History of the Development, Use, and Management of Forest Resources

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INTRODUCTION

Bordered by three mountain ranges and bisected by a fourth (Figure 2-1), the region of southwestern Oregon and northern interior California contains a diverse array of soils, vegetation, topographic features, and climatic conditions. A history of wildfire, mining, grazing, farming, and logging has created a mosaic of vegetation types (Figure 2-2), and a patchwork of public and private ownership is superimposed on the landscape, adding an additional layer of complexity to the region (Figure 2-3). It is small wonder, therefore, that forest resource management in the region has likewise evolved to a high degree of complexity.

This chapter traces the history of resource use from early fur trapping to the present, focusing on the development of timber as the dominant resource. It identifies the obstacles to successful reforestation and discusses their economic implications. Finally, it sketches the development of forestry research in the region, culminating with the FIR Program (Forestry Intensified Research), a major research and technology-transfer program directed at improving reforestation practices.

RESOURCE HISTORY: EXPLOITATION TO MANAGEMENT

The arrival of Euro-American explorers in the early 1800s wrought changes affecting both the landscape and the natural resources of the region. Fur trapping, settlement, game hunting, mining, grazing, logging, and
recreation have all shaped the present-day complexion of southwestern Oregon and northern interior California.

**Exploration, Trapping, and Hunting**

According to LaLande (1979 and 1980), McDonald (1979), and Martin et al. (1981), the first notable entry of whites into the region occurred in the winter of 1826-1827, when a party of Hudson's Bay Company trappers led by Peter Skene Ogden explored the area. Indeed, the word "Siskiyou," denoting the mountains in the area, is believed to have originated when a Hudson's Bay fur-trapping party lost a bobtailed race horse (called a "siskiyou" in the Cree language) during a snowstorm in 1828 at what is now known as Siskiyou Summit (McArthur 1982). In any event, trapping of beaver, otter, marten, and other fur-bearing animals by the British company continued for about 20 years in a concerted effort to trap out the streams and thus discourage American exploration and settlement.

Although corporate fur trapping ended in the late 1840s, there have been several other periods of exploitation of wildlife in the region. Professional hide hunters, known as pelters, set up camps in the area soon after the 1868 fire (Cooper 1939). Within a short time they so depleted the herds of deer and elk that local settlers rose up in arms and drove them out of the Rogue River country.

The early history of the Siskiyou National Forest (1914-1939) contains several reports of cougar and coyotes killed to protect deer and sheep. One puzzling statistic given in the 1925 report (Cooper 1939, p. IV-41) states: "Six hundred cougar were estimated for the Forest, but the figure was reduced by the Regional Office."

**Mining, Grazing, and Settlement**

The discovery of gold at Sutter's Mill on January 24, 1848, led to the California Gold Rush of 1849. By late that year, prospectors had moved up from the American and Trinity Rivers to the Klamath and Salmon Rivers in northern California, discov-
The region's initial mining boom waned in the late 1860s, but a later boom occurred between 1880 and the end of World War I (LaLande 1980). Minerals extracted during this period included copper and chromite as well as gold. Gold panning by individual prospectors gave way to larger-scale hydraulic (placer) and lode ("quartz") mining by companies during the late 19th century. The development of dredges to extract gold from river bottoms and gravel bars also helped extend the mining period into the 1930s (McDonald 1979, Martin et al. 1981).

The miners had a significant impact on the region (McDonald 1979, LaLande 1980, Martin et al. 1981). They explored the drainages, opened up the area to settlement, vanquished the native Indian tribes, disrupted many stream channels, and burned the landscape. They also created a demand for meat, leading to the coming of stockmen into the area by the 1860s.

By 1884 the growing interest in ranching and lumbering led to diversification of livelihoods (Johnson 1979, Martin et al. 1981). Many miners and ranchers supplemented their income by farming, logging, hunting, and fishing. Johnson (1979, p. 135) describes how Isaac Custer, "a carpenter and farmer, like a true frontiersman, also found the ambition and energy for mining and lumbering." Charley McCann, an early settler who arrived in the Applegate Valley of southwestern Oregon in 1880, "raised beef and dairy cattle, [and] like so many of the ranchers in those days did some logging and milling" (Johnson 1979, p. 143).

The grazing of livestock in the forests and meadows of the Siskiyous and Cascades greatly affected the landscape (Minore 1978, LaLande 1980) (Figure 2-4). Swine, cattle, sheep, and goats ranged the area, leading to severe depletion of forage in many locations. Burning and seeding were frequently done to increase forage production, usually at the expense of forested areas (Hayes 1959). For example, LaLande (1980) reports that local settlers set fire to large areas of the southern Cascades.
in order to promote the growth of huckleberries and browse for big game and livestock. By the early 1900s, the vast expanse of "gloriously dense and majestic forest" was marred by patches of charred snags.

Even today in northern California, much of the commercial forest land that was once well stocked with conifers is now poorly stocked, or stocked with hardwoods of low commercial value, as a result of unsuccessful attempts to convert the land to grazing (Oswald 1970). As late as the 1970s, grazing of livestock was having an adverse impact on conifer forests—usually because of physical damage to young seedlings (Williamson and Minore 1978). Conflicts over grazing also have occurred in the Coast Range. Hayes (1959, p. 26) mentions the struggle over "attempts to convert excellent forest lands to pasture, especially in Coos County."

