then moves on to address biomass removal and utilization, NTFPs, and lastly, grazing. The chapter concludes by suggesting some of the ways in which managing forest products for community benefit may also benefit forest and rangeland ecosystems.

Timber Production and the Wood Products Industry

Trends in Harvesting, Employment, and the Industry

Detailed accounts of conditions and trends in California's wood products industry can be found in Morgan et al. (2004, 2012), upon which the following discussion is based. California has been among the top softwood lumber-producing states in the United States since the 1940s. The wood products industry in California is influenced by a number of variables, including national and international economic conditions, markets, technology, public policy and regulations, and available timber inventories. National forests have been an important source of timber for California's wood products industry since the 1960s. Although a severe recession and weak markets caused a drop in timber production and related employment in the early 1980s, this dip was followed by a recovery that lasted through the end of the 1980s. Since the early 1990s, the availability of timber—particularly from federal lands—has been a major factor influencing California's wood products industry. Timber harvests from national forests declined during the 1990s because of policy and legal constraints on harvesting related to the protection of old-growth forests and threatened and endangered species, restrictions on harvesting in unroaded areas, and timber sale appeals and litigation. At the same time, state regulations caused timber harvests from state and private lands to decrease. In the 2000s, timber harvest on California national forests has been driven more by restoration goals (e.g., hazardous fuels reduction) than by timber production goals (Christensen et al. 2008). An economic recession in the early 2000s, declines in housing construction since 2006, and increased imports of lumber from Canada following expiration of the Canadian softwood lumber agreement in 2001 have caused the price of wood products to be low for much of the 2000s. Market conditions combined with other factors, such as increasing fuel prices and reduced timber availability, caused a further decline in California's wood products industry during the first decade of the 2000s (Morgan et al. 2012).

Trends in California's timber harvests are reflected in figure 1. The total volume of timber harvested in California in 1988 was 4.84 billion board feet, and in 2010, it was 1.29 billion board feet—73 percent below what it was in 1988 and 74 percent below what it was in 1972. The volume of timber harvested from Sierra Nevada national forests was 1.29 billion board feet in 1988, and 183.8 million board feet in

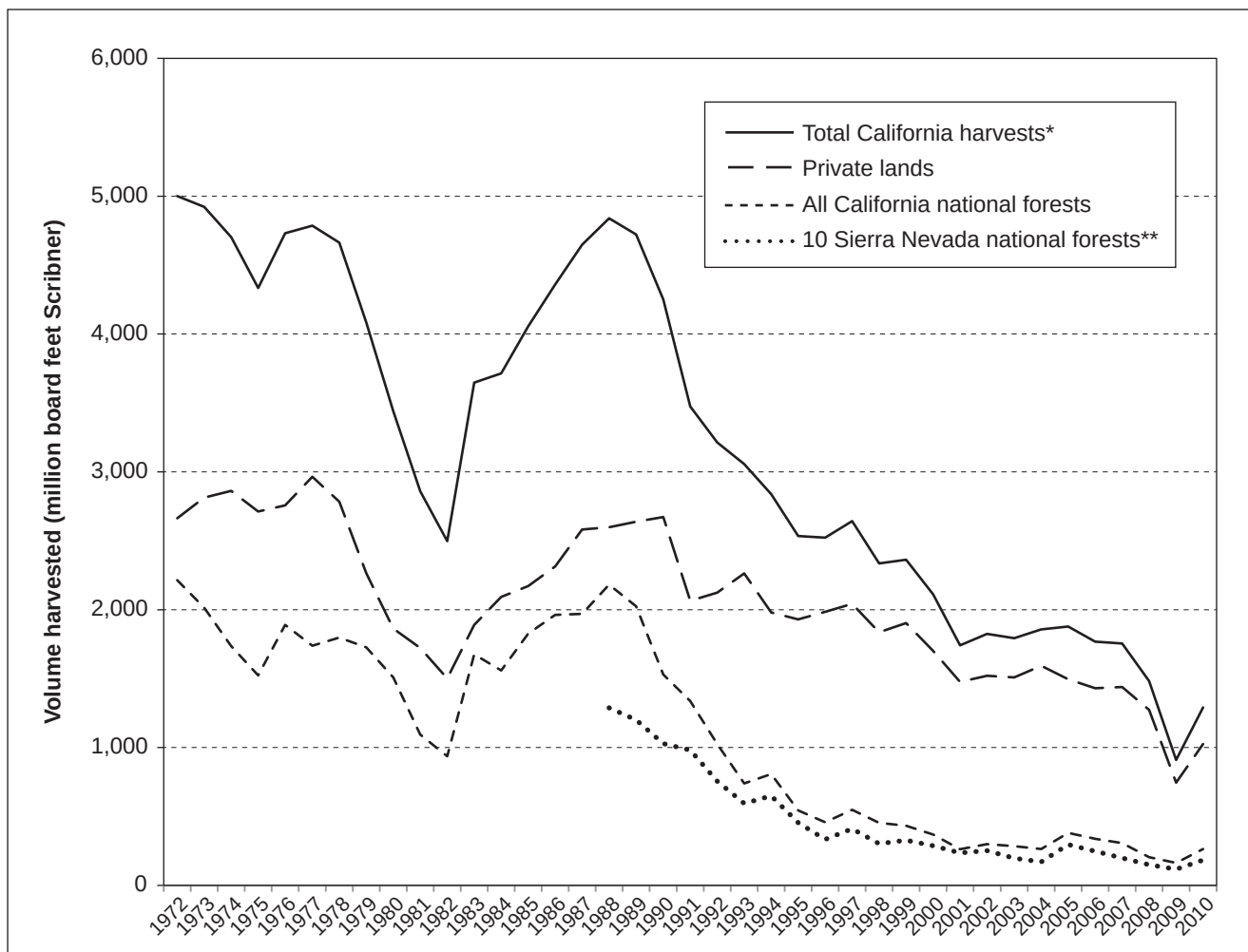


Figure 1—Volume of timber harvested from all lands, private forest lands, national forest lands, and 10 Sierra Nevada national forests in California, 1972–2010. Source: Ruderman 1984, 1985; Warren 1989–2011. * = Harvest data from state lands were missing for 2003–2010, and data from lands overseen by the Bureau of Indian Affairs were missing for 2001–2010; they are not included in the totals for those years. Harvest data for Bureau of Land Management lands were <1 million board feet for 2001, 2003, and 2004, and are not included for those years. ** = Modoc, Lassen, Plumas, Tahoe, Eldorado, Stanislaus, Sierra, Inyo, and Sequoia National Forests, and the Lake Tahoe Basin Management Unit. Data for Sierra Nevada forest harvests were unavailable prior to 1988 from the Warren (1989–2011) and Ruderman (1984, 1985) reports.

2010, 86 percent lower than it was in 1988. As figure 1 indicates, the decline in total timber harvests in California since 1990 has largely been the result of reductions in timber production on national forest lands, though harvests from private lands also dropped for reasons explained above. In response to these trends, California mills have become increasingly reliant on out-of-state and Canadian sources of timber to meet their supply needs (Morgan et al. 2012). Imports have constituted an estimated 6 percent of the annual volume of timber processed in California in recent years (Morgan et al. 2012).

