SECTION II
HUMANS IN CALIFORNIA'S CONIFEROUS FORESTS

In a document with the scope of *The Conifer Connection,* it is impossible to go into depth regarding the history of a region the size of California's coniferous forests. *The Conifer Connection* provides a brief summary of the human history in the coniferous forest region. In general, this section includes only the most basic information about how people have interacted with the forests and watersheds. Of course, there are many other important aspects to our history in California.

For those who want to go into greater depth, many books have been written about specific local history. Some of them are listed in the Resources and Works Cited in the Appendices. Local parks, museums, libraries, schools and colleges, and book stores can provide a wealth of additional information.

Those with a particular interest in the coast redwood will be interested in *Redwood Ed*, which is also published by California State Parks. *Redwood Ed* is similar to *The Conifer Connection*, but it focuses on the coast redwoods. It includes an extensive review of the history of humans in the coast redwood forests.

Figure 180. Steam tractor, circa 1900. Note the men riding on the pine logs. (Photograph courtesy California State Parks Photographic Archives.)

CHAPTER 1
Native Americans and the Coniferous Forests

Note: Many different groups of Native Americans lived in California, and still do. In *The Conifer Connection*, we will not attempt to discuss the cultures of individual groups because there is not space to do them justice. Rather, we will provide some general information about how Native Americans interacted with California's coniferous forests. For more detailed information, consult parks and libraries in the area to be visited.

The first people to inhabit California were the Native Americans who, according to their traditions, believe that they were placed in their homelands by the Creator and that they have lived there since "time immemorial." Most scientists agree that the people who are now called Native Americans are probably descendents of people who migrated to North America from Asia about 15,000–10,000 years ago, when the last ice age lowered sea level to a point several hundred feet below its present level. "Indians" probably came to California from elsewhere in North America about 10,000–8,000 years ago.

Estimates of the number of Native Americans in California at the time of Columbus range from about 200,000 (Hewes, 1981) to as many as 700,000 (Wilson, 1998); by 1900, there were probably no more than 15,000 (Emanuels, 1993).

Teaching Idea

Have students find the average of 200,000 and 700,000. Then have them compare that number (450,000) to the populations of large cities in California and of the state. Discuss how more people are able to live in California now than 500 years ago. Be sure to discuss not only how agriculture and medicine have changed our lives, but also how people living in cities depend on food and, especially, water from elsewhere, i.e., the populations of cities exceed the carrying capacity of that area's land.

In some areas, such as the north coast, food was abundant and travel difficult, so the people didn't travel very far. They were relatively isolated from other groups, and thus developed fairly distinct languages and cultures.

Dense forests were of little use to the Native Americans. The shade inhibited the growth of plants that they used for food, as well as plants needed by deer, rabbits, and other food sources. Dense forests also inhibited travel and provided hiding places for enemies. The Native Americans generally did not cut trees down.

They did, however, make use of wood in a number of ways. Willow was woven to make a variety of large baskets and basket-like items. In some places, slabs were used to make houses and other structures. In other areas, large pieces of bark from trees such as redwoods and cedars were used to make houses.

Acorns were an important part of the diet of many of California's Native American groups. Where they grew, tanoak acorns were preferred, but black oak and live oak acorns were also used. Since oaks grow better in clearings than under a forest canopy, the Native Americans learned to start fires on a regular cycle. The regular burning produced openings in the canopy, which resulted in a larger acorn crop, and it also

provided fire breaks around villages, reduced the invasion of conifers into clearings, reduced the intensity of accidental fires, and provided habitat and food for a variety of desired plants and animals such as rabbits, deer and elk. Burning to improve acorn crops was especially common in the inland forests, but was also practiced in the coastal forests.

Teaching Ideas

Discuss what might have happened if the Native Americans had not set fires in the grasslands and prairies, i.e., if they hadn't managed the resources. (At first bushes and shrubs, and then trees, would grow along the grassland/ forest margin. Then the forest would encroach on the grassland, eventually replacing it with forest. This is an example of biological succession.)

Fires are generally suppressed throughout the forest regions today. Ask students to discuss what is happening to the forest clearings as fires are prevented. When visiting a park, have the students look for evidence of forests moving into fields. Also ask them for ideas of ways other than fire to keep bushes and trees from invading the grassland.

Be sure to discuss the problem of accumulation of fuel from decades of fire prevention. When fires burn an area every few years, there is little damage to the large trees because there is not enough fuel for a large, hot fire. If fuel accumulates for many years, fires tend to be much larger and more destructive. Sometimes ***prescribed*** *or* ***controlled burning*** *is used as a tool to reduce the accumulation of hazardous fuel, but air quality and cost concerns limit its use. Depending on the location, lightning fires may or may not be rapidly suppressed. Logging or thinning can also help reduce the fuel load. There are seldom simple solutions!*

See activity "The Only Constant is Change: Succession in Action" on page 235.

Many of the illustrations in Section II are provided two-to-a-page so that they are large enough to use as masters for overhead transparencies. Smaller images provide the user with ideas of things to look for and point out to students while on a trip to the forest.

See "Ideas for Using Historic Images" on page 184.

Pictures from many sources in Appendices III, IV, and V can be used as a basis for student-built models of Native American houses.

Figure 181. Student-built model of a Yurok plank house on display at

Figure 182. This replica of a Yurok redwood plank house can be seen at Patrick's Point State Park, north of Arcata. Note the small entrance opening, which helps conserve heat and makes the dwelling more secure. Since the house surrounds a pit, the walls didn't need to be very tall.

Figure 183. Replicas of Miwok cedar bark houses at Marshall Gold Discovery State Historic Park in Coloma, east of Sacramento.

Coastal Indians made similar structures from redwood bark.

Teaching Idea

Discussion of burning by Native Americans should include discussion of the results of fire prevention around towns and cities today. When brush and dead wood are allowed to accumulate, fires are much more intense than they are in areas that are regularly burned. Regular, cyclical burning by Native Americans reduced the intensity of the fires that they started or that occurred naturally. Fires occur every spring, summer, and fall, and they threaten human life and habitation, especially in southern California. Save clippings or articles about these fires and discuss the pros and cons of controlled or prescribed burning. Invite speakers from the U.S. Forest Service, the California Department of Forestry and Fire Protection, or local fire departments to discuss controlled burning and fire safety, including "defensible space."

CHAPTER 2
Prior to 1848

The Spanish and the Russians

The Spanish began to come into what is now California in the 1500s. They were primarily interested in establishing ranches and missions along the coast and in the central valley. Their buildings were often made of adobe bricks, so they had relatively little need for large quantities of lumber. They did use trees for doors, beams, furniture, and fences, but did not have the technology for processing large trees into lumber.

While they utilized wood wherever they were, the Spanish had little interest in entering the forests of the Sierra Nevada.

In the 1700s and 1800s, coast redwoods were an important source of timber. Redwood was used in the Spanish missions, and for the Russian settlement at Fort Ross.

The first sawmills were simple two-man operations consisting of a pit over which a log to be cut was laid. A whipsaw was used to cut the log into boards, with one man in the pit and the other over the log above.

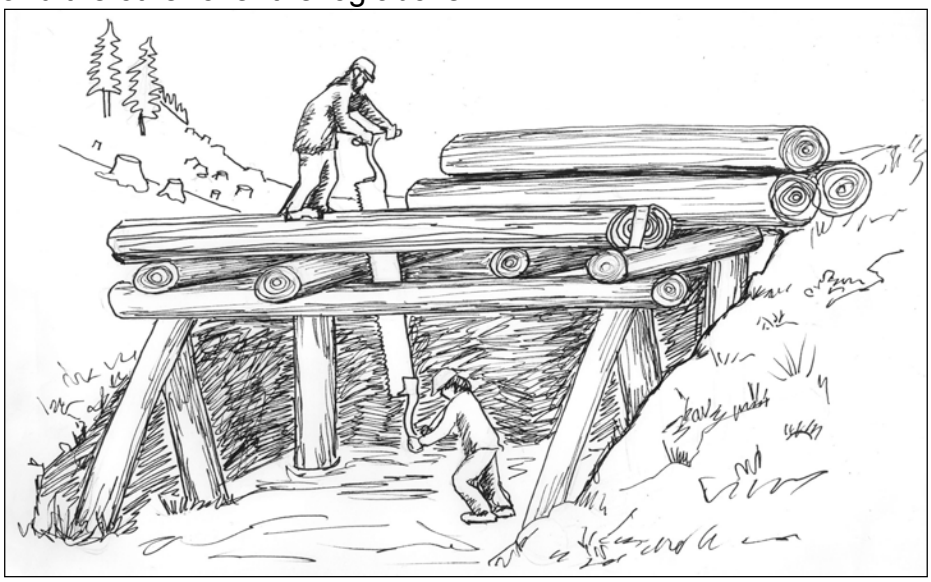


Figure 184. A two-man sawmill. The pit type of sawmill was used to cut boards from relatively small diameter trees. (Illustration by Faith Rumm.)

Teaching Idea

When visiting historical sites, look for opportunities to point out the spacing of the rings in the ends of logs. Trees that grow slowly produce closely spaced rings. Most of the wood used in the historical buildings was from "old-growth" forests, which were very shady, resulting in closely spaced rings. (Old-growth trees growing in an opening, however, may have produced widely spaced rings. Trees may also grow slowly for a while, then more rapidly if the forest ***canopy*** *opens, then slow down again when the canopy closes up again.) Most timber harvested today is from young-growth forests, which are generally more open, resulting in more rapid growth and more widely-spaced rings.*

However, much of the wood that students will see in historical buildings is not the original wood.