In 1907 Congress passed the Forest Homestead Act, permitting settlement and private ownership of potential agricultural areas within the National Forests (Figure 2-5). The homesteaders, often referred to as "stump ranchers," customarily cleared a modest tract of timber, constructed a crude cabin, established a small garden, and then, once title (patent) was acquired to the 160-acre parcel of land, sold it to a timber company (LaLande 1979 and 1980). In the Siskiyou National Forest area, Cooper (1939, p. 57) reports that by 1930, "only five of the [142] tracts were being farmed, and on only one was the owner able to make his living entirely on the place." Although many of these supposed "homestead" claims were denied and the program ultimately terminated by the government, the land rush prompted by the Forest Homestead Act had a definite influence on the land ownership pattern in the region.

Another dominant feature of this pattern is the checkerboard arrangement of public and private lands (Figure 2-3). Approximately two-thirds of the area is laid out in this patchwork of alternating public and private land; the remaining one-third consists of almost solid blocks of National Forest land (Moravets 1951).

The configuration of unconnected parcels and multiple ownerships resulted from the granting of alternating sections (640-acre blocks) of land to the Central Pacific (later Southern Pacific) and Oregon and California (O&C) railroads and to the Coos Bay Wagon Road in the late 1860s (Moravets 1951, Richardson 1980, Martin et al. 1981). Odd-numbered sections in the proximity of the thoroughfares to be constructed were given to the transportation companies as incentive for development. Most parcels were eventually sold to settlers, timber companies, or investors, although the Southern Pacific Railroad retained several hundred thousand acres for its own use. Other unsold portions, however, were revested by the federal government in 1916 because the terms of the grant had been violated. The public-domain (even-numbered) sections, along with the revested sections,
were retained by the U.S. Department of the Interior and eventually came under the jurisdiction of the Bureau of Land Management (BLM) in 1947. A 1937 law authorized the Interior Department to harvest and sell the O & C timber on the basis of sustained yield, with a portion of the revenue to be returned directly to the counties (Beckham and Haase 1987).

The period of early settlement and development had dramatic impacts on the physical landscape of the region. As described by Johnson (1979, p. 217):

In 1900, the land along the Applegate—fifty years earlier a virgin wilderness traveled only by Indians who broke no soil, cut only a few small trees for their modest dug-out dwellings—had been divided into sections by property lines that ignored waterways and the contours of valley, slope, draw, mountain. Brush and timber had disappeared by the thousands of acres, and by the millions of board feet; soil by the thousands of acres had been worked for minerals, cultivated for crops; many of the properties were already crossed or bordered by roads, irrigation ditches, telephone lines, power lines.

Fire

Fire, whether natural, accidental, or intentional, has been influential—perhaps even the dominant factor—in shaping the landscape of the region. Lightning strikes are common enough to be an important natural cause of wildfires (cf., Cooper 1939, Brown 1960 and 1971, LaLande 1980, McNeil and Zobel 1980, Martin et al. 1981). For example, historical data for the Rogue River National Forest indicate that between 10 and 60 percent of fires have been caused by lightning, with the highest frequency occurring in the Cascades portion of the Forest (Brown 1960). During the fire episode of 1987, more than 1,600 lightning strikes were recorded during a 12-hour period in late August in southwestern Oregon (O.T. Helgerson, personal communication). These and similar strikes in northern interior California led to wildfires on almost a million acres of timberland in the region.

Local Indians used fire to fell large pines and cedars for use in their villages, and they also burned areas to maintain forage, favorite huckleberry and blackberry patches, and hunting sites (Leiberg 1900, LaLande 1979, McDonald 1979). McDonald describes the use of fire encrolement by Shasta Indians in the fall to drive deer into ambushes in the high Siskiyous. Most of the fires set by Indians were “small and circumscribed,” but one series of burns east of Crater Lake near Klamath Marsh covered about 60,000 acres over the past 3 centuries (Leiberg 1900).

Early miners, settlers, and ranchers used fire to clear the land and improve forage conditions for livestock (LaLande 1980). Fire was often used as an expedient way to clear windfalls along roads (Leiberg 1900). Hunters also started many fires in an effort to remove the impenetrable brush and facilitate hunting (Brown 1960). Such fires often created considerable waste and devastation of the forest.

The frequency of fire in the region has gradually declined since the days of early settlement. Leiberg identified this trend as early as 1900 and attributed it to four major factors:

The numerous fire breaks caused by the earlier burns; the gradual extinction of the game and consequent diminished number of hunting parties and lessened risk from unextinguished camp fires; the acquisition of valuable timber claims by private parties throughout the heavily forested sections and the measure of protection, prompted by self-interest, bestowed on their property and incidentally on adjoining areas; and lastly, the destruction of the humus layer, the chief factor in the spread of forest fires in this region, by the earlier conflagrations and the insufficient accumulations of this material since then to support hot, large, and destructive fires (Leiberg 1900, p. 277).