The number of primary wood processing facilities in California has also been declining, a trend ongoing since 1968 (table 1). Reduced timber availability was the primary driver of sawmill closures between 1988 and 2006 (Morgan et al. 2012). Other factors contributing to sawmill closures over time have been technological advances leading to increased processing efficiency, market conditions, and the shift to harvesting smaller logs. Between the late 1980s and 2000, California milling capacity dropped by almost 60 percent; since 2000, it has continued to drop as mills have closed (Christensen et al. 2008, Morgan et al. 2004). As a result, California's capacity to process sawtimber went from 6 billion board feet in 1988 to below 1.8 billion board feet by 2009 (Morgan et al. 2012). In 2006, there remained 12 sawmills, two medium-density fiberboard and particleboard mills, and no veneer mills in counties within the Sierra Nevada synthesis area (Morgan et al. 2012). Figure 2 shows the distribution of mills of all types in California as of 2006.

Table 1—Number of sawmills, veneer and plywood mills, and pulp and board mills in California, 1968–2006

Year	1968	1976	1985	1994	2006
Sawmills	216	142	89	53	33
Veneer and plywood mills	26	21	6	4	2
Pulp and board mills	17	7	11	12	4

Source: Morgan et al. 2012.

Declining mill capacity has important implications for the ability of federal and private forest owners to produce timber. Mills provide a market for timber; fewer mills mean less competition and lower stumpage prices; and the farther the haul distance from the harvest site to the processing facility, the higher the transportation costs and less economical the timber sale. Greater haul distances also mean an increase in fossil fuel consumption, increasing carbon emissions. Maintaining the remaining wood processing infrastructure in the Sierra Nevada synthesis area is important for supporting continued timber production from national forests to help accomplish ecological restoration goals and maintain jobs in the wood products industry.

Employment in California's forest products industries has fluctuated over time, and declined 33 percent between 1989 and 2010, from 112,500 jobs in 1989 to 75,100 jobs in 2010 (fig. 3). These trends have largely resulted from fluctuations in the lumber and wood products sector, rather than in the paper and allied products sector. The decline in California's wood and paper products industry employment since 1989 can be attributed mainly to reduced timber harvest and availability, as well as increased mill efficiency and the recent economic downturn and housing

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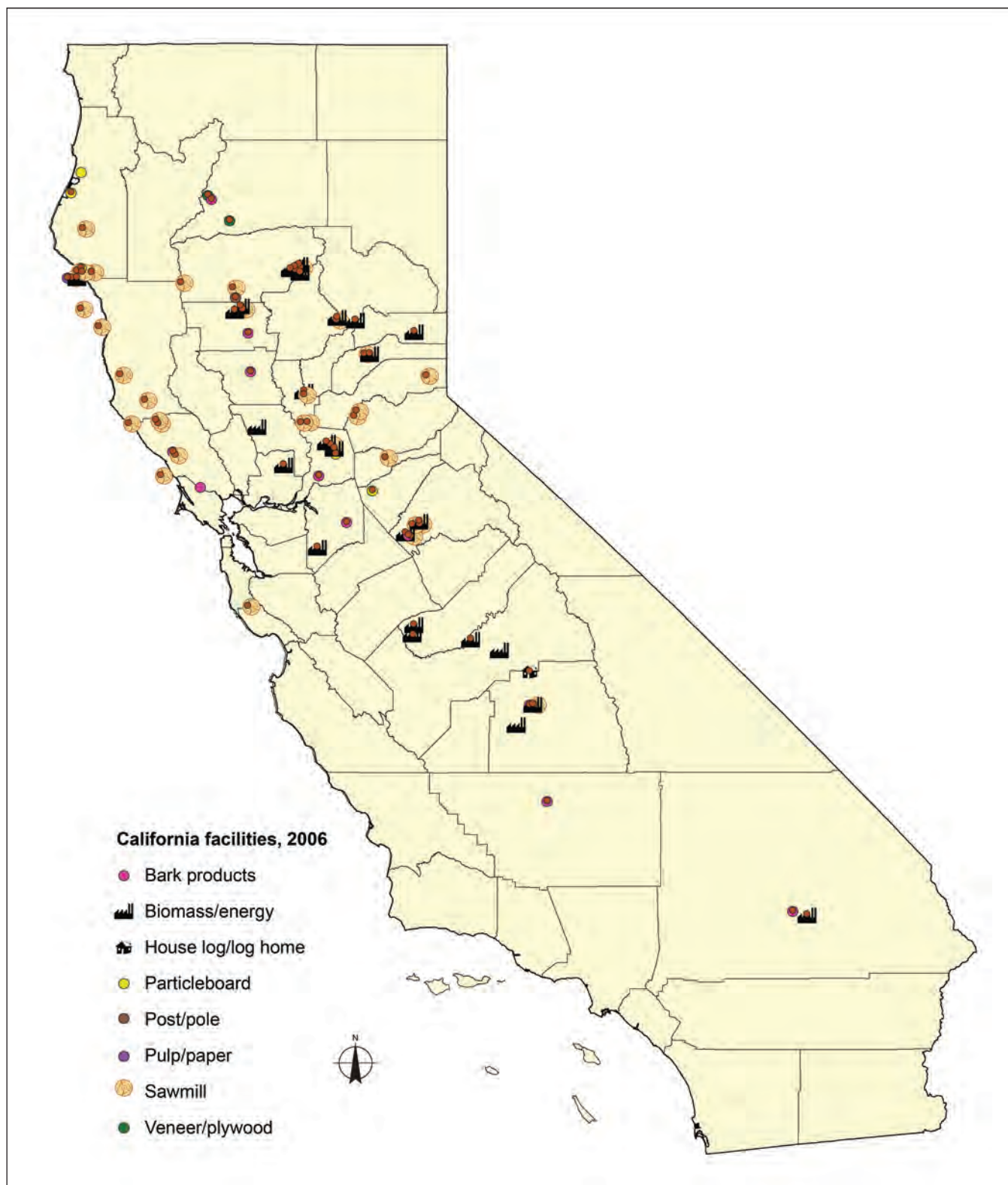


Figure 2—Mills in California, 2006. Source: figure 9 in Morgan et al. (2012).