See the activity "Fence Post Studies" on page 286.

The Americans

Americans began to arrive in California in the 1800s. Jedediah Smith arrived in California while searching for beaver in 1827. In the 1830s and 1840s, the Sierra Nevada were an obstacle to be crossed by settlers on their way to California's central valley and coastal regions. Many arrived in California via routes north of the Sierra Nevada mountain range, and a few struggled through Sierra mountain passes. Few, however, stayed in the mountains. The destination was the central valley or the coastal settlements.

Teaching Idea

Beaver populations were not high in the California streams, but there were a few. Their numbers are now increasing in several areas. If you are taking students to a park, inquire about the presence of beavers, and look for gnawed aspen or cottonwood trees when you do your pre-trip visit. If gnawing is visible, point it out to students when on the trip, but let them figure out what might have caused it. In places where the snow gets deep, you might find gnawing several feet off the ground. Ask the students how a beaver might have reached that high on the tree. In some areas beavers build dams and lodges, but in others they burrow into the stream bank.

Figure 185. Stump of quaking aspen cut by beavers at Tallac Historic Site Visitor Center, Lake Tahoe.

CHAPTER 3
The Miners

In January of 1848, there were about 2,000 Americans living in what is now California. When the word of the discovery of gold spread, Americans, Mexicans, and others rushed to the gold fields. By the end of 1849, there were about 53,000 Americans in California (Farquhar, 1965). Gold camps and towns sprung up throughout the Sierra foothills and also in the more northern ranges.

As the pioneers and gold seekers brought their wagons across the mountains, they encountered a forest that looked very different from today's forests. Fire was a common natural event in California's forests, burning through most areas every 10–30 years. Such frequent fires kept dead wood, brush, and small trees from accumulating, resulting in a much more open forest floor than we see today in most places.

Teaching Idea

When in a forest area where trees, brush, and dead wood have been allowed to accumulate, ask the students to think about how difficult it would have been to drive a horse-drawn wagon through the forest. Then ask what might have made the forest more open. Lead them to the idea that fire was a natural part of the forest ecosystem and that suppression has allowed the forest to close in. Also discuss how frequent burning helped keep fires from burning high into the trees, allowing large trees to survive. Discuss whether the drier south-facing slopes and ridge tops would probably have been more open than north-facing slopes or valleys. See Figures 36–40 on pages 43–45.

While the first miners often used cloth from the sailing ships that they abandoned in San Francisco Bay to construct simple tents, lumber soon became an important commodity in the mining communities. It was used not only for buildings, but also for **flumes** to bring water to the pumps, processing mills, and hydraulic mining operations, for railroad ties and trestles, and to shore up railroad tunnels and mine. (A flume is a man-made channel or trough.) Mining resulted in the first extractive cutting of the forests of the Sierra (Duane, 1999).

Many students have little connection to railroads, but in the mid-1800s and early 1900s, the railroad was an important means of transportation. In 1862 a Railroad Act was passed mandating the building of the trans-continental railroad. Wood was an important part of that project, as it was required for fuel and for building the train cars, bridges, trestles, station houses, fences, telegraph poles, and, especially for railroad crossties. Between 1850 and 1920, the United States increased its railroad mileage from less than 100,000 miles to over 350,000. Over 2,500 crossties were used for each mile, and untreated ties generally needed to be replaced every five to seven years! It is estimated that it took from 15 million to 20 million acres of forests just to provide the wood for crossties in 1900! By the late 1800s, nearly a quarter of the timber cut in the U.S. went to the railroads (Leavell, 2001).

Figure 186. Coast redwood made excellent railroad ties. The old-growth wood used in the 1800s and early 1900s was relatively knot-free, so it split easily. The tannins in the wood made it rot- and insect-resistant. Note the tremendous amount of wasted wood. (Library of Congress photograph.)

Teaching Idea

Railroad crossties aren't precisely spaced, but they are spaced about 20" or so apart. If we add on 8" for the tie itself, there is a tie about every 28". Students can calculate the number of ties per mile.

A typical railroad tie is about 7–9" square x 7'–9' long. A typical power pole is about 45' tall (above ground). Have students calculate how many ties could be made from a tree the size of a power pole, and how many such trees it would take to lay one mile of track if 2,500 crossties were used per mile. (Of course most ties came from larger trees such as redwoods that provided many ties per tree.)

45 ft. per pole ÷ 8 ft. per tie = about 6 ties per pole (tree)

2,500 ties per mile ÷ 6 ties per tree = 417 trees per mile

Then have them calculate how many such trees it would have taken for the first transcontinental rail line. The distance from Omaha to Sacramento was 1776 miles, but it continued west to San Francisco and also eastward to the cities of the East Coast.

1776 miles x 417 trees per mile = 740,592 trees

Point out that by the end of the 1800s, the U.S. had five transcontinental rail lines, and many more miles of local lines and branches.

The town of Coloma that grew up around Sutter's Mill included blacksmith shops that made a wide variety of iron tools and implements. California has very little coal, and shipping coal from the East was expensive, so the blacksmiths used charcoal made from burning wood in large pits. Sometimes soil was used to exclude oxygen in the charcoal-making process. At other times, unfired bricks were used, thus firing the bricks and creating charcoal at the same time. Hillsides around towns were often denuded to supply lumber and fuel for homes and blacksmiths, mines, and other businesses.

Trees were also cut to fuel steam engines at the mines. The steam engines at the Empire Mine in Nevada City consumed up to 20 cords of wood a day (Lescohier, 1992).

Teaching Ideas

A cord of wood is 128 cubic feet of neatly stacked wood. It would form a stack 4' x 4' x 8'. To give students an idea of how much wood a cord is you might use string to outline that space. Use a 24' long piece of string held 4' off the ground to form a 4' x 8' rectangle.

Then use a 104' long string to form a rectangle 32' x 20', held 4' off the ground, to show the size of 20 cords—the amount of wood burned at the Empire mine per day.

Caution

A more tangible way to help students understand what a cord of wood is would be to have a cord of firewood delivered and have the students move and stack it. Provide gloves to protect against splinters and spiders, and caution the students to be careful not to smash their fingers!

A typical wooden power pole has about 45' above ground and is about 10–15" in diameter. Provide the students with the formula for finding the volume of a cylinder and have them determine how much wood is in the above ground portion of a typical power pole. Then have them calculate how many such poles it would take to provide 20 cords of firewood used per day at the Empire mine.

$$\text{Volume of a cylinder} = \pi \times \text{radius}^2 \times h$$

Therefore, if the diameter is 12", the radius is 0.5 ft.

$$3.14 \times 0.5^2 \text{ ft.} \times 45 \text{ ft.} = 3.14 \times 0.25 \text{ ft}^2 \times 45 \text{ ft.} = 35.325 \text{ ft}^3$$

128 ft^3 per cord ÷ 35.325 ft^3 per pole = more than 3.5 such poles to make a single cord of wood.

(Power pole sizes vary according to the use. There are several simple ways to estimate height and diameter. Have students do some research to find simple ways to determine height and diameter, or teach them one of the ways diagrammed below.

See the activity titled "Making a Forester's Diameter Tape" on page 186.

Figure 187. **Measuring a pole's diameter:** Make a "caliper" using a yard stick and two rulers held perpendicular to it (parallel to each other).

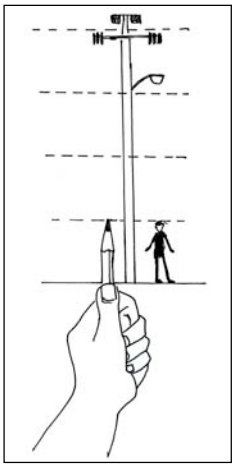


Figure 188. **Measuring a pole's height, method 1:** Have a student of known height (e.g., 5') stand at the base of the pole. Stand back at least 70'. Use your thumb on a stick or pencil to mark how 5' appears from that distance. Mentally mark 5' increments as you move the pencil up the pole. If the pole is a little more than 4' of the 5' increments, it is about 21' tall.

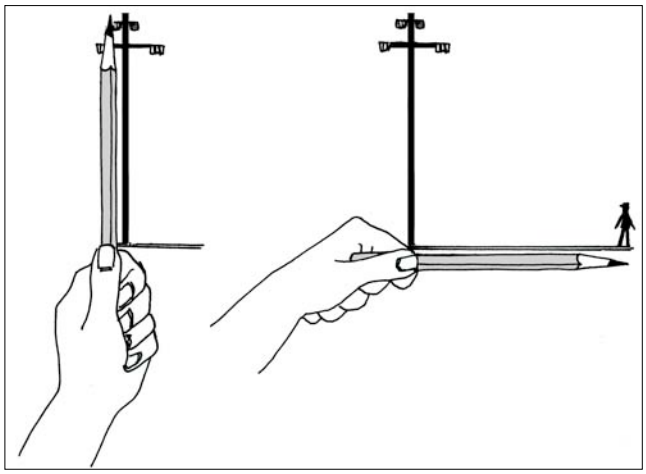


Figure 189. **Measuring a pole's height, method 2:** Stand back about 70' from the pole and hold a pencil or stick out at arm's length. Place the tip of the stick at the top of the pole and your thumb at the base. Turn your hand 90°, keeping your thumb at the base of the pole. Have a student stand where the tip appears. The distance from the student to the base of the pole is the pole's approximate height.