Despite the pervasive influence of fire on the region, historians have had difficulty in accurately reconstructing the time of occurrence and the extent of many of the early burns associated with settlement. Morris (1934, p. 325) described his
assessment of fire history as follows: "the forest cover of the southwestern Oregon counties today is a maze of young age classes which have been established after fires, and the effect of countless repeated burns makes it impossible to determine the extent of the early fires."

In recent times, fire has been used as a tool by foresters to dispose of brush and woody fuels, to prepare sites for seeding and planting, and to manipulate the process of natural plant succession (cf., Stewart 1978, McNeil and Zobel 1980, Walstad et al. 1987b, Agee 1990, Walstad and Seidel 1990). The controlled use of fire is termed "prescribed burning," and the practice is useful in both managed and wildland forests. Its techniques range from broadcast burning of logging slash, to burning of piled and windrowed material, to underburning of mature forest stands (cf., Marlega 1981, Martin 1990).

Much of the natural vegetation of the region is adapted to periodic fire, especially the hardwoods, chaparral brush species, and some conifers (Thomas Atzet, personal communication; see also Chapter 5). Vast expanses of the region have burned repeatedly, often destroying conifer regeneration as well as stands of mature timber (Cooper 1939). Throughout the Rogue River Valley, for example, most of the brushy hillsides have been periodically burned off for many years, probably accounting for the continued existence of the chaparral species (Detling 1961, Gratkowski 1961). E.H. McDaniels, an early supervisor of the Siskiyou National Forest, stated that he had seen fires burn in timber and brush in every month of the year (Cooper 1939).

Leiberg made the following observations during his survey in 1900:

> Fires have widely ravaged the region examined [Cascade Range, Ashland Forest Reserves, and adjacent areas]. There is not a single forested township either on the west side or the east side of the range in which the timber is not more or less fire marked (Leiberg 1900, p. 276).

Fire has often left a legacy of poorly stocked forests, brushfields, and open meadows (Hayes 1959, Minore 1978). The Forest Survey of southwestern Oregon, conducted in 1947-1949 by the Pacific Northwest Forest and Range Experiment Station of the USDA Forest Service, found 269,000 acres deforested by fire that were not restocked:

> Practically all the acreage was in old burns, those on which the original fire occurred from 15 years to several decades in the past. Most of these areas now support a dense cover of brush (Moravets 1951, p. 7).

Martin et al. (1981, p. 126), describing the situation in the Shasta-Trinity National Forest of northern California, state, "Frequent fires, which followed upon logging, destroyed the young growth, and chaparral covered large areas." In some cases, however, fire has not been severe enough to denude areas or prevent natural regeneration. Indeed, many of the relatively even-aged stands of conifers present in the region today were fire-generated (Thomas Atzet, personal communication). In the absence of fire, the process of plant succession eventually leads to the dominance of conifers in most areas of the region. However, the time required for succession to conifers can be lengthy.

Effects of fire on vegetation are largely determined by the frequency of occurrence. McNeil and Zobel (1980) found that the natural frequency of fire in the southern Cascades near Crater Lake varied from intervals of less than 3 years to those of more than 50 years. Snowbrush ceanothus, a fire-adapted species, was dominant in areas where the mean interval between fires was 15 years or less, whereas it was almost absent in areas where the interval was greater than 20 years and where the long absence of fire had allowed true fir forests with sparse understory shrubs to develop and persist.

Fires usually occur more frequently in the interior portion of the Klamath and Siskiyou Mountains than in the Cascades and Coast Range. An average frequency of 20 years is representative of the area, although the variance is considerable (Thomas Atzet, personal communication). Consequently, the flora contains a high proportion of chaparral species well adapted to periodic fire.
Recreational Use

Hunting and fishing have always been important activities in the region (McDonald 1979, LaLande 1980). Indians and early Euro-American trappers and settlers relied on fish and game for subsistence. By the late 19th century, sufficient agricultural development had occurred to sustain most of the population, reducing the dependency on local wildlife. Hunting, fishing, and, to a lesser extent, trapping have continued to be popular recreational pastimes, however.

Many favorite camping areas in the region were identified by the late 1800s, and steady improvements in road access during the early 1900s opened up additional areas (Figure 2-6). Residents of the hot interior valleys began spending several weeks each summer in the cooler lake country of the southern Cascades. For example, as many as 1,500 berry pickers camped on Huckleberry Mountain near Prospect, Oregon, in the early 1900s (LaLande 1980). Scenic attractions such as Mount Shasta in northern California, Crater Lake in southern Oregon, and mineral springs near Ashland, Oregon, became popular vacation spots and health resorts by the early 1900s (LaLande 1980, Martin et al. 1981). Most of the old-time mineral-spring resorts declined, however, as the automobile became a popular means of transportation. As explained by Charles Masson in an article by O'Brien (1951, p. 229):