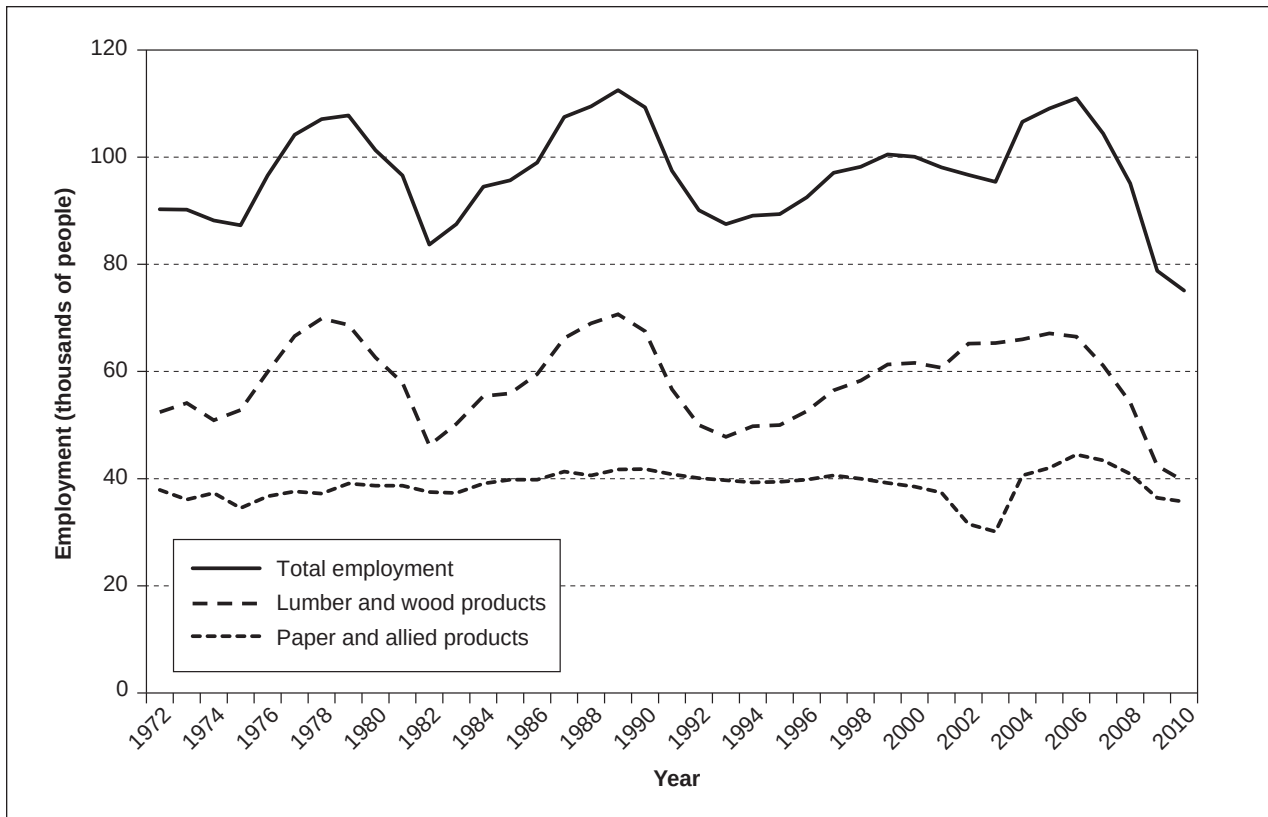


Figure 3—Employment in the forest products industries in California, 1972–2010. Source: Ruderman 1984, 1985; Warren 1992, 2002, 2011.

decline (Morgan et al. 2012). The effects of declining forest products industry employment have been greatest in northern California counties, where the forest products industry is concentrated, including the northern Sierra Nevada counties of Lassen, Modoc, Plumas, and Sierra (Morgan et al. 2004).

Wildland fire can also have a substantial economic impact on the timber industry and on wood products markets because it reduces the standing inventory of timber. Although socially controversial because of environmental concerns, post-fire salvage logging has a number of economic benefits for producers of damaged timber and consumers (Prestemon and Holmes 2004, Prestemon et al. 2006), and is socially acceptable among many residents of fire-prone and fire-affected communities (McCaffrey 2008; Ryan and Hamin 2008, 2009) (see chapter 4.3, “Post-Wildfire Management”). For example, research from the Sierra Nevada community of Arnold, California, near the Stanislaus National Forest, found a strong level of support for postfire restoration and rehabilitation activities on Forest Service lands, including salvage logging, among community members economically dependent on natural resources (Ryan and Hamin 2008, 2009). Reasons included the ability of salvage logging to provide local jobs, a supply of material for local industry,

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and income to fund postfire restoration activities, another potential source of local jobs. Research on postfire restoration and rehabilitation, and on salvage logging in particular, finds that salvage logging is likely to be more socially acceptable if it is done in ways that are appropriate to, and do not harm, the local ecology; if scientific research supports the approach used; and if the income from salvage logging is invested in local postfire restoration or wildfire prevention activities around communities (Ryan and Hamin 2009). Extensive and consistent communication and outreach by the Forest Service during the process are also important (Ryan and Hamin 2008). In addition, planning and making decisions about how to approach salvage harvesting in advance of a wildfire in the context of overall forest restoration objectives at the landscape scale may help reduce debate about salvage operations following a fire (McCool et al. 2006).

Impacts of Reduced Federal Timber Harvesting on Communities

A number of social scientists have studied the impacts of reduced federal timber harvesting (fig. 4) on forest communities in the Pacific Northwest, and how communities have been adapting to this change (e.g., Carroll 1995, Charnley et al. 2008a, Helvoigt et al. 2003, Kusel et al. 2000). Research on the impacts of reduced federal timber harvesting on Sierra Nevada communities is much less prevalent, and existing research has focused primarily on Plumas County, where the Quincy Library Group emerged. The community of Quincy is one of many places in California and the Pacific Northwest where the “timber wars” of the 1980s were fought, and



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Figure 4—Timber harvesting on the Eldorado National Forest.

there exist many published versions of this story (e.g., Bernard 2010, Bryan and Wondolleck 2003, Colburn 2002, Marston 2001) because it led to one of the first community-based, collaborative conservation initiatives associated with forestry in the Western United States (see chapter 9.6, “Collaboration in National Forest Management”). As in many timber-dependent communities and counties, decreases in timber harvests on the Plumas National Forest (which occupies roughly 75 percent of Plumas County [Bernard 2010]) led to the loss of logging jobs and mill closures with associated job losses in Quincy, home foreclosures, reduced payments in lieu of taxes to county governments to fund schools and roads, and declines in Forest Service budgets and staffing, making it harder to prepare timber sales and carry out treatments to reduce fire hazard and improve forest health (Bernard 2010, Colburn 2002). Changes in forest management policy that took place in the early 1990s have had different effects in different communities, depending on local characteristics and relations to national forest lands (Charnley et al. 2008a).

Quincy and Plumas County, like many communities and counties adversely affected by the shift away from intensive timber production on national forests, have evolved over the past two decades. Jobs in agriculture and forestry are still important, though there are many fewer jobs associated with timber production alone, and there is a greater proportion of jobs in forest restoration. Recreation and tourism, long important in the area, have expanded to include golfing, wind surfing, high-end resort development, and shopping (Bernard 2010, Colburn 2002). New residents drawn by the county’s natural amenity values have settled or bought second homes there, although the associated rise in real estate values has made it difficult for other residents to afford homes. Investment in watershed restoration and improvements in the Feather River watershed, an important source of water for California, have created local jobs and had significant conservation outcomes; water from the Feather River watershed could be a source of greater local economic opportunity in the future. However, the economic recession that began in 2007 led to closure of Quincy’s last sawmill in 2009, and a slump in real estate development (Bernard 2010).