Several methods were used to mine gold. The famous discovery of gold at Sutter's Mill occurred in stream gravel. Obtaining gold by washing it from gravels is called **placer mining**. The first gold seekers panned for gold. Panning had relatively little effect on the coniferous forests, unless fires used to clear brush or for other uses got away from the miners.

Dredges were sometimes used to get at gold-bearing gravel in rivers and ponds. As gravel was dredged, the stream bed was torn up, effectively ruining spawning grounds for salmon and other aquatic organisms. The gravel was often dumped along the side of the stream, covering the riparian communities.

Water was used to remove the less dense sand and gravel from the gold. Where there wasn't enough water, ditches and flumes were built to bring water to the mine site. One flume ran 15 miles, bringing water from the Stanislaus River to the mines in the town of Murphys (Farquhar, 1965).

Hydraulic mining was an especially destructive method in which water cannons were used to access gold found in ancient gravel deposits in hillsides. Not only were the hillsides washed away, but huge amounts of sand and silt washed downstream from the watersheds. Some of the silt was deposited in streams in the central valley, thereby decreasing their depth. The shallower streams tended to flood more often, and central valley land owners eventually complained enough that the hydraulic mining was halted (Farquhar, 1965).

Teaching Idea

Students might investigate the case of Edwards Woodruff vs. North Bloomfield Mining and Gravel Company, in which the Judge decided in favor of the farmers in 1884, declaring that hydraulic mining was a "public and private nuisance."

Most of the gold country streams eventually enter San Francisco Bay. When the streams entered the bay, they dropped their loads of silt, having a huge impact on the organisms in the bay, especially by burying spawning grounds and organisms such as oysters that were unable to move.

When tunnels were used to access veins of gold found in quartz rock, the tunnels needed to be shored up with timbers. The Plumas Eureka Mine, near Quincy, had over 60 miles of tunnels that needed shoring up, and other mines in the area also needed timbers (Hartman et al., 2004). Nearby hillsides were soon denuded of trees as they were cut not only for mine timbers, but for railroad ties, buildings and fuel.

Yet another impact of mining on the forest ecosystems and those downstream from the mines was the use of mercury and cyanide to extract gold from the ore. Those toxic chemicals would sometimes escape into streams, killing aquatic organisms. Of course they also endangered people and animals drinking the water, eating contaminated food, or handling the chemicals. Mercury and asbestos are still present at hazardous levels in some streams.

With the influx of gold seekers, California's population exploded. That population created a demand for lumber for railroad ties, houses and other buildings, fuel, and other uses. California's population explosion begat a thriving timber harvesting industry.

Figure 190. Mine tunnel at the Princeton Mine, near Mariposa, CA. Mines needed timber for shoring up the walls and ceilings as well as for buildings and fuel for stamp mills and other machinery. (Photo courtesy Mariposa Museum and Historical Center Incorporated.)

Figure 191.
Hydraulic mining at Malakoff Diggins. Water cannons washed the gold-bearing soil and gravel from the hillside. (Photo courtesy California State Parks Photographic Archives.)

Figure 192. Malakoff Diggins in 1967…Approximately 100 years after the above photograph. (Photo courtesy California State Parks Photographic Archives.)

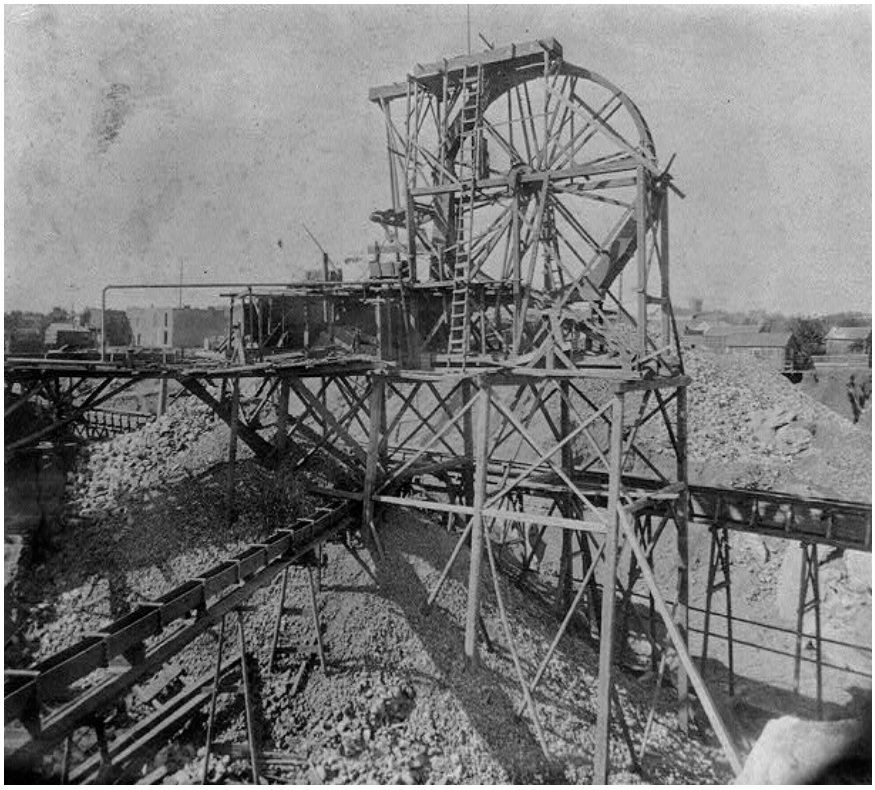


Figure 193. Flumes bring water to hydraulic lift at Columbia mining operation, in Tuolumne County. (Library of Congress Photograph.)

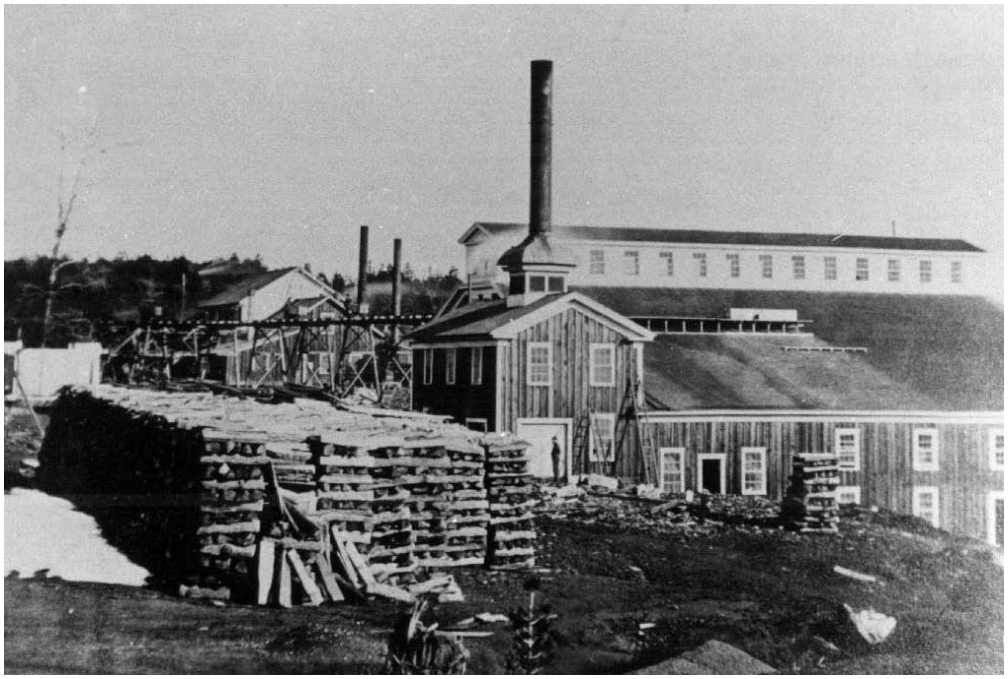


Figure 194. Firewood stacked at Empire Gold Mine in Nevada County. To operate the mine's steam-powered machinery, as much as 20 cords of wood were burned per day. (Library of Congress photograph.)

CHAPTER 4
Early Logging and Forestry

Most of the gold mining activity occurred in the foothills or lower elevations of the Sierra Nevada mountain range, and in northern California. Logging took place (and still occurs) wherever there were sufficient quantities of harvestable timber.

One point should be made at the start of this section: the term “logging” refers to the act of cutting and removing timber from the forest. Modern forest resource management involves more than just cutting trees and hauling logs to the mill. Modern companies not only log timber, but they must take into consideration and attempt to mitigate the effects of their operations on fish and other wildlife, plan for regeneration of trees, carry out research, hire professional biologists, hydrologists, geologists, archaeologists, and lawyers, and work with many public and private agencies, among other things. They are not only cutters and millers of trees, but growers of trees and managers of the forests.

Many early loggers came to California from the woods of Maine or Michigan. With the discovery of gold in 1848, many loggers headed for the gold fields, including some along the Trinity River and, later, on the Smith and Klamath Rivers in the redwood region, as well as the better-known gold fields of the Sierra foothills.

Not finding much gold, many loggers-turned-miners returned to their previous work as tree fellers. As California’s gold rush-fueled population exploded, the demand for lumber also increased. Seeing the profits to be made by filling the increased demand for lumber, some entrepreneurs started lumber companies.

Even as the gold fields played out, demand for wood continued to increase. Ex-miners provided a labor force that turned to harvesting, **milling**, and shipping lumber throughout California and around the world. There was a high demand and ample labor, and new technologies enabled the logging companies to access and harvest previously un-loggable timber. The costs of transporting both logs and milled lumber inhibited the logging industry, but developing technologies soon made logging very profitable.