They used to come here, entire families, with trunks, and spend three or four weeks. But with the automobile, no one wanted to spend his summer vacation staying in one place. He wanted to be on the move and see the country—200 or 300 miles of it a day, every day. The old fashioned resort was through.
Other recreational uses of the region's forests have grown in recent decades. Reports from the Rogue River National Forest, for example, indicate an ever-increasing number of weekend campers; visitors to the Forest now number in the hundreds of thousands each year (LaLande 1980). In some areas recreation has eclipsed timber and agriculture as the most important element in the local economy. This is evidenced by growing pressures for the development of trails, campgrounds, and parks, as well as set-asides for preservation of scenic views, wildlife habitat, and wilderness. As LaLande (1980, p. 42) summarizes:

"The area's remoteness, so long a barrier to development, now is viewed as a valuable resource in its own right. Designation of [scenic areas]; development of the new Pacific Crest Trail; continuing proposals for a "Red Buttes Wilderness"; legal suits over the disposition of roadless areas—all are aspects of one new perspective on the future of the [Rogue River National Forest]."

Logging and Manufacturing

Lumbering began in the region when Johnathan Otis constructed a whipsaw lumber mill in Shasta County, California, in 1850 (Giles 1949, p. 144-149). The first sawmill in southwestern Oregon was built at Ashland in 1852 (Clark 1962). The building of sawmills continued during the rest of the century (McDonald 1979, LaLande 1980, Martin et al. 1981), but the extremely steep country, coupled with the limited transportation network into the forested mountains, precluded much utilization of the timber resource until World War II (Hayes 1959). Indeed, large-scale commercial timber harvesting did not begin in the region until after 1915, and initial efforts were focused on the gentler slopes of the southern Cascades rather than the rugged Klamath and Siskiyou Mountains (McDonald 1979).

Most of the early logging and sawmilling was accomplished by "local miners and ranchers turned lumberjacks and millmen" (Johnson 1979, p. 165). Mining and ranching required considerable lumber for support timbers, flumes, sluices, and buildings. Small, portable sawmills were usually set up near the timber to be logged, avoiding the problem of hauling logs over the primitive roads to more centralized locations (Johnson 1979, McDonald 1979, Martin et al. 1981). For example, A.L. Edgerton, an early lumberman in Grants Pass, designed his mills to be moved from place to place. This allowed him to purchase timber from ranchers at low prices (Clark 1962).

Rivers often were used to transport logs and lumber over longer distances. The Klamath River served as a means of getting lumber to coastal markets in an area where roads were extremely poor (McDonald 1979). The Sacramento River was another important artery. As early as 1857, it was used to raft hewn timbers and shingles from the mills near Redding to Sacramento and then on to San Francisco (Giles 1949, p. 144-149). The trip took about a month and required skilled raftsmen.

The primitive logging practices employed toward the end of the 19th century generated a great deal of waste. Because much of the large, old-growth timber was defective as a result of fire scars and ensuing decay, much of it was left in the woods after logging. Leiberg (1900, p. 275) noted:

"Most of the very aged sugar pine and red fir have rotten cores or gum cracks in their trunks. The incense cedar, on both sides of the Cascades, rarely has a sound center. It is seldom sawn except for shingles."

By the early 1900s, lumbering provided a higher and more dependable income than mining or ranching. The timber industry continued to grow well into the 1980s, when it contributed from 12 to 31 percent of the total wage and salary payroll of areas centered around Medford and Roseburg, Oregon (Greber 1990).

With few harbors in the region, markets for lumber were largely confined to the local area until completion of the O&C-Southern Pacific Railroad on December 17, 1887 (McDonald 1979). Even then, high freight rates discouraged shipping to other parts of the country for many years (Clark 1962). Consequently, the shipment of timber generally was limited to the local mining and farming communities, and cutting during this period was primarily restricted to the pine stands scattered on the valley floors and foothills (LaLande 1979).
Figure 2-7. The advent of World War II led to a dramatic increase in logging in southwestern Oregon and northern interior California. Photo courtesy of Medford Corporation and Southern Oregon Historical Society.

Railroads eventually reached the woods. Companies such as Weed Lumber (soon to become Long-Bell) and Fruit Growers’ Supply constructed rail spurs in the early 1900s to facilitate the transport of logs (McDonald 1979). One line was even sold to Southern Pacific, which extended it to Klamath Falls. The new line replaced the Shasta Valley route as the main north-south line. Railroad logging continued in the region until 1962, when Medford Corporation ended its railroad operations and switched entirely to truck transport.

Originally, the development of the fruit industry in the Medford area had provided a strong local demand for box lumber during the early 1900s (LaLande 1979). This led to heavy cutting of pine at lower elevations in the Rogue River Valley (Hayes 1959). Growth in construction markets in San Francisco and southern California prompted the expansion of several mills during this period. For example, Weed Lumber began to manufacture sash and door materials in 1907 for rail shipment to California and elsewhere (McDonald 1979).