Elsewhere in California and the Pacific Northwest, decreases in federal timber yields on federal lands had similar effects on forest communities. They have responded in a number of ways. Community capacity lost when workers who lost jobs in the forest products industry moved away has been gradually rebuilt in some communities where new residents have moved in, drawn by recreation, natural amenities, and relatively low costs of living (Charnley et al. 2008a). Economic diversification has also occurred. Forest community residents have taken advantage of economic opportunities associated with recreation and tourism, agriculture, nontimber forest products, public and tribal administration, forest restoration,

small-diameter wood manufacturing, and being located along major transportation corridors or close to regional centers (Charnley et al. 2008a). In California, some forest community residents have turned to marijuana growing as an economic diversification strategy in response to declines in wood products industry employment, although this trend is much more prevalent in California's north Coast Range than in the Sierra Nevada (Leeper 1990). The emergence of community-based collaborative groups in forest communities in California—such as the Quincy Library Group—has been an important mechanism for innovation in seeking new ways to link communities and forests to promote economic and ecological health associated with forest management (Donoghue and Sturtevant 2008). This topic is discussed further in chapter 9.6.

Tools

Some tools have been developed that can help assess how wood products obtained from national forests translate into jobs and income that benefit regional economies. These tools are useful for forest planning as well as monitoring. The Bureau of Economic Analysis has developed a Regional Input-Output Modeling System (RIMS II) that can help planners assess the regional economic impacts of planned projects by producing multipliers that estimate the total economic impact a project will have on a region.³ Regional Economics Models, Inc. (REMI) has developed another model called Policy Insight (PI+) that generates annual estimates of the total regional economic and demographic effects of policy initiatives, which can be used for forecasting.⁴ Perhaps the most useful tool for forest managers is IMPLAN, developed by MIG, Inc.⁵ IMPLAN can be used to model the economic impacts of management activities down to the ZIP code level. These models are not limited to assessing the economic effects of forest plans and proposed projects on the wood products industry; they also have application for assessing how the production of other forest products and recreation activities on national forests translate into jobs and income that benefit regional economies.

Future Prospects and Management Implications

Demand for wood products in California has been increasing and is predicted to continue to do so as a result of population growth (Christensen et al. 2008). The majority of wood products produced in the state are consumed there (Morgan et al.

³ More information about the model can be found at https://www.bea.gov/regional/pdf/rims/RIMSII_User_Guide.pdf.

⁴ More information about PI+ is available at <http://www.remi.com/products/pi>.

⁵ IMPLAN, http://implan.com/V4/index.php?option=com_content&view=frontpage&Itemid=70.



Figure 5—Forest community in the Sierra Nevada foothills.

2004, 2012). High demand for wood products, productive forests, and high-quality timber in California mean that the state's wood products industry has the potential to remain viable (Christensen et al. 2008). Maintaining the industry is important from the standpoint of both national forest management and jobs in forest communities. A 2002/2003 survey of California's primary wood products industry leaders asked what issues they thought would affect the performance of their operations in the coming 5 years, in order of importance (Morgan et al. 2004). Energy costs, California regulations, and timber availability from private lands were at the top of the list. Timber availability from federal lands ranked number 10; most respondents no longer considered federal lands a reliable source of timber, basing their operations instead on timber harvested from private lands. Nevertheless, federal timber supplies were critical to the operations of some respondents, and for the future viability of their firms (Morgan et al. 2004).

These findings point to several strategies that could be pursued to support jobs in the wood products industry and keep mills operating to maintain wood products industry infrastructure so that forest owners (including the Forest Service) can accomplish forest restoration and hazardous fuels reduction. One is to provide a stable and predictable supply of wood from national forest lands. Especially in places where federal lands supply a significant portion of the timber, the ability to retain existing infrastructure and to invest in new infrastructure and technologies that keep mills competitive depends on having a reliable supply of wood from

national forests (Keegan et al. 2006). Another strategy is to offer financial assistance to mills struggling to stay operational to help them invest in measures that improve their efficiency and competitiveness. The Forest Service used American Recovery and Reinvestment Act funds to do this during the economic recession of 2007–2009, with positive results (Charnley et al. 2012). A third strategy is to plan timber sales that are scaled in size to the capacity of local community operators, so that they can bid on them. The inability of small, local logging businesses to bid on big Forest Service timber sales when clearcutting was a common practice was one source of controversy in Quincy that brought loggers to the table to search for alternative forest management approaches (Colburn 2002). Finally, postfire rehabilitation and restoration activities, particularly salvage logging, can help reduce economic losses to the wood products industry following a wildfire. Planning for salvage operations in advance of a fire, using science to inform salvage operations to minimize environmental risk, investing revenue generated from salvage sales in postfire restoration and fire risk-reduction activities, and good communication can help salvage logging move forward so that its economic benefits are realized. These strategies are summarized in “Management Implications” below.

Management Implications: Maintaining California’s Wood Products Industry

- Provide a stable and predictable supply of wood from national forest lands.
- Offer financial or other forms of assistance to mills struggling to stay operational to help them invest in measures that improve their efficiency and competitiveness, and to maintain what remains of local wood processing infrastructure.
- Plan timber sales that are scaled in size to the capacity of local community operators so that they can bid on them.
- When salvage logging is part of postfire recovery plans, take steps to make it more socially acceptable, such as planning for salvage operations in advance of a fire in the context of broader landscape-scale restoration; using science to inform salvage operations to minimize environmental risk; investing revenue generated from salvage sales in postfire restoration and fire risk reduction activities; and good communication.

Biomass Utilization

The Forest Service defines woody biomass as trees and woody plants—including limbs, tops, needles, leaves, and other woody parts—that grow in forests, woodlands, or rangelands and are the byproducts of forest management.⁶ Woody biomass typically has lower monetary value than timber and cannot be sold in traditional wood products markets. Nevertheless, it can potentially be converted into bioenergy (such as electricity, heat, gas, and biofuels) and be utilized for other bio-based products, such as solid wood products, composites, and paper and pulp. The development of biomass utilization opportunities has received much attention over the past decade because (1) biomass holds promise as a domestic source of renewable energy; (2) biomass utilization can partially help offset the cost of needed hazardous fuels reduction treatments on public lands; (3) it can contribute to economic development opportunities in forest communities (Aguilar and Garrett 2009, Morgan et al. 2011, Nechodom et al. 2008); and (4) biomass utilization reduces the onsite burning of piled material produced by ongoing fuels treatments on public lands, which emits greenhouse gases and reduces air quality (Daugherty and Fried 2007, Springsteen et al. 2011).

Noting that treatment costs are a major constraint on the pace and scale of Forest Service fuels treatments in Sierra Nevada national forests (which are well below what is needed to mimic fuels reduction under historical fire regimes), North (2012) identified biomass utilization as one way of improving the economics of fuels treatments. Nielsen-Pincus et al. (2013) found that national forest ranger districts that are close to sawmills and biomass facilities treated more overall hectares for hazardous fuels reduction, and more hectares in the wildland-urban interface (WUI), than those farther away, and that there was a threshold distance for this effect. Given its potential, why has biomass utilization infrastructure not developed more widely in association with federal land management in California and elsewhere in the West, and what can be done to support its development? These questions are the focus of this section. Figure 6 shows the location of biomass power plants in California as of 2011.