The Mixed Conifer Forest Region–The Sierra Nevada and Other Mountain Ranges

While some mining towns were basically tent cities, others included substantial brick and wood buildings. Fires often destroyed the towns, which may or may not have been rebuilt. Each rebuilding, of course, required more lumber.

California’s population continued to rise. The vast conifer forests seemed almost infinite to many, and the science of forestry was still in its infancy. The forests seemed so unending that one writer wrote in 1858, that “California will for centuries have virgin forests, perhaps to the end of Time.” Little thought was given to conservation or renewing the forests. To many, the trees were much like a mineral, something to be extracted from the earth (Raphael, 1994). Sheep and cattle still roamed freely in many forests, and logging was largely unregulated. The government was anxious to settle the west, and both individuals and companies such as railroads were given or sold land, including forested land, for very low prices.

Some important dates in U.S. forestry history (Miller and Staebler, 1999):

1862 The U.S. Department of Agriculture was established.

1862 The Homestead Act was passed to encourage people to settle on public land.

1873 The Timber Culture Act authorized the granting of 160 acre parcels of forested land to settlers.

In the late 1870s several laws were passed allowing people to cut timber on federal land.

1881 The Division of Forestry was established as part of the Department of Agriculture.

1891 The Forest Reserve Act authorized the president to set aside forest reserves.

1898 Gifford Pinchot, the "Father of American Forestry," becomes Chief of the Division of Forestry.

1905 The USDA Forest Service (USFS) and National Forest System were created.

1908 Laws passed requiring the USFS to share 25% of its receipts with states for use on roads and schools where national forests are located.

1919 Efforts began to establish federal regulation of private forestry.

1944 Smokey (the) Bear becomes the symbol for forest fire prevention.

1960 Multiple Use Sustained Yield Act requires the Forest service to give equal consideration to timber, water, outdoor recreation, range, and wildlife and fish.

1970 The Environmental Protection Agency was established.

1973 The Endangered Species Act was passed.

1976 Federal Land Policy and Management Act established multiple-use and sustained-yield as policy.

1992 Forest Service and other federal agencies declared "ecosystem management" as their management approach.

Teaching Idea

Students can do research on the story of Smokey (the) Bear. At one time, Smokey Bear posters were ubiquitous in parks and forests. Why are they rare now? Why was Smokey's slogan changed from "Prevent forest fires" to "Prevent wild fires?"

As the gold rush wound down, a movement to protect exceptional areas was developing. In 1864, Congress gave the Yosemite Valley to the State of California for use as a public park. At the same time there was pressure on the federal government to protect at least some of the Giant Sequoia trees and the Yosemite Valley area. In 1890, a park was created to protect Sequoias in a "public park," and the Yosemite Act was

passed to “reserve forest lands” and watersheds in near Yosemite Valley. These areas were soon renamed as National Parks. In 1906, Yosemite Valley and the Mariposa Grove of Giant Sequoias were added to Yosemite National Park (Farquhar, 1965).

The giant Sequoia groves of the central Sierra were also becoming tourist attractions. One tree in what is now Calaveras Big Trees State Park was cut down, and the stump used as a dance floor. Several giant Sequoia and coast redwoods had tunnels cut through them so that cars and wagons could pass through.

As California’s (and the nation’s) population continued to rise, so did the demand for lumber. Vast tracts of publicly owned land were opened to logging, and individuals and companies continued to acquire land through purchase or the Homestead or Timber Culture acts. The timber industry, born during the gold rush, grew to maturity.

The Coast Redwood Region

By the early 1840s, an American merchant named Thomas O. Larkin, who was the U.S. Consul in Monterey, was shipping boards, shingles, and other redwood products from Monterey Bay to Santa Barbara and Los Angeles. He even shipped redwood to Hawaii and Tahiti, where the rot- and termite-resistant wood was especially valued. Larkin shipped over a million board feet of redwood lumber to the east coast of the United States in 1846 (Barbour et al., 2001).

Teaching Idea

An excellent collection of primary sources, mostly by writers who revered not only the redwoods but nature in general, is Giants in the Earth: The California Redwoods, edited by Peter Johnstone. It includes pieces by over three-dozen writers and poets, ranging from Walt Whitman and John Muir to Arthur Conan Doyle, Tom Wolfe, and Julia Butterfly Hill. Topics include natural history, Native American legends, exploration, logging (including one called “Women in the Early Logging Camps”), preservation efforts and others. The writing styles are greatly varied, and it is interesting for students to compare the various authors’ phraseology and vocabulary to the other authors and to contemporary writing.

Redwood became a major building material throughout California. Continued development of logging and milling technologies made it easier and more profitable to produce redwood products ranging from siding and framing timber, to decks and water towers, to shingles and grape stakes. The rapidly developing railroad industry not only enabled lumber to be shipped throughout California, but also resulted in a huge demand for redwood for use as railroad ties.

By the late 1800s, the redwoods near San Francisco Bay were rapidly disappearing before the loggers’ axes, especially the trees that were easily accessible to the growing communities around the Bay. At the same time that the trees were disappearing, people began to seek recreation in the redwood groves near Santa Cruz. By the 1890s, they started to awaken to the rapid disappearance of the huge trees and a redwood conservation movement began to develop. Alarmed at the loss of the trees, John Muir would state that, “As timber, the redwood is too good to live.”

In the later part of the 19th century, the northern redwood region of Humboldt and Del Norte Counties developed into a major source of redwood lumber. Large companies bought up huge tracts of timber, and large-scale operations included logging camps, sawmills, railroads, and even lumber schooners that sailed from Humboldt Bay with boards destined for San Francisco, Los Angeles, and beyond. In 1882, there were about 340 sawmills in all of California. By 1884, there were at least 400 sawmills operating in the north coast counties alone. In 1853, about 100 ships sailed from Humboldt Bay; in 1876, 1100 ships left Humboldt Bay loaded with redwood and wood products (Barbour et al., 2001). The trees near Humboldt Bay were soon cut. (Note: They eventually re-grew so that the town of Arcata now has its own managed young-growth municipal forest, and many such second growth redwood stands can be found near Humboldt Bay.)

CHAPTER 5
Early Logging Practices

In the early days, the great size of the coast redwoods and some other species presented loggers with problems. The equipment simply could not handle the large trees, nor was there a need to cut the largest trees because there were plenty of smaller trees that were easier to cut, transport, and mill. The largest trees, or those in hard-to-reach areas, were left behind. When the medium-sized trees were removed from a stand, the opening allowed more light into the forest, which increased the growth rate of the remaining trees. As lumber prices rose and new technologies were developed, loggers often returned to previously cut areas to take the large trees that had been left.

Early cutting down, or **felling**, of trees was usually done with axes, with the logs simply rolled downhill to creek bottoms or **skid trails**, which were built by placing logs across creek bottoms or other areas to provide a surface on which the logs could be pulled without having them dig into the ground. It could take three or more days for a two-man team to fell a twelve foot diameter redwood tree. Larger logs were often split into manageable sizes, sometimes using explosives. When large crosscut **whipsaws** were developed, a crew might cut one or two large trees a day.

Some species, such as redwoods, often have a larger, sometimes significantly larger, diameter at the base than a few feet higher up the tree. In addition, sometimes the freshly cut, water-saturated wood at the base was so dense that it would sink when dumped into a river or mill pond. To get above the base, loggers cut notches in the thick bark and inserted **springboards** into them. They used the springboards as scaffolding while they cut the tree several feet off the ground. The actual cut might be 10' or more off the ground. Figure 195 on page 123.

The first cuts were made on the side of the tree towards which the loggers wanted the tree to fall. This was usually the uphill side so that when the tree fell, the stump and the angle of the branches would keep it from sliding downhill. After cutting a huge notch, called an **undercut**, the choppers made the **back cut** from the other side. Eventually **cross-cut saws**, called whipsaws or **misery whips**, were made large enough to cut through the trunk, but axes were used in the early days. Figure 195 on page 123.

After the tree was felled, the limbs and bark had to be removed. The branches, tops, bark, and other waste were called **slash**, and it was left on the forest floor to decompose or piled to dry for burning in the late summer or fall. Slash fires often resulted in accidental burning of nearby uncut forest. When slash was burned, of course, other plants were also burned, as were animals that could not escape.

After the trees were cut and the branches removed, the main stem, called the **bole**, had to be cut up, or **bucked**, into pieces of a manageable size. In the early 1800s, bucking was done with axes, which was not only time consuming but wasteful, as much of the wood was reduced to chips. By the early 1900s, large bucking saws were introduced. (Figure 195, page 123 and Figure 203, page 128.) Cumbersome gasoline-powered **drag saws** were developed in the late 1800s, and lighter gasoline saws were in limited use by the early 1900s, but human-powered saws and axes remained the main tools in the forests until after World War II. Figure 196 on page 123.

Teaching Ideas

See Figure 195 (page 123), Figure 197 (page 124), and Figure 201 (page 127). Some of the pictures, especially from before the 1970s, show very wasteful practices that resulted in great disturbance of both the land and streams. In many of them, the loggers pose happily, seemingly oblivious of the scene around them. To men working with hand tools, the forests must have seemed inexhaustible. Discuss with the students how attitudes and methods have changed, both in the woods and at the mill. Also discuss how what appears to be total devastation can often recover as new plants grow, in time, into stands of young-growth trees. Discuss the difference between "logging" and forest resource management, logging being cutting and removing, and management involving much more, such as replanting, stream protection, leaving trees and snags for wildlife, etc.