The vast stands of timber in the mountains, though, remained economically inaccessible until the 1940s (Hayes 1959, Minore 1978). World War II and the ensuing postwar era brought a high demand for lumber (Figure 2-7). Road and rail improvements, along with technological advances such as lightweight chain saws, heavy-duty trucks, and yarding systems, made logging possible in areas previously considered unprofitable or inaccessible. There was also a shift during this period from small, isolated sawmills to large, centralized wood-products facilities located near population centers (McDonald 1979). As summarized by Martin et al. (1981, p. 107):

The overall trend of the timber industry in the Forest was thus one of development from small operations serving local needs to large heavily capitalized companies serving national and even international markets. The earlier type of operations did not disappear when the larger operations developed, but accounted for less of the total cut.

Since World War II, consequently, the cutting rate has rapidly increased, leading Hayes (1959, p. 31) to remark: “Present cutting rates probably cannot be long maintained, however, due to overcutting on some private lands.” This forecast was realized in southwestern Oregon, as shown in the report by Sessions (1990). Board-foot harvest declined from about 3.0 billion bf in the late 1960s and early 1970s to about 2.4 billion bf in the mid-1980s—a 25-percent reduction. Further declines are anticipated until early in the next century when current young stands reach maturity. However, uncertainties over the future intensity of forest management that will be permitted on public and private land, coupled with the perceived need to reserve large areas to protect the northern spotted owl and other sensitive wildlife species, greatly complicate future projections of timber supply in southwestern Oregon (cf., Greber et al. 1990, Sessions 1990).

Current timber supply is less constrained in the interior region of northern California. Except during the recession of the early 1980s, annual harvest levels since 1948 have remained steady at about 1.3 billion bf (Colclasure et al. 1986). Yet
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growing stock—at least on private lands—has changed very little since 1968. Softwood volume has decreased 1.8 percent and hardwood volume has increased 1.85 percent during this period (Colclasure et al. 1986). Uncertainties over forest management practices and land allocation cloud the future of this area as well.

Regardless of what the future brings, timber is the primary resource supporting the economy of the region (Hayes 1959, Bassett 1979). At least 16 softwood species and eight hardwood species in the region are commercially valuable (Table 2-1). Agriculture (primarily livestock, poultry, and fruit orchards) and outdoor recreation constitute other key resources, but to date they are of secondary importance. As Hayes (1959, p. 29 and 9) summarizes:

Furs and minerals attracted the first white men to southwestern Oregon; but with permanent settlement about a century ago, agriculture pre-empted first place as a means of livelihood, a position it continued to hold until the expansion of timber harvesting during World War II. Timber has since been the most important resource in the economy and should retain that position indefinitely.

Due to rough topography, four-fifths or more of the province will continue to be best adapted to tree growing, less than one-tenth to crops, and the remainder to pasture.

Timber from this region is important not only to the local economy but to the national economy as well. Bassett (1979) reports that in the early 1970s, nearly 5 percent of the nation's lumber and 20 percent of its veneer and plywood came from southwestern Oregon. Approximately one-third of Oregon's and California's timber harvests come from southwestern Oregon and northern interior California (Bassett 1979, Colclasure 1986, Warren 1987). Although a decline in harvestable timber inventory is anticipated toward the end of this century, intensified management practices and continued growth of current stands promise to sustain the long-term production of timber from this region (Oswald 1970, Beuter et al. 1976, Stere et al. 1980, Sessions 1990).

Table 2-1. Commercially important tree species in southwestern Oregon and northern interior California. Adapted from Clark (1962.)

<table>
<thead>
<tr>
<th>Conifers</th>
<th>Hardwoods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coast redwood</td>
<td>Bigleaf maple</td>
</tr>
<tr>
<td>Douglas-fir</td>
<td>California black oak</td>
</tr>
<tr>
<td>Grand fir</td>
<td>California-laurel (Oregon myrtle)</td>
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<tr>
<td>Incense-cedar</td>
<td>Golden chinkapin</td>
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<tr>
<td>Jeffrey pine</td>
<td>Oregon white oak</td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>Pacific madrone</td>
</tr>
<tr>
<td>Mountain hemlock</td>
<td>Red alder</td>
</tr>
<tr>
<td>Ponderosa pine</td>
<td>Tanoak</td>
</tr>
<tr>
<td>Port-Orford-cedar</td>
<td></td>
</tr>
<tr>
<td>Red fir</td>
<td></td>
</tr>
<tr>
<td>Sitka spruce</td>
<td></td>
</tr>
<tr>
<td>Sugar pine</td>
<td></td>
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<tr>
<td>Western hemlock</td>
<td></td>
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<tr>
<td>Western redcedar</td>
<td></td>
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<tr>
<td>Western white pine</td>
<td></td>
</tr>
<tr>
<td>White fir</td>
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</tbody>
</table>

Forest Management

Forest management in the region originally centered around fire protection (LaLande 1980). With thousands of acres consumed by fire each year, and with resource values rapidly increasing, this was a logical and necessary focus. For example, LaLande (1980, p. 80) states that in southwestern Oregon "the 'great fires' of 1878 [1868], which were mentioned as burning vast amounts of timber in the upper Applegate drainage [of southwestern Oregon]...probably 'harvested' far more trees than all the area's early sawmills put together." Show (1930, p. 1) described the situation in northern interior California as follows:

The area of once forested lands requiring planting in the California pine region is very large...On a large part of these lands all timber growth has been swept away by repeated fires and no chance for natural reproduction remains. For the rest, lumbering followed by fire, and in recent years lumbering alone, have denuded the land quite as thoroughly.
The extensive mortality of timber caused by periodic infestations of bark beetles was another major concern of early forest managers in the region. Between 1911 and 1925 the Division of Forest Insect Investigations operated field stations at Yreka, California, and Ashland and Klamath Falls, Oregon, to contend with these outbreaks (Wickman 1987). It was during this period that F. Paul Keen developed the widely-used Keen tree vigor classes for rating susceptibility of ponderosa pine to bark beetle attacks.