Economic Issues

A nationwide survey of Forest Service district rangers and biomass coordinators (Sundstrom et al. 2012) found that respondents in Region 5 (the Pacific Southwest Region) perceived the greatest barriers to biomass use to be economics and Forest Service capacity (e.g., declining agency budgets and staffing levels, lack of a

⁶ Woody Biomass Utilization, <http://www.fs.fed.us/woodybiomass/>.

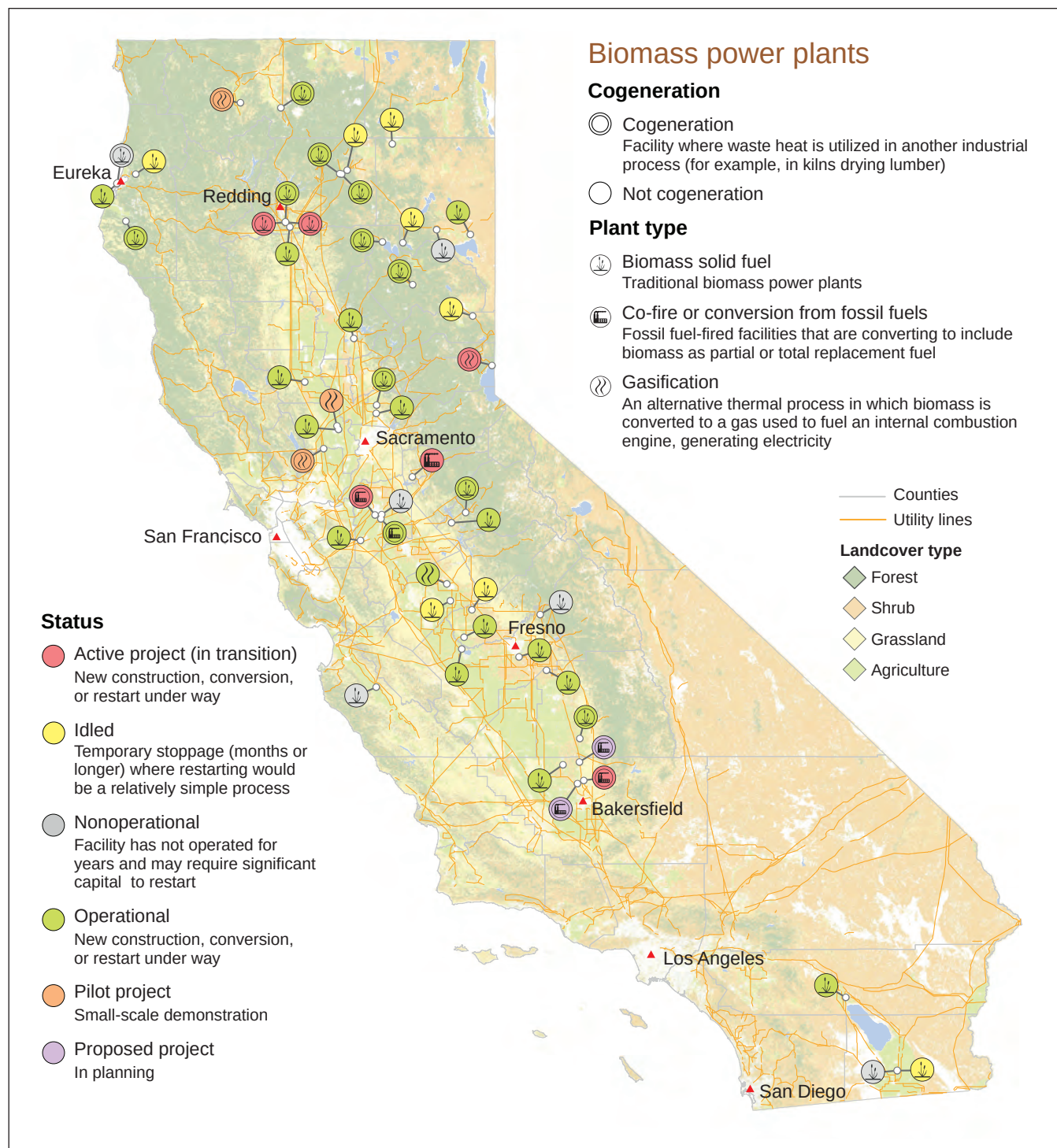


Figure 6—Biomass power plants in California, 2011. Source: Mayhead and Tittmann 2012. Copyright 2012 Regents of the University of California.

guaranteed supply from federal lands, lack of staff expertise). Economic issues associated with developing viable biomass utilization opportunities include the supply of material, lack of industry infrastructure, harvest and transport costs, access to markets, and market trends.

For a business to be successful and attract investors, it must have an adequate and predictable supply of biomass, which is a concern in places where federal land is the main potential source of supply and inconsistent harvests have been a problem in the past (Becker et al. 2011, Hjerpe et al. 2009). The supply problem could be addressed by diversifying the source of raw material, and through the use of stewardship contracts, which can be awarded for up to 10 years and provide a supply guarantee (Becker et al. 2011, Hjerpe et al. 2009, Nicholls et al. 2008). Factors contributing to inconsistent supply are lengthy National Environmental Policy Act (NEPA) processes and the threat of appeals and litigation, which slow down removal (Becker et al. 2011, Morgan et al. 2011); the ability to gain access to material (Becker and Viers 2007); requirements to conduct biomass inventories at the same level of detail as a traditional timber cruise, which is cost prohibitive; and lack of institutional support for biomass utilization for whatever reason (Morgan et al. 2011). Identifying and addressing institutional barriers, and disincentives to biomass utilization among employees, could help.

The presence of wood products industry infrastructure has been found to enhance the development or expansion of biomass utilization, which is difficult to develop as a stand-alone enterprise (Becker et al. 2011). Companies that use biomass often include sawmill residues produced as byproducts from primary wood product manufacturing as an inexpensive part of their feedstock, making their operations more financially viable. The presence of timber industry infrastructure also helps maintain the capacity of the local workforce needed to carry out biomass harvesting and utilization (Becker et al. 2011). Furthermore, in places having a local market for sawlogs, harvesting timber as a component of hazardous fuels reduction treatments can help pay for the cost of biomass removal, making it economically feasible to treat larger areas for fire hazard reduction (Barbour et al. 2008, Skog et al. 2006). In some contexts, it may be necessary to remove sawlog-sized trees in intermediate or mid-canopy layers to reduce crown fire potential to acceptable levels (for an example from the synthesis area, see Schmidt et al. 2008). Lack of wood products industry infrastructure has been found to be a major barrier to forest restoration and associated biomass utilization in many parts of the West, though the reasons for this lack are variable (Becker et al. 2009a, Hjerpe et al. 2009). Supporting remaining wood products industry infrastructure in order to prevent its further loss can help provide opportunities for biomass removal and utilization.