See the activity "The Case of the Runaway Topsoil" on page 173.

In the 1800s, as much as 35% of the wood from a redwood tree might be left in the forest as unusable branches, stumps, chips, and shattered trunks. Since there was so much high quality wood, wood that was less than prime was often left, as were cut trees that had hidden rot, charring, or other defects. Most of this material was left to **decompose** in the forest or burned up by slash fires. Another 30% of the tree was often wasted at the mill in the form of sawdust and scraps. Consequently, sometimes only about a third of the cut wood actually became usable lumber (Adams, circa 1969).

(Note: Modern logging techniques result in much less waste, both in the woods and at the mill. Ninety-nine percent of the "mill residue" is used for fuel, pulp, particle board, or other uses.)

Figure 195. Logging with axes was hard, dangerous, time-consuming work. To fell the large trees, special axes with longer handles were made. The introduction of the whipsaw made the felling of the giants easier and faster. Note the springboards and the waste chips around the base of the tree. (Photo courtesy Clarke Museum.)

Figure 196. The gas powered drag saw proved cumbersome in the rugged mountains. (Photo circa 1940.) (Photo courtesy Humboldt Redwood Company, formerly Pacific Lumber Company.)

Figure 197. Teams of mules or horses were used to drag logs to the rail landing, or to a river. Skid trails of logs were made to keep the logs from digging into the ground. Many trees were often left standing because only the best trees were cut. (Photo courtesy of Humboldt Redwood Company, formerly Pacific Lumber Company.)

Figure 198. Ox-drawn log cart, circa 1900s. (Photo courtesy California State Parks Photographic Archives.)

Figure 199. The Dolbeer Donkey engine, named for its inventor, John Dolbeer, who was a partner in the Dolbeer and Carson Lumber Company of Eureka, made it easier and faster to move logs to a landing. It also was hard on the forest plants and soil. (Photo courtesy Humboldt State Library Humboldt Room Collection.)

Figure 200. Sky-line cabling moves logs to landings with the whole log suspended on cables. Both high-lead and sky-line cabling systems require the removal of trees and brush along the route to prevent the logs and cables from getting tangled in the intervening trees. Compare this picture with Figure 212, page 142. (Photo courtesy Clarke Museum Collection.)

Railroads were important in moving the logs out of the forest to the mills. Originally small cars with a few logs were pulled by horses, mules, or oxen. Sometimes logs were used as rails. Steam locomotives were added in the 1870s. Steep, narrow, twisting canyons made building railroads especially difficult, and truly spectacular railroad trestles were built. Some rail lines were built with the intention of moving them after only a season or two. The expense of building railroads in rugged country required the companies to **clear-cut** in order to make a profit. Clear-cutting and disruption of steeply sloped hillsides resulted in much erosion.

While the railroads made it easier to get wood out of the forests, they also made it easier for tourists to visit the remaining stands. Ironically, many of those visitors were inspired to join forces to try to stop the logging of the most magnificent stands of trees and, eventually, to form groups such as the Save The Redwoods League and the Sierra Club. Even after railroads were no longer used for log trains, the paths cleared for the rails often became roads that made it easier for people to visit the groves.

During the gold rush era, railroads and wagons moved the lumber to markets in Sacramento and the San Francisco Bay area. Redwood was brought from the North Coast by hundreds of sail- and steam-powered **schooners**, which carried redwood not only to the San Francisco Bay area, but also to San Diego, Hawaii, and Australia.

Prior to the 1880s, sawmills were small and could be taken apart and moved to a new area as the trees in a section of the forest were cut. Later, large permanent mills were built near the mouths of rivers along the coast, or near large rivers inland. Logs were floated downstream to the mills.

Smaller streams could only float logs during the rainy season, and the logs would tear up the streambed as they moved downstream. To prevent log jams, streamside vegetation was often removed. Sometimes, logs were stored in streams until rains came to swell the streams enough to carry the logs downstream. Dams were built to store both logs and water. When the dams were broken, the flash flood carried the logs downstream to the mill. Between the scouring of the streambed by logs and the erosion caused by the removal of streamside vegetation, many creeks and rivers were significantly damaged, especially with regard to their suitability for salmon **spawning**.

Teaching Idea

There are a number of curriculum programs that help students learn about freshwater habitats. See Appendix III (Organizations and Agencies) for information on Salmon in the Classroom, Adopt-A-Creek, Adopt-A-Watershed and others.

In some areas, long chutes and flumes were used to move smaller logs downhill.

By the early 1900s, railroads had essentially replaced floating logs down the streams (Hyde and Leydet, 1963).

Figure 201. The rugged terrain of northern California required the building of some impressive railroad trestles. Note the nearly clear-cut hillside, and also that young trees have started to grow. For scale, see the man standing on a log near the middle of the train. (Photo courtesy of Humboldt Redwood Company, formerly Pacific Lumber Company.)

Figure 202. Temporary horse- or mule-drawn “railroad” with wooden tracks. Sometimes logs were used for tracks instead of boards. Note the wide wheels on the cart. (Photo courtesy of the California Redwood Association.)

Figure 203. Huge trees were sometimes “bucked up” (cut into sections) with whip saws to make railroad ties, grape stakes, shingles, or other split goods. (Photo courtesy Humboldt Redwood Company, formerly Pacific Lumber Company.)

Figure 204. Shingles and boards were needed for building houses. Redwood’s resistance to rot made it ideal for shingles, grape stakes and railroad ties. Here “split product,” probably shingle wood, is moved by horse-drawn cart to a shingle mill, port or railroad loading area. (Photo courtesy Clarke Museum.)

Beginning in the 1920s, diesel-powered **tracked** vehicles began replacing the steam-powered bull-donkey. These machines were able to work in steep terrain, maneuver around standing trees, bulldoze roads, push slash into burn piles and perform many other useful functions in the woods. The California Division of Forestry and the U.S. Forest Service encouraged the use of these “cats” because they allowed for more **selective logging** or “selective harvesting.” Their steel tracks, however, first tore up the topsoil and then, especially when the soil was wet, compacted it, sometimes making sprouting of erosion-reducing plants more difficult. See Figure 205.

(Note: Modern management practices seek to limit soil disturbance to an “acceptable” level by limiting when and where tractors can be used. In addition, there are regulations intended to protect streams.)

Figure 205. Tractors with “caterpillar” treads or “tracks” allowed dragging of the huge logs from the forest, but caused much soil disturbance, resulting in erosion of soil into the streams. (Photo courtesy of Humboldt Redwood Company, formerly Pacific Lumber Company.)

By the 1930s, trucks were rapidly replacing both schooners and railroads, at least for shipping lumber within California. By the 1930s, too, some companies were practicing **sustained yield** logging, leaving a certain number of seed trees per acre, and some had even started their own nurseries.

CHAPTER 6
Not Just Logging

As the population of California continued to grow, so did the demand for wood products, water, minerals, and land.

Technology evolved in the first half of the 1900s, making it easier and cheaper to cut and process increasingly large trees, resulting in great profits for lumber companies, especially during economic upturns and the building booms that came with them. Recognizing the need to regulate the logging industry, California passed a Forest Protection Act, and hired the nation's first state forester in 1905.

As San Francisco grew, so did its need for water and electricity. A dam was proposed on the Tuolumne River in the Hetch Hetchy Valley, in Yosemite National Park, and which John Muir had declared to be second only to the Yosemite Valley in grandeur. After a long battle, the Hetch Hetchy dam was approved in 1913. The final dam was completed in 1938. Two hydroelectric plants were also built downstream.

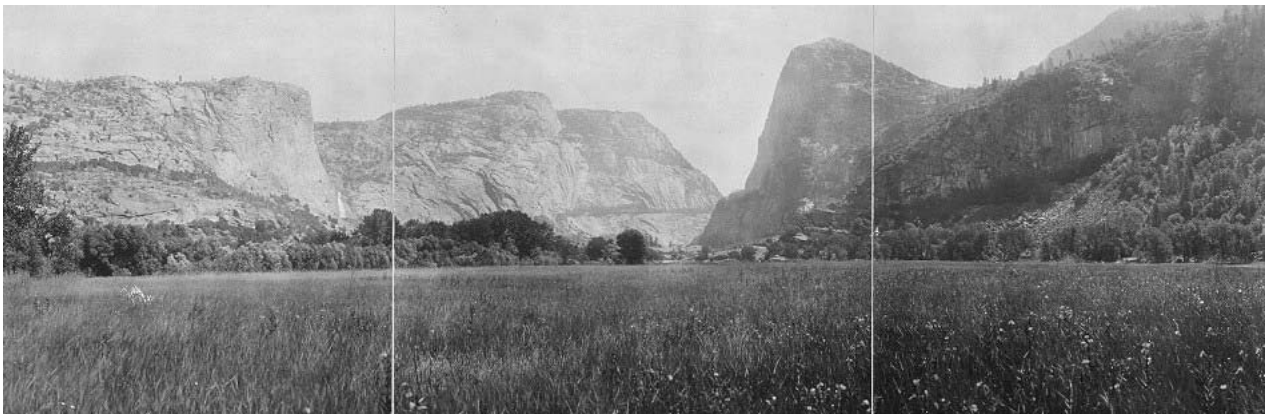


Figure 206. Hetch Hetchy Valley in 1914. Note waterfall left of center, and absence of trees in the valley. (Library of Congress photograph.)

Figure 207. Hetch Hetchy Valley in 2010.