Even though fire and insect protection received the most emphasis, there were some attempts at silviculture in the early 1900s. A nursery was established at Page Creek, Oregon, and it produced several hundred thousand seedlings before being discontinued in 1921 because of repeated failures with planted stock (Cooper 1939). California nurseries were established at Susanville and at Pilgrim Creek, near Mount Shasta, but these, too, were soon abandoned (Martin et al. 1981). Nursery production did not return to the interior region until 1979, when the J. Herbert Stone Nursery of the USDA Forest Service was constructed near Medford, Oregon.

Attempts were made at establishing both exotic and native tree species throughout the first half of the 20th century, but most were small in scale and usually resulted in failure (Show 1930, Fowells and Dunning 1948, Hayes 1959, LaLande 1980). Native species planted or seeded included sugar pine, ponderosa pine, Jeffrey pine, Douglas-fir, white fir, incense-cedar, Port-Orford-cedar, and redwood (Show 1930, Cooper 1939, Fowells and Dunning 1948). Several exotic species such as Scotch pine, European larch, and Norway spruce were also tried when local seed crops failed (LaLande 1980). These attempts at artificial reforestation usually were directed at reclaiming old brushfields or reforesting new burns. In their survey of planting on several National Forests in California, Fowells and Dunning (1948, p. 22) concluded: "On the whole the 16 year planting program made little progress toward reclaiming the extensive deforested area or in developing successful new methods." Likewise, direct seeding failed to achieve satisfactory stocking on most of the areas where it was attempted. Principal causes for these failures were competition from brush; damage from insects, rodents, and other animals; and faulty matching of stock to site conditions (Chapter 13).

In the early 1950s, direct seeding, including spot seeding of species such as sugar pine, ponderosa pine, and Douglas-fir, was successfully applied in the South Umpqua River and upper Rogue River drainages (Stein 1955a, 1955b, and 1957). The use of pesticides to protect the seeds and young germinants from rodents and cutworms was a prerequisite to success.

Most reforestation efforts prior to 1950 relied on natural regeneration, however. Generally speaking, clear-cutting in staggered settings was practiced in areas containing the Douglas-fir and Shasta red fir-mountain hemlock types (Stein 1954, Gratkowski 1958), whereas partial cutting was the norm in areas containing the mixed conifer and ponderosa pine types (Hayes 1959, Bassett 1979). The selection of which system to use, though, depended more on the mixtures of age classes and species present, the amount of merchantable volume available per acre, and the condition of the timber involved (much of it was defective old growth) than it did on timber type or regeneration concerns.

As the rate of timber harvesting accelerated during World War II and the ensuing postwar years, numerous trials of various harvesting and regeneration systems were conducted (cf., Moravets 1951, Minore 1978, LaLande 1979, Stein 1981, Strothmann and Roy 1984, Stein 1986). Diameter-limit cuts were prevalent throughout the 1940s and 1950s. Methods gradually shifted from these individual tree selection cuts to group selection and block clear-cutting by the late 1950s. Chronic reforestation problems, however, led to a decrease in clear-cutting on most federal lands in the early 1960s. Two-stage shelterwood harvesting with some underplanting where natural regeneration is unreliable has been used extensively on federal land since that time (Figure 2-8).

Meanwhile, the forest products industry generally continued to pursue a clear-cut-and-plant management regime (Figure 2-8). Companies such as Medford Corporation began successfully planting cut-over lands in the early 1960s, gradually intensifying their practices to include the use of select seed, precommercial thinning, and other treatments (LaLande 1979).
The success of all of these methods of harvesting and regeneration has been highly variable. Stein (1981), for example, found that many clearcuts in the Butte Falls area of the southern Cascades were well stocked with regeneration, but those on the Dead Indian Plateau were not. Most shelterwood cuts in these two areas were adequately stocked, but seedling growth and vigor were often less than desired. In the Siskiyous, both clear-cutting and shelterwood cutting have led to full stocking, but once again, growth and vigor of seedlings in shelterwood units are often marginal (Stein 1986).

There are numerous reasons for the poor performance of regeneration in certain areas of the region (cf., Hermann 1965, Minore 1978, Williamson and Minore 1978, Stein 1981, Strothmann and Roy 1984, Stein 1986) (Figure 2-9). The Mediterranean-type climate creates hot, dry conditions throughout much of the growing season, particularly on south-facing slopes. Poorly conditioned planting stock and careless planting practices account for much of the mortality. Predation of seed by rodents has hampered many attempts to use natural regeneration and direct seeding. Severe frosts on the Dead Indian Plateau have killed saplings up to 10 ft tall. Clipping by pocket gophers, mountain beavers, and other rodents accounts for much of the seedling mortality throughout the region. Browsing by deer and elk has reduced the growth and vigor of young seedlings. Grazing and trampling by unmanaged herds of cattle have destroyed many new plantations.