Harvesting timber as a component of hazardous fuels reduction treatments can help pay for the cost of biomass removal, making it economically feasible to treat larger areas for fire hazard reduction.

A number of authors have found that the cost of harvesting biomass, combined with the cost of transportation from the forest to the utilization facility, is an important factor limiting biomass use (Aguilar and Garrett 2009, Becker et al. 2009a, Pan et al. 2008). Becker et al. (2009a) used a financial model called the Harvest Cost-Revenue Estimator to estimate cost-to-revenue thresholds for different biomass harvesting scenarios under three different categories of policy options and applied it to Southwestern ponderosa pine forests. The categories included policies to offset the cost of harvesting biomass, policies to reduce transportation costs through incentives or subsidies, and policies to stimulate favorable manufacturing and consumer markets for biomass and its products. They found that the cost of transporting biomass from the harvest site to the market outlet was the single greatest cost associated with biomass utilization, and that decreasing the proximity of markets to harvest sites was the only strategy that offset this cost in a meaningful way. Thus, locating processing facilities near harvest areas to reduce transportation distances and associated costs is an important strategy. The nature of the processing infrastructure is also important, however; if the scale and type of processing infrastructure do not match the amount and size of hazardous fuels that need to be removed, they can be additional barriers to utilization (Becker et al. 2009b).

Economical haul distances differ by place and depend on the species and quality of the material (and therefore its value), ease of access to the site where harvesting occurs, and the presence of sawmills (Becker et al. 2011). Developing new harvest methods that are more cost efficient can also help offset the cost of biomass use (Aguilar and Garrett 2009). For example, Skog et al. (2006) found that, in the Western United States, treatments would be cost effective primarily on gentle slopes, while treatments on steeper slopes requiring cable-yarding systems would require significant subsidies of either \$300 or \$600 per acre.

Some ways to address these limitations are to establish a network of decentralized processing facilities of an appropriate size and type closer to the source where biomass is removed (Aguilar and Garrett 2009, Nielsen-Pincus et al. 2013); to develop utilization options that focus on higher value products; to bundle biomass removal with the removal of larger trees that produce higher value products (e.g., lumber) to make removal more economical (Barbour et al. 2008); to develop transportation subsidies, which Oregon has done (Becker et al. 2011, Nicholls et al. 2008)—although these may not be desirable—and to implement financial incentives (e.g., cost shares and grant programs for facility development and equipment purchases, and tax incentives for facility development and harvesting and transporting biomass) (Sundstrom et al. 2012). Because biomass produced as a byproduct of forest restoration tends to be of low value, strategies associated with national forest management are likely to focus on siting smaller processing facilities closer

to public lands (Becker et al. 2011). Small and mid-sized facilities that focus on electricity generation, firewood, animal bedding, commercial heating, or combined heat and power systems may be more feasible than large processing facilities. This is because they tend to be less controversial and require a smaller supply of biomass to operate (making it easier to obtain in a reliable manner) (Becker et al. 2011). However, significant economies of scale favor construction of larger plants (or retrofitting of existing plants) to utilize diverse feed stocks (Nicholls et al. 2008). Daugherty and Fried (2007) found that in northern California and southern Oregon, unless small-capacity (< 15 megawatts [MW]) facilities are at least 90 percent as efficient as large facilities, they do not represent an economically viable alternative, because their lower efficiency offsets the reduced costs they may incur by gathering biomass from a smaller supply area (with a shorter average haul distance).

Biomass market conditions can change dramatically within the timeframes required for developing and implementing projects on national forests that include biomass removal (Morgan et al. 2011). Federal land managers involved with biomass removal from hazardous fuels reduction treatments suggested that placing individuals who are aware of biomass market conditions on NEPA interdisciplinary teams would help them plan economical projects (Morgan et al. 2011). Demand for bioenergy is contingent on energy markets, although plants with long-term power purchase agreements are sheltered from market volatility during the period of their agreement, assuming the agreement price is not tied to a floating market reference point.

Many existing biomass power plants have 30-year contracts with California's large investor-owned utilities (IOUs), but these often pay low prices for the energy produced (though contracts vary), meaning some plants can no longer afford to run, and new contracts are not being developed (Mayhead and Tittmann 2012). Consequently, it has not been financially feasible to increase biomass capacity in California, with the possible exception of refurbishing and restarting nonoperational facilities or developing co-fire/conversion projects. Increasing the price paid for electricity generated from biomass is one way of overcoming these constraints and creating an incentive to expand biomass utilization capacity in California, whether through small-scale or larger scale facilities (Mayhead and Tittmann 2012).

Nevertheless, California currently has more biomass power plants than any other state (Mayhead and Tittmann 2012), and its capacity to utilize biomass has been growing (Morgan et al. 2004). Power derived from biomass currently contributes only about 2 percent of the state's electricity, however (Mayhead and Tittmann 2012). Under the 2011 California Renewable Energy Resources Act (SB X 1-2), electrical utilities are required to obtain 33 percent of the electricity they sell to retail customers in California from renewable sources by 2020. Biomass is one eligible renewable energy source. However, the largest electrical utilities in

California currently favor wind and solar sources of electricity, despite the fact that these sources do not provide a consistent baseload of power (unlike biomass) (Mayhead and Tittmann 2012).

California's Senate Bill 1122, passed in September 2012, aims to address this problem by stimulating California's market for bioenergy from a distributed network of small renewable biomass projects.⁷ As of February 2014, California's Public Utilities Commission is working to finalize rules directing the state's IOUs to collectively procure at least 250 MW of generating capacity from bioenergy projects. Of this 250 MW, 50 MW is to come from biomass produced through sustainable forest management in high-fire-risk areas within the range of the IOUs. Eligible biomass facilities will be required to have an effective capacity of no more than 3 MW, and to be interconnected with the electricity grid. Final dates for program launch have shifted from the June 2013 date defined in the original bill, though final rules were expected to be adopted in spring 2014. This bill may alleviate some of the market barriers to developing biomass utilization in California.

Social Issues

One study focusing on the social acceptability of biomass utilization comes from Oregon, though the findings may be applicable to California (Stidham and Simon-Brown 2011). Based on interviews with people representing nine different stakeholder groups, the authors found a wide level of support for wood to energy projects, and that the main factor behind this support was a recognized need for forest restoration to improve forest conditions, which were viewed by many as being overstocked. However, the social acceptability of fuels treatments and associated biomass utilization opportunities varied by forest type. Stakeholders were much more supportive of active management of lower elevation ponderosa pine forests than of upper elevation mixed-conifer forests, where the scientific evidence for an ecological need to reduce fuels was sparse. One finding is that science-based planning is an important mechanism for improving the social acceptability of biomass utilization projects. Scientific research studies can demonstrate that forests have departed from their natural range of variability, and that restoration treatments are needed to bring them back into that range (Stidham and Simon-Brown 2011).

Even where scientific evidence attests to the need for forest restoration and stakeholders agree on this need, there can be social disagreement on the treatment types and specifications used to accomplish it. Restoration can mean different things to different people, with the removal of big trees and the intent to make economic

Science-based planning is an important mechanism for improving the social acceptability of biomass utilization projects.