The general slowdown in the economy during the Great Depression also slowed down the harvesting of trees. Many logging companies went out of business or temporarily shut down. The post-World War II building boom saw a revival in logging, as loggers and other skilled workers returned from the war and technologies such as tracked vehicles allowed logging on slopes that had previously been considered too steep.

After World War II, California experienced an unprecedented building frenzy, and the demand for redwood and Douglas-fir soared. The number of coastal sawmills more than tripled between 1945 and 1948 (Barbour et al., 2001).

Another housing boom in the 1960s further increased the demand for lumber. Japan's building boom of the '60s added to the demand.

Today, only about 5% of old-growth redwood forests remain uncut. Several companies have sold their forested lands for non-timber uses, which is part of the explanation for the decreasing harvests since the 1950s. Most redwood lumber produced today comes from second- or third-growth forests. Timber companies have little old-growth left to cut. Over 95% of the remaining old-growth redwood is in parks and preserves.

Coniferous forests were also affected by mineral extraction, which increased as the building boom increased the demand for gravel, limestone, and other mineral resources.

Post-war California also needed ever more electricity, and more dams and power plants were built on mountain rivers.

The population grew, and not only did logging increase, but more people moved to forested areas. Increased population meant more roads, houses, businesses, schools, and other development, all of which resulted in loss of forested land.

CHAPTER 7
Mid-20th Century Logging and the Beginnings of Resource Management

After World War II, bulldozers, tractors, and trucks replaced steam railroads. This new technology again expanded the land that could be profitably logged and resulted in the building of many roads into the forests. Taxes were based on standing timber, so companies often clear-cut 70% or more of their trees to save money. Many companies developed nurseries in which they grew seedlings to use in replanting clear-cut hillsides.

In some areas, selective logging was tried. With selective logging, a portion of the stand, usually between 50% and 75%, was (is) left for future growth and reseeding. This approach to timber harvesting was facilitated by the development of new types of logging tractors and other equipment.

Selective logging was problematic in many areas because strong storm winds tended to blow down the exposed remaining trees. Selective logging tended to convert some stands to brush and less economically desirable types of trees such as hemlock and grand fir, at least in the short term. Repeated entry of heavy equipment into the forest sometimes caused damage to the remaining trees and soil. For these and other reasons, including profitability, selective logging has been replaced by clear-cutting in

many areas, especially in the northern regions. Some companies, however, do use selective logging successfully.

As old-growth forests were harvested, second- and third-growth forests were maturing to a harvestable size, and timber companies began harvesting the young-growth stands. New laws and regulations required lumber companies to replant more trees, reduce damage to the land, and provide more protection for streams and wildlife. At the same time, some companies were developing different attitudes and practices.

The face of the timber industry was changing from exploitative logging to management of not only timber, but soil, wildlife, water, and other resources. Management for sustainable growth became the objective in many forests, public and private. Goals changed from simply cutting and selling wood to the preservation of land as forest, restoration of forests, and connecting forest landscapes for forest and wildlife health.

Meanwhile, the conservation and preservation movements were growing.

CHAPTER 8
Conservation Concerns and Efforts

The giant Sequoia redwoods of the Sierra (*Sequoiadendron giganteum*) were among the most heavily exploited during the gold rush and became the first to be protected. The Lincoln-Mariposa grove received protection in 1864; in 1890, groves in Sequoia-Kings Canyon and Yosemite received protection. The giant Sequoia was, and is, much more limited in range than the coast redwood, Douglas-fir, pine, and other commercially important species, which were also heavily exploited during the gold rush.

Efforts to protect coast redwoods in the San Francisco Bay Area resulted in the formation of parks such as Big Basin State Park and Muir Woods National Monument.

Figure 208. An expedition to the Big Basin area of the Santa Cruz Mountains in 1900 resulted in the formation of the Sempervirens Club, which worked for the creation of the world's first redwood park, in 1902.

(Now named the Sempervirens Fund, the organization has raised funds to preserve over 20,000 acres in the Santa Cruz Mountain area.)

(Photograph courtesy of the Sempervirens Fund.)

Around the turn of the century, California's State Board of Forestry was created to both regulate and assist the lumber industry. Most of its efforts centered on fire prevention and how to deal with limbs, tops, and other waste, which is called **slash**. This was the first state forest regulatory body in the nation.

In the mid-1940s, a number of forestry bills were passed by the state legislature, and in 1945, the Forest Practices Act established four Forest Districts. The 1945 Forest Practice Act, however, was essentially toothless. It relied on education and persuasion to try to get the timber industry to regulate itself–with voluntary compliance. Fire protection statutes were sometimes used to try to get the industry to improve its management, but, other than sending letters, little was done (Arvola, 1976).

In the early 1950s, logging permit systems and other statutes were enacted, providing some tools for regulation of the industry, but they mostly applied to publicly owned land. In the mid- and late 1950s, the Forest Practices Act was further strengthened and clarified. At the same time, laws to protect streams and fish resources began to be enacted. In the mid-1950s, the Sierra Club and other environmental organizations began to criticize the law because of its lack of effective regulation of the timber industry.

From the 1940s to the1960s, timber owners were taxed on the amount of standing timber, which encouraged them to cut the trees, especially the larger ones. (Since the 1970s, taxes have been based on the amount of wood harvested.)

As an educator, when discussing the harvesting of trees, it is important to keep in mind that most logging is done to fill a demand for lumber. If people weren't buying the wood, the companies wouldn't be cutting it. We all use wood products in many ways. In some cases, using wood is environmentally preferable because wood is renewable, recyclable, biodegradable, and a vigorously growing young forest provides many environmental benefits.

It is also important to keep in mind that different people have different interests and priorities, and that society's values change over time. In the 1800s, trees were logged with little regard for the environment. Some refer to the early practices as "mining" the forests–cut and get out. Today, logging companies are heavily regulated and many also have learned the importance of minimizing environmental damage to their land by practicing sustained yield management. In the 1700s and 1800s, the vast expanses of forest must have seemed limitless to many, especially when logging was done with a hand axe. Today's increased population and modern technology have "shrunken" the world so that the remaining stands of protected groves seem, to many, to be inadequate.

A preservationist, a logger, a home builder, a park department employee, and a county tax collector might all view the same stand of trees very differently. Decisions about resource management are a complex balancing act of social, environmental, economic, aesthetic, and spiritual values. (For those interested in such issues, Timothy Duane's *Shaping the Sierra–Nature, Culture, and Conflict in the Changing West* (1999) will provide interesting reading.)

In the book *Logging Practices* (1982), Steve Conway noted that:

> In some cases, a NIMBY (Not In My Back Yard) attitude exists. Whereas California was recently self-sufficient in meeting its lumber needs, the state now imports 70–80% of the wood it consumes. In Oregon, clear-cuts of up to 120 acres are allowed, and Washington allows clear-cuts of up to 240 acres. California's regulations limit clear-cuts to 40 acres, and most are limited to 30 acres or less. Is it preferable to import clear-cut pine or Douglas-fir from Oregon or Washington for use in California? Is it acceptable to cut young-growth trees but not old-growth? Many people who oppose the logging of redwoods also use redwood lumber to build their decks and fences and panel their offices. Some people get upset when they can see the clear-cuts along a roadside, but say nothing when the logging is out of sight.

From the perspective of the timber industry, trees on private land are a crop to be harvested and re-grown in an ongoing, sustainable way. Crops of carrots and corn are harvested after a season; crops of trees are harvested in cycles that are decades long. While a corn field or carrot patch doesn't usually provide much habitat for wildlife, a growing stand of trees provides habitat and other benefits. Unlike some alternatives, trees are a renewable resource. Furthermore, there are land ownership questions. Why should land owners be prevented from running a business and making a profit from timber on land that they own? What about a private land owner who has grown trees for 30 or more years, anticipating harvesting them, only to have the regulations change? But what about trees grown on publicly owned land? The coast redwood is the only commercially harvested tree the majority of which grows on private land. Other species are grown (and cut) mostly on publically owned national forest lands. Ponderosa pine is grown (and harvested) on private land in great quantities.

A young-growth forest is not, of course, the same as an old-growth forest, and the logging of trees, whether young growth or old-growth, impacts many more species than just the trees being harvested. While a backyard garden may re-grow in a few months, a tract of clear-cut trees covers up to 25 acres, will usually be covered with a variety of new growth within a few years, and after some decades will re-grow a forest of large trees, providing wildlife habitat in the meantime. The harvesting of the trees is heavily regulated, and a stand of healthy trees provides wildlife habitat and other environmental benefits. On the other hand, cutting the forest to make way for houses, roads, and other development eliminates wildlife habitat and results in other environmental problems, such as runoff and pesticide pollution. Should forests be cut for development?

Criticism of the logging industry continued in the 1960s, particularly in regards to protection of fish habitat and breeding grounds. Throughout the second half of the 1960s, the Forest Practices Act was further modified and somewhat strengthened, and the Department of Fish and Game continued to press for more involvement in the regulation of logging practices because of their impact on streams.

According to Hackett (2005), environmental regulations have played a role in job losses in the lumber industry, but other factors, such as mill consolidation, have played a greater role.