By far the most significant problem facing young conifer regeneration in the region is competing vegetation, termed “damnable brush” by at least one early surveyor (LaLande 1980, p. 25). With limited amounts of soil moisture, competition from woody and herbaceous vegetation greatly reduces the survival and growth of conifers (Gratkowski 1961 and 1978, Minore 1978, Williamson and Minore 1978, Stein 1981, Strothmann and Roy 1984, Stein 1986, Walstad et al. 1987a; see also Chapters 7, 10, and 16). Tall-growing shrubs and hardwoods such as snowbrush ceanothus, tanoak, canyon live oak, Pacific madrone, bigleaf maple, and chinquapin also intercept enough sunlight to interfere with young conifer development (Stein 1986). As summarized by Hayes (1959, p.19):
Figure 2-9. Major problems affecting conifer seedlings in southwestern Oregon and northern interior California include (A) hot, dry climatic conditions (note shade card), (B) severe frosts (note dead, drooping leader), (C) clipping by pocket gophers and other animals (note gnawed stem of seedling), and (D) weed competition (note dead pine sapling in manzanita clump).
In some places brush apparently excludes forest reproduction and in others causes long delays in restocking. It may take 30 to 50 years for seedlings to get above the brush cover. And wherever present, brush undoubtedly slows tree growth.

To remedy the situation, Halin (1968, p. 17) made the following recommendation:

Therefore, positive steps are needed, such as planting or seeding as soon as possible after harvest cutting before vegetation becomes fully established, or removing or killing part of established vegetation before attempting to establish regeneration.

Current recommendations advocate clear-cutting followed by site preparation and planting for the portions of the region suitable for Douglas-fir (Strothmann and Roy 1984). With recent improvements in stock quality, site preparation practices, planting techniques, and protective measures, this system of regeneration has generally proved to be more reliable than natural methods or direct seeding (Strothmann and Roy 1984).

This is not to say that all reforestation problems can be solved through conventional clear-cutting and planting techniques, particularly in timber types other than Douglas-fir. In 1973, W.F. Edinger, a BLM forester, succinctly summarized the situation on the Dead Indian Plateau, where the shelterwood harvesting system has proved to be necessary in order to regenerate stands vulnerable to drought, heat, frost, and animals:

In the true fir forest, on the Dead Indian Plateau south of Mt. McLoughlin, clear cutting was thought by many to be a way to convert old stagnant, unevenage stands to a thrifty young forest. Over several years, these early cuttings did not reforest naturally. Plantings of true fir and Douglas-fir died. Ponderosa pine survived some of the time. Often, those that made it through the first summer succumbed to pocket gophers or grasshoppers. Sometimes heavy grass and sedge invasion prevented survival due to competition for moisture in summer. Ground temperatures up to 140°F proved lethal to volunteer and planted trees alike. Despite repeated planting and seed spotting, many of these clearcuts are still unstocked twenty years after cutting. We have learned the lesson that hot, dry summers and low nutrient soils will not permit us to denude the landscape on the Dead Indian unless we can somehow manage to make boards out of gophers, weeds, and elderberry bushes (Edinger 1973, as quoted in Minore 1978, p. 8-9).

Forestry Research

As we have seen, early research in the region was largely a trial-and-error process focused on fire suppression, bark beetle control, and reforestation. Initial reforestation efforts were directed at securing regeneration of the burned and cut-over land. Between 1908 and 1913, scores of large-scale trials of direct seeding were conducted, virtually all of which resulted in failure (Show 1930).

The first planting experiments in northern California were conducted in 1911, but these, too, encountered serious obstacles to successful reforestation (Show 1930). They led to the establishment of a forest experiment station at Feather River in the Sierra Nevada in 1913. Although abandoned for a brief period around 1916 (Martin et al. 1981), the station became a branch of the California Forest Experiment Station (eventually the Pacific Southwest Forest and Range Experiment Station) of the USDA Forest Service in 1926. Show and his associates established nurseries at Feather River and at Pilgrim Creek on Mount Shasta and conducted numerous outplanting trials of various species and stocktypes. Although the work was considered "well worthwhile," the experiments were curtailed in 1920, and no effort was expended on reforestation during the next few years (Martin et al. 1981). Nevertheless, Show's classic monograph on nursery and planting practices in northern California strikes a contemporary chord:
Planting can be done successfully on all potential timberlands. Experience in many countries shows that problems in reforestation and afforestation that have at first appeared insolvable have been solved...Success in planting depends on attention to a multitude of details, in raising the stock in the nursery, in selecting sites, and in the actual conduct of planting...Planting is tremendously complicated, however, by the fact that this denuded land has been captured by a dense stand of brush...Brush-field planting is the outstanding problem in the region (Show 1930, p. 1-3).