⁷ California Senate Bill No. 1122, http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?_afjsessionid=cd36e5138d18004eeb1fc4f367a0?bill_id=201120120SB1122.



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Figure 7—Biomass power plant in Burney, California.

use of restoration byproducts controversial (Hjerpe et al. 2009). Lack of trust in agencies by some stakeholders can be another social barrier to developing biomass utilization opportunities (Stidham and Simon-Brown 2011). The concern is that agencies will overharvest in the name of restoration. Yet limiting the size and number of trees to be removed through restoration can reduce its effectiveness and make removal of small-diameter material and biomass even less economical. Developing fuels reduction and restoration activities, and biomass utilization projects and infrastructure, through collaborative processes that include stakeholders in planning, decisionmaking, and partnerships to promote biomass use is one suggested approach for overcoming this social disagreement and lack of trust (Becker et al. 2011, Hjerpe et al. 2009, Stidham and Simon-Brown 2011, Sundstrom et al. 2012). Another suggested approach is to develop pilot demonstration projects in the places and forest types where activities would be located (Stidham and Simon-Brown 2011).

Tradeoffs

Although biomass utilization holds promise for contributing to the resilience of forest ecosystems and communities in the Sierra Nevada, it is important to note that it may involve tradeoffs. From an environmental standpoint, biomass utilization

may encourage harvesting by whole-tree removal, which removes nutrients from the forest and poses a threat of nutrient depletion to coarse-textured, low-nutrient soils in particular (Raulund-Rasmussen et al. 2008). The California Forest Practice Rules may help to mitigate this risk (Evans et al. 2010). Some scientists predict that increasing harvests for the purpose of bioenergy in the Sierra Nevada may increase carbon emissions compared to “business as usual,” despite the potential for reducing wildfire risk (Hudiburg et al. 2011). Other scientists question this prediction, as it depends on the parameters of the life cycle assessment being used (SAB 2012). Biomass removal may also threaten the long-term sustainability of forests if small-diameter trees are overharvested in response to high demand (Aguilar and Garrett 2009). From a social standpoint, communities may be concerned about traffic congestion and emissions associated with biomass facilities (Searcy et al. 2007).

Tools

A number of tools have been developed to help national forest managers assess the financial and economic dimensions of biomass removal during fuels treatments. They are summarized in Morgan et al. (2011) and described in Loeffler et al. (2010), with links for gaining access to them, a summary of data requirements, and key contacts provided. Tools that may be most relevant to forest managers in the Sierra Nevada are the Forest Service Forest Inventory and Analysis program’s BioSum model (Barbour et al. 2008, Daugherty and Fried 2007, Fried and Christensen 2004), which assesses how fuels reduction treatments and the siting of biomass-based energy facilities can be optimized to reduce fire hazard at the landscape scale;⁸ the Forest Residue Trucking Simulator, which compares the relative costs associated with alternative methods of transporting biomass from the forest to a utilization facility;⁹ the Fuel Reduction Cost Simulator, which estimates the cost of fuels reduction projects that entail tree removal for wood products or chips;¹⁰ and the Southern Research Station’s Moisture Content Converter, which helps managers estimate the dry mass of biomass that will be sold and processed from a treatment.¹¹

The management implications of research findings about how to increase biomass utilization from national forests discussed here are summarized below.

⁸ BioSum 3.0, <http://www.fs.fed.us/pnw/fia/biosum/>.

⁹ Forest Residues Transportation Costing Model, <http://www.srs.fs.usda.gov/forestops/downloads/FoRTSv5.xls>.

¹⁰ Fuel Reduction Cost Simulator, <http://www.fs.fed.us/pnw/data/frcs/frcs.shtml>.

¹¹ Moisture Content Converter, <http://www.frames.gov/rcs/7000/7670.html>.

Management Implications: Opportunities to Increase Biomass Utilization From National Forests

- Identify and address internal (Forest Service) institutional barriers to producing a predictable supply of biomass from national forests.
- Support establishment of appropriately scaled and typed biomass utilization facilities close to harvest areas on national forests to reduce transportation distances and associated costs.
- Develop biomass utilization options that focus on higher value products.
- Include merchantable trees in biomass removal projects where appropriate for fire hazard reduction and to make removal more economical.
- Place individuals who are aware of biomass market conditions on NEPA interdisciplinary teams to help plan biomass removal projects that are aligned with market opportunities.
- Support science-based planning and engage in collaborative processes when developing projects and infrastructure to promote biomass use to improve their social acceptability.
- Develop pilot demonstration projects for biomass utilization in the places and forest types where they would be located to increase social acceptability.
- Take advantage of existing tools to help assess and design financially feasible projects.
- Work to improve markets for biomass.
- Help maintain existing timber industry infrastructure to make biomass utilization more feasible.

Nontimber Forest Products

Nontimber forest products (NTFPs) include a wide range of forest plant species and their parts—excluding industrial lumber—that people harvest (Jones and Lynch 2007). Examples include foods, medicinal plants and fungi, floral greens and horticultural stocks, fiber and dye plants, lichens, and oils, resins, and other chemical extracts from plants, lichens, and fungi (McLain and Jones 2002), as well as poles, posts, Christmas trees, and firewood (Jones and Lynch 2007). There is a rich literature documenting historical and more recent Native American uses of NTFPs in California, including the Sierra Nevada (e.g., Anderson 2005, Weigand 2002); there is much less literature available regarding present-day uses by other groups. Reduced timber harvesting on national forests in the early 1990s, and associated job loss in forest communities in the Sierra Nevada and elsewhere in northern California, spurred interest in exploring the potential for commercial

Not only do nontimber forest products (NTFPs) have cultural importance and offer economic diversification opportunities in rural communities, but harvesters can also contribute to the sustainable management of NTFPs on national forest lands.

NTFP harvesting—especially of medicinal plants—as an alternative source of employment (Weigand 2002). Most research on commercial NTFP harvesting has been carried out in the Pacific Northwest, however. There is a research gap regarding the role of commercial NTFP harvesting in California, and how it contributes to rural economies in forest communities. For most commercial harvesters, NTFPs provide a supplemental, but important, source of income (Jones and Lynch 2008).

Nontimber forest products harvested from Forest Service lands in the Sierra Nevada include wild food plants (e.g., mushrooms, fruits, ferns), medicinal plants, floral greens, seeds and cones, posts, poles, firewood, transplants, and Christmas trees (Richards 1996). Although NTFPs are not as abundant in the Sierra Nevada as they are in moister bioregions of California (such as the northern coastal areas), they are nevertheless relatively abundant compared with other bioregions in the state (Christensen et al. 2008). Most people harvest NTFPs for personal and subsistence uses, but commercial harvesting is also important. Nationwide, the annual retail value of commercial NTFP harvests from forest lands is estimated at \$1.4 billion, with about 20 percent of the supply coming from Forest Service lands (Alexander et al. 2011). Not only do NTFPs have cultural importance and offer economic diversification opportunities in rural communities, but harvesters can also contribute to the sustainable management of NTFPs on national forest lands (Jones and Lynch 2008). They can do this, for example, by sharing the ecological knowledge and management practices they have developed through their harvest activities, and participating in NTFP research and monitoring efforts (Ballard and Belsky 2010, Charnley et al. 2008b, Jones and Lynch 2008).