In 1982, writing in the book *Logging Practices*, Steve Conway noted that:

> "Although the preservationists are relatively few, they have been able to arouse the public merely by focusing attention on industry's mistakes. They look at the burns, poorly stocked lands, ugly clear-cuts, erosion, and misplaced forest roads and point an accusing finger. It does not matter who is actually to blame–the logger, a governmental agency, or a careless tourist–the entire wood products industry gets the blame. This is a contention that is easy for much of the public and many legislators in urban and non-timber-producing areas to accept.
>
> The environmentalist and preservationist have a point; the industry has not been doing the best job possible. Yet as a result of the hard-hitting attacks begun during the sixties and continuing into the present, industry leaders have begun to solve some of the problems. At times the solutions are painful, requiring industry to accept the full responsibility for some glaring errors of judgment. However, there are numerous examples of how the overall effect of these attacks has been good for both the public and the industry."

In the early 1970s, the Forest Practices Act was significantly strengthened, largely due to public concern about logging in redwood forests near urban areas. The laws became stricter and inspections more frequent. Compliance with the laws steadily increased from 80% compliance in 1950, to 96% in 1975, the last year for which my source (Arvola, 1976) provides data.

In 1973, the Z'berg-Nejedly Forest Practices Act became law, further regulating logging practices. Over the next couple of years, various agencies worked to try to establish new forest practices and laws. In 1975, it was determined that the Forest Practice Act fell within the realm of the California Environmental Quality Act of 1970, and that Environmental Impact Reports would be required for logging operations. In the mid-1970s, Governor Edmund G. Brown, Jr. directed several state agencies, including the State Board of Forestry, Department of Fish and Game, and the State and Regional Water Resources Control Boards, to work together to develop effective rules and regulations. Meanwhile, California's population continued to grow, further increasing demand for wood, wood products, recreational areas, and living space. Policies and laws were, and are, often influenced by the political climate as well as by science (Barbour et al., 2001).

The original 1945 Forest Practices Act was implemented in 1947 with the first edition of the Forest Practices Rules. Published in pocket-sized booklets, the 1947 rules were the equivalent of about fourteen 8½ "x11" pages of 10-point type. The 2005 Z'berg-Nejedly Forest Practice Act would take over one hundred standard pages to print. (Source: email from a Legislative Analyst with the California Department of Forestry and Fire Protection.) Of course, as the volume of the Forest Practices Act has grown, so, too, have the difficulties and costs of complying with the various regulations.

Compliance with new laws has required a major change in thinking and planning in the forest products industry, and has added greater expense to the timber management process. One study, reported by Thompson and Dicus (2005), indicates that the average annual per acre cost of preparing a Timber Harvest Plan rose from $0 prior

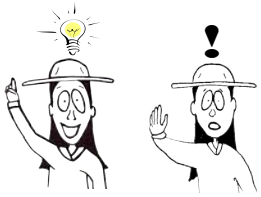
to 1974 to about $100 in 1992 to over $600 per acre in 2004. Not only is this a huge increase, but it occurred in a very short time.

As it is now interpreted, the California Forest Practices Act allows the logging of old-growth trees, but not if it will affect endangered species. This law applies to private forest land as well as state owned land.

Much of the second-growth timber is now over a hundred years old, and it has developed some characteristics of “old-growth” forests, including trees of considerable size. Harvesting of those older second-growth forests is sometimes contentious.

As our understanding of natural systems has increased, the emphasis in forest protection has changed. In the 1920s, conservationists emphasized protecting stands of trees. By the 1960s, the importance of protecting watersheds was understood. Now, we are beginning to look to protection and management of whole ecosystems, seeking to encourage development of forests with old-growth characteristics even as areas are logged, and trying to find ways to include connecting forested areas between preserves to provide corridors for animal movement. More attention is also being paid to areas that may not be as visually appealing as a stand of big trees but may be ecologically important to many species for a variety of reasons.

Teaching Ideas/Caution



The Lorax, by “Dr. Seuss,” is a story about greed and abuse of natural resources. Some teachers have used it in classrooms to promote preservation of resources and to paint the logging industry as “bad guys.” When done in communities in which many of the parents are employed in the logging industry, this has, of course, caused problems.

*If you want to use The Lorax, be aware of, and sensitive to, possible conflicts with the local community, including the students’ families. It is important to keep in mind that we all use resources. While nobody is in favor of pollution or waste of resources, we all produce some pollution and use our share of resources. The Lorax can be useful in teaching the difference between “*wants” and “needs*.” Indeed, the story focuses on the destruction of the environment to make “thneeds,” which are things that people don’t really need. The book and movie also end with the positive notion that individuals can help protect the environment through personal choices. They can also be useful in teaching about the complexity of decisions about resource use and management.*

Older students may be able to understand the use of emotion to make a point in The Lorax, especially the movie version. Discussion could include separation of fact from insinuation, critical thinking vs. emotional response, and generalities vs. specifics.

The Man Who Planted Trees, by Jean Giono is an interesting story about a man who planted trees and restored a forest.

The conservation movement has evolved over the years. Early efforts focused on purchasing land or setting aside public land for parks so that they could be visited and enjoyed by people seeking recreation. As logging continued and accelerated through the 1950s, so, too, did efforts to protect the remaining stands of pristine forest. Groups such as the Save-the-Redwoods League, Sempervirens Fund, and Trust for Public Land have raised millions of dollars to purchase and preserve forest land, which was subsequently donated to California State Parks and other state agencies. They also pressured state and national governments to both purchase additional lands and to regulate logging on the remaining prime potential park land. Federal funds have also been used to purchase park lands. Sometimes landowners have been cooperative in saving the lands, even donating or selling the lands at discount prices. Sometimes they hastily logged the lands prior to their being purchased, or threatened to do so in what some saw as an apparent effort to drive up the price. Modern conservation and preservation efforts focus on cooperation and collaboration among environmental groups, landowners, and governmental entities.

Teaching Idea

Have students send for brochures about parks, or use the Internet to find out about them. Many forest product companies have information that they are happy to provide. Students can prepare posters and/or give oral presentations.

The actions taken to manage private, commercial, and park lands have also evolved over the years. Early logging practices resulted in erosion, damage to wildlife habitat and other problems; modern forest management strives not only to avoid such problems but to help damaged forest land heal. Early preservation efforts have protected some groves from the chainsaw only to see the trees threatened by human-induced damage such as soil compaction, paving over, introduction of non-native species, and by natural plant community succession as fire and flood have been kept out of the forest. Modern park management strives to allow humans to enjoy the parks while seeking ways to protect the groves from both human and natural impacts.

CHAPTER 9
The Modern Forest Products Industry: Resource Management

The exploitive logging of the 1850s through the1950s is no more. A combination of dwindling old-growth stands, better understanding of the need for forest management, public outcry, and regulation have resulted in a very different industry than previously existed. Where loggers once “cut out and got out,” modern companies manage their resources for the long-term. Companies have come to realize the economic necessity of not only harvesting trees sustainably and caring for their resources, but also of maintaining good public relations, lest laws become even more restrictive and compliance more expensive. Today’s timber industry generally seeks to practice sustained yield forestry, with at least as much new wood grown each year as is harvested.

Different people, of course, have differing opinions as to what is the best use of a forest. Some favor ever-increasing amounts of protection and preservation in parks. Even those who favor preservation sometimes disagree. Such things as how much and what kinds of human use should be allowed, how much development should occur, and whether cutting of some trees should be allowed, are important issues, as are whether fire should be used to try to replicate natural conditions, and whether invasive species should be removed and, if so, how? How much regulation of privately-owned forest land is appropriate, and how much access to public forest land timber companies should have, and how much they should pay for wood from public lands, are questions for which answers are not easy to develop or agree upon.

Other people focus on harvesting of timber to meet the demands of California's–and the nation's–growing population. The worldwide average for wood products consumption is about 0.7 cubic meters per person per year. We in the United States average almost three times that much, and the average for Californians is higher than the U.S. average. Meeting that demand, now and in the future, requires the modern timber company to carefully manage its forests, especially since timber harvests from public lands are down more than 90% from what they were in the 1980s (Dekker-Robertson, 2004). Modern timber management involves the development of new tools, new methods, new knowledge, and new attitudes. California's laws and political climate provide more environmental protection than most other places. Since we are going to use wood products, a case can be made for using California-grown wood, which is a renewable resource grown under heavy regulation.

A growing concern is the subdivision of large blocks of forested land into smaller units that are more difficult to manage for timber or to protect for public use. This **fragmentation** is not only a problem for resource companies, but it is a problem for wildlife. There is increasing pressure to sell forested land for development. This is due both to attractive profits to be made from land sales and to the increasing costs of taxes and complying with regulations. Landowners have rights and obligations with regards to how they use their lands. The rights of landowners must be balanced with the needs of society.

Teaching Idea

Project Learning Tree has an activity titled "A Forest of Many Uses" in which students discuss and role-play making forest management decisions. *See Appendix IV, page 346.*

See the activity "Connie's Woods: Tough Choices" on page 262.

Whether logging old-growth or young-growth trees, the logging industry has changed tremendously over the years. Some modern practices are described on page 139.

Planning and Permits

Logging in California generally requires the filing of a **Timber Harvest Plan (THP)** or, if the landowner has "small" holdings (less than 2,500 acres), a "Non-Industrial Timber

Management Plan" (NTMP) with the California Department of Forestry and Fire Protection (Berger, 1998). The plan, which must be prepared by a registered professional forester, is intended to ensure compliance not only with the Forest Practices Act, but also with the California Environmental Quality Act, the Water Quality Act, and the Endangered Species Act.

The major elements of a Timber Harvest Plan are listed below, not necessarily arranged as they are in the THP forms. Many of them require contracting with trained professionals such as soils specialists, geologists, hydrologists, wildlife biologists, archaeologists, and various governmental agencies.

a. Introduction, including the location and boundaries
b. General Physiographic Features: climate, geology, slope, soil types, etc.
c. Forest Description: type of forest, description of the site and previous cuttings, roads
d. Cumulative impacts on such things as wildlife, water quality, wood supply, soil, recreation, and visual impacts
e. Management Objectives: wood products, range, water course and lake protection, wildlife protection, recreation, and economics
f. Silvicultural Treatment: site preparation, logging practices, erosion control, pest management, reforestation, etc.
g. Forest Regulation: cutting cycles, allowable cut, future cuts, and planning for sustainability
h. Other Management Factors: road development, fire protection, impacts on neighboring properties, cultural and archaeological resources, and unusual circumstances

Completing all of the required steps for filing a Timber Harvest or Management Plan is a major task, and a major expense. After the plan is filed, there is opportunity for public input. However, if the company has followed all of the required procedures, they are generally allowed to proceed with their cutting.

As part of the planning, surveys of the plants and animals present in the area are required. Special attention is paid to "listed" species*, i.e.,* those that are considered endangered or threatened.

In addition to the state rules and laws, some counties have adopted their own Forest Practice Rules which have stricter standards than the state regulations.

Having a plan is not, of course, the same thing as <u>following</u> the plan. Nature does not always cooperate, accidents do happen, and corners are sometimes cut. It is noteworthy that the California Department of Forestry is now called the "California Department of Forestry and Fire Protection" or CAL FIRE. Fire protection and suppression receives 85–90% of the department's budget, leaving only a small percentage of the budget for enforcement of the Forest Practice Rules.

On the whole, though, logging is a much different proposition than it was only a few decades ago. A logger or company found to be in violation of the rules or laws, or not following the harvest plan, can be made to take corrective action, be fined, have the

operation stopped, be put in jail, or be put out of business. A forester who repeatedly submits inadequate plans can lose his or her license to practice forestry.

Falling (Felling)

Using chain saws to **fall** (or fell) the trees is faster, easier, and less wasteful than using axes. See Figures 195, 196, 203, 209, and 210, on pages 123, 128 and 140 respectively.

Figure 209. Most trees currently harvested are much smaller than those of 60 or 70 years ago. The modern chain saw enables faster cutting with less waste. (Photo courtesy Mendocino Redwood Company.)

Some operations, especially the larger ones, use modern machines such as mechanical harvesters or feller-bunchers. Mechanical harvesters can cut the tree down, remove the branches, and cut the tree to desired lengths. The entire process is controlled by a computer so that the maximum volume of lumber is harvested from each tree. Feller-bunchers can cut and bundle several trees at once, or can fell a single tree and carefully place it on the landing. These machines are most useful when the trees are of relatively small size.

Figure 210. Wheeled feller-buncher. The circular saw blade is at the bottom of the group of trees. (Photo courtesy John Deere Corp.)

Part of the management plan indicates the type of harvest–clear-cut, single tree, small group or other. (If all trees are removed from more than 2.5 acres, it is considered a clear-cut.) A goal of modern management of clear-cut (or “even aged”) areas is to mimic natural disruptions such as fire, flood, or landslides. Uneven aged stands require more

frequent re-entry for subsequent harvesting, and that, too must be taken into consideration in the plan. Much of the long-term damage done by logging operations is due to soil compaction or other soil disturbance. Root and stem injuries caused by frequent entry of machinery into the forest may outweigh the benefits of periodic thinning or selective harvesting (McEvoy, 2004).

Management plans require Watercourse and Lake Protection Zones of varying widths, depending on the situation. These “buffer zones” are intended to protect fragile aquatic habitats and vary in width, depending on factors such as the presence of fish and the slope of the hillside. Some trees can be harvested from the buffer zones, but, depending on the stream and types of fish that live in it, 50–85% of the canopy cover must be left to shade the streams.

Some maintain that the required buffer zones are inadequate to effectively protect the streams from soil loosened and exposed by logging operations. Increasing stream buffer zones to 200' has been proposed. A stream or watercourse need not have water in it year-round, or have fish in it, so a 200-foot buffer zone would greatly reduce the amount of area that would be available for harvesting timber, and trees generally grow most vigorously near streams.

Yarding or Skidding

The practice of bringing logs to a **landing** where they are gathered for hauling is called **yarding** or **skidding**. As previously noted, early methods of yarding were extremely destructive, especially when logs were skidded or **gulched** to (and in) the streams. Another major impact of yarding was the disruption of the soil, both from logs digging up the soil as they were dragged across it and from compaction by the tires or treads of the equipment, especially where the soil was damp. Modern practices seek to avoid damaging streams and a variety of methods are used to reduce soil disruption.

Figure 211. Skidder bringing a log to a landing, where it will be loaded onto a truck.

Road building is one of the most potentially damaging aspects of logging, especially on steeper slopes. Modern timber plans include not only where the roads will be built (often on ridge tops, away from streams), but how they will be built to minimize erosion.

Various types of skidders are used today. Tracked skidders enable logging on steep slopes, while rubber-tired skidders are faster. Since the weight is concentrated on a smaller area, though, tired skidders tend to compact the soil more, especially where the soil is wet or exposed.

Moving the logs by cable (**cabling**) is common today, especially on steep terrain. The cable might drag the logs along the ground (ground lead… usually most disruptive to the topsoil), drag the logs with one end elevated on a **high lead** cable, or move the log while it is suspended above the ground with a **skyline** (the least disruptive method). Logging inevitably disturbs the soil. Modern management seeks to keep the disturbance to an "acceptable" level.

Figure 212. The use of a **cable yarder** operating from high on the hillside or on the ridge enables logs to be pulled uphill rather than dragged through stream beds. Compare this picture with Figures 200 and 205. (Photo courtesy of Mendocino Redwood Company.)

Teaching Idea

Students can build models of high-lead and sky-line systems. Some parents (or grandparents) might also be interested in building models that can be kept for use in future years. They might even include model trains.

Helicopters are sometimes used to remove logs from the woods. This is very expensive proposition, and is only economically feasible when other factors such as too many streams, steep terrain, or exceptionally valuable wood exist.

Hauling

Most hauling is now done by trucks driving on roads that are engineered to minimize erosion. Erosion still occurs, but much less than in earlier times. In areas that have already been logged, old roads or railroad beds are sometimes re-contoured to reestablish the original slope, and old stream crossings are sometimes removed or replaced to improve fish habitat and reduce erosion. Modern operations often build roads on ridges to facilitate cabling operations and effectively reduce sedimentation of streams.

Milling

As noted elsewhere, early logging operations sometimes left as much as a third of the wood in the forest as chips, slash, or other waste. Of the two-thirds that came to the mill, half was often wasted as sawdust, trimmings, or other waste. In the 1940s and 1950s, this mill waste was generally burned in "tipi burners."

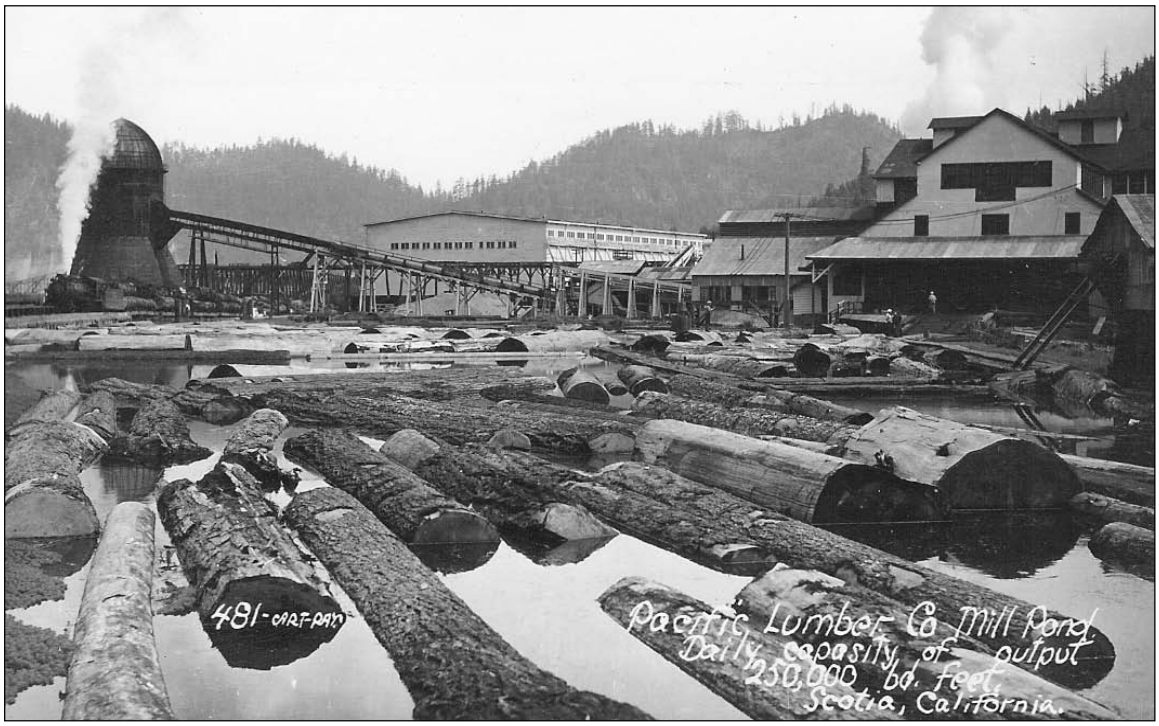


Figure 213. Large