Show goes on to describe other problems associated with planting: careless handling of planting stock, poor planting practices, drought (exacerbated by competition from brush), and damage by rodents. Although his group solved many of the nursery problems, he emphasizes the importance, and the difficulty, of solving problems in the field:

In field planting a great deal remains to be learned...The continued loss in plantations 15 years old, partly attributable to poor planting, shows the necessity for further study of the technic of setting out plants...Brush-field planting remains the problem of outstanding importance (Show 1930, p. 73).

Other than the work on bark beetle control at the Ashland Field Station between 1912 and 1925 (Wickman 1987), forestry research in southwestern Oregon was virtually nonexistent until the establishment in 1948 of the Siskiyou-Cascade Research Center of the Pacific Northwest Forest and Range Experiment Station in Roseburg, Oregon (Hayes 1959). A companion facility of the Pacific Southwest Forest and Range Experiment Station was established in Redding, California, in the late 1950s to better serve the Klamath Mountains, the Cascades, and the northern Sierra Nevada. Both centers undertook a broad array of silvicultural research, with major emphasis on harvesting and reforestation systems, natural regeneration, seeding and planting, shrub ecology and brushfield reclamation, forest protection, and growth and yield. Several university scientists also worked in the region during the 1950s and 1960s, contributing to the forestry and ecological literature for the area. The Siskiyou-Cascade Research Center closed in the mid-1960s, however, leaving much of the area without local research support.

Two publications in the 1970s compiled the previous six decades of experience with various regeneration practices in California and Oregon. The first, by Schubert and Adams (1971), titled *Reforestation Practices for Conifers in California*, consolidated the information available on topics ranging from cone and seed handling practices to nursery production, site preparation, planting, and seeding. The second publication, edited by Cleary et al. (1978) and titled *Regenerating Oregon's Forests*, compiled similar information for Oregon. Both of these publications provide a solid core of knowledge on natural and artificial methods of forest regeneration.

Despite the aforementioned efforts, significant forestry problems continued to plague the region well into the 1970s. Repeated regeneration failures on BLM lands in the Medford District, for example, led to the withdrawal of 270,000 acres

| Assumptions: |  
| Withdrawn land = 200,000 acres |  
| Site productivity = 200 BF/acre/yr |  
| Stumpage price = $150/MBF |  
| Direct job multiplier = 6 jobs/MMBF |  

| Production capacity: |  
| 200,000 acres X 200 BF/acre/yr = 40 MMBF/yr |  

| Value: |  
| 40 MMBF/yr X $150/MBF = $6,000,000/yr |  

| Direct jobs: |  
| 40 MMBF/yr X 6 jobs/MMBF = 240 jobs |  

1Abbreviations:  
BF = board feet  
MBF = thousand board feet  
MMBF = million board feet
of timberland from the allowable-cut base in 1978 (cf., Hobbs et al. 1983, Hobbs 1984). The economic implications of this action were especially profound, considering the fact that other land management organizations in the region were also encountering reforestation problems. In addition to the immediate reduction in harvest level, the region stood to lose at least 240 mill jobs and over $6 million a year in perpetuity as a result of taking this land out of production (Table 2-2).

In 1978 the situation prompted community leaders in southwestern Oregon to approach the College of Forestry at Oregon State University and the Pacific Northwest Research Station of the USDA Forest Service to see whether additional research could help solve the chronic reforestation problems in southwestern Oregon (Figure 2-10). This was the genesis of Forestry Intensified Research (FIR), a 13-year, $20-million cooperative research and technology-transfer program (Hobbs et al. 1983, Hobbs 1984).

The future economic livelihood of this region will continue to be linked to forest resources and their management. Reforestation is a key factor in sustaining both the vitality of the timber industry and the ecological integrity of the area. Finding ways to regenerate harsh sites in southwestern Oregon was a major thrust of the FIR Program during the 1980s. Companion research efforts by the Pacific Southwest Forest and Range Experiment Station have addressed similar problems in northern interior California. These efforts have been highly successful (cf., Walstad and Tesch 1987 and 1989), as evidenced by the BLM’s restoration, in 1991, of about 109,000 acres to its base of potentially manageable timberland in the Medford District. The
remaining chapters of this text elaborate on these and other key results of forestry research in the region.

**SUMMARY**

The region of southwestern Oregon and northern California has a unique array of climatic conditions, geologic features, floristic composition, and historic land use patterns. Its landscape has been repeatedly shaped by disturbance—both natural and induced. In particular, a history of frequent fires has had a marked influence on the landscape, accounting for the mosaic of pine- and fir-covered mountainsides intermingled with chaparral and hardwoods. The influence of fire has been accompanied by continuous shifts in resource use, starting with fur trapping and progressing through mining, hunting, grazing, logging, and recreation.

The economy of the region has been largely dependent on timber, but persistent difficulties in reforestation have jeopardized the ability to sustain this renewable resource in many locations. Recent advances in reforestation technology, attributable to the FIR Program and other research endeavors, promise to help regenerate many of the sites heretofore considered unsuitable for sustained timber production.

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