A number of authors have examined how national forest management can support economic diversification opportunities in forest communities through NTFP harvesting (e.g., Charnley et al. 2007, 2008b; Jones and Lynch 2008; Jones et al. 2002). Although their findings are based on research carried out in the Pacific Northwest, these findings are likely to be relevant to the management of NTFPs in the Sierra Nevada also. They are summarized in “Management Implications” below. Despite these opportunities, it is important to be aware that commercial NTFP harvesting on national forest lands carries with it safety risks. Moreover, forest workers who harvest NTFPs on hired crews are vulnerable to exploitation, especially if they are undocumented workers (Sarathy 2012). The Northwest Forest Worker Center, whose mission is to promote forest stewardship that is respectful of all workers, harvesters, and the land, is a support organization for harvesters and a

resource for national forest managers—especially in northern California—who are engaged with these issues.¹²

Management Implications: Nontimber Forest Product Harvesting

- Engage in active management of commercially valuable NTFPs to sustain or increase their diversity, productivity, and availability by integrating them into forest management activities.
- Avoid the destruction of important gathering sites when planning timber sales and managing for fire.
- Integrate commercial harvesters, buyers, and processors into forest management activities associated with NTFPs so that they can share their ecological knowledge and insights about these species, and information about harvesting activities, with land managers.
- Enlist harvesters in inventorying NTFPs and in monitoring the impacts of forest management activities (e.g., timber harvest, grazing, fire management) and harvesting on NTFP species populations to support their management.
- Adjust access fees and permit prices so that they do not undermine the financial feasibility of commercial harvesting.
- Ensure reliable access to NTFPs, perhaps through forms of access such as zoning, stewardship contracts, or leases so that harvesters can engage in the stewardship of harvest areas for an extended period of time.
- Include harvesters in forest planning and decisionmaking processes.

Grazing

Researchers studying grazing in California and elsewhere in the West have pointed out the important role of grazing on public lands for maintaining viable ranching operations (Gentner and Tanaka 2002, Huntsinger et al. 2010, Sulak and Huntsinger 2007). As of 2005, roughly 71,000 cattle used Forest Service rangelands in California under approximately 400 permits (Huntsinger et al. 2010). Some of the ecological considerations associated with grazing management on Sierra Nevada national forests, including potential benefits as an environmental management tool in California (e.g., Huntsinger et al. 2012), are addressed in chapter 6.4, “Wet Meadows.” Here, the focus is on the social dimensions of public lands grazing.

California ranchers often maintain livestock herds that are larger than their private lands can support because of the number of cattle needed to have a finan-

¹² Northwest Forest Worker Center, <http://www.nwforestworkers.org>.

cially viable ranching enterprise (Sulak and Huntsinger 2007). This means they must lease public or other private lands for part of the year. Ranchers living in the western foothills of the central Sierra Nevada typically graze their animals in the foothills in winter, and in montane meadows on Forest Service lands in summer. Because summer range is relatively scarce and of high quality on national forest lands, its economic importance is high (Huntsinger et al. 2010). Research among grazing permittees using the Tahoe, Stanislaus, and Eldorado National Forests found that on average, these ranchers used about 2.6 leases per year per operation, and that the public lands lease contributed an average of 41 percent of the income they earned from ranching (Sulak and Huntsinger 2007). The importance of public land leases on these forests led one-third of the permittees interviewed to state that if they lost their leases, they would probably sell all or part of their private ranch. Private rangelands in California are rapidly being converted to more intensive land uses given high development pressure, and the rate of rangeland conversion to development is increasing annually (Brunson and Huntsinger 2008, Sulak and Huntsinger 2007). This trend is leading to a shortage of leases on private lands. Thus, the stability of public lands grazing is critical for maintaining ranching operations in the Sierra Nevada and elsewhere in California given the overall dependence of ranchers on leased rangelands. Public land grazing enables ranchers to maintain ranching as a component of their livelihood strategies and their culture. It also contributes to the conservation of private rangelands and their associated ecological values by helping prevent the sale of private ranches by ranchers whose operations would fold without public leases (Brunson and Huntsinger 2008, Sulak and Huntsinger 2007).

Public lands play a critical role in providing a stable forage supply for livestock. However, there have been downward trends in authorized grazing and in the number of animal unit months grazed on Forest Service lands in the West over the past several decades (Huntsinger et al. 2010). Recent declines are attributed largely to drought. In addition, fire suppression has caused a buildup of woody vegetation on Forest Service lands, reducing forage productivity. Permittees feel uncertain about what the future productivity of their allotments will be because they have little control over how national forests are managed, and they perceive increasing restrictions and more costly and complicated management requirements. Maintaining stable leases and a stable forage supply through management actions, communicating with ranchers about grazing-related issues and problems, and involving permittees in management decisions by integrating their knowledge and recommendations can help sustain ranching in the Sierra Nevada, and the broader socioeconomic and

conservation benefits that ranching brings to the area (Huntsinger et al. 2010, Sulak and Huntsinger 2007).

Management Implications: Grazing on National Forests

- Maintain stable leases and a stable forage supply for livestock on Forest Service allotments through management actions.
- Communicate with grazing permittees about grazing-related issues and problems, and involve them in management decisions by considering their knowledge and recommendations.

Conclusions

This chapter has sought to provide a social and economic context for understanding timber harvesting, biomass utilization, NTFP harvesting, and grazing in the Sierra Nevada science synthesis area, as well as associated management issues. The sustainable management of timber, biomass, NTFPs, and forage from national forests in the Sierra Nevada can benefit nearby forest communities where these activities are important by contributing to both economic and social sustainability, consistent with the direction of the 2012 Forest Service Planning Rule. The chapter points out a number of strategies forest managers might take—grounded in the published social science literature—to support continued production of forest products from national forests in the Sierra Nevada in a manner that may benefit local communities. Doing so represents an investment in long-term, sustainable job creation and more diversified local economies (Charnley et al. 2012). It may also help the Forest Service meet its mission-related goals. For example, national forest timber sale programs support local processing infrastructure and maintain markets for sawlogs and small-diameter wood, helping the agency accomplish hazardous fuels reduction. They also produce timber sale receipts that can defray the costs of restoration projects. Plieninger et al. (2012) found that private landowners in California who maintain working forests and rangelands and engage in commercial timber and livestock production are much more active than purely residential owners in carrying out management practices related to biodiversity enhancement, soil and water protection, and improving “provisioning” ecosystem services associated with timber and livestock production. Yet these authors also found that the number of owners of working forests and rangelands in California is declining. To the extent that managing federal lands for productive uses helps maintain working forests and rangelands on private lands, managing forest products on national forests for community benefit may have environmental benefits for forest and rangeland ecosystems across ownerships.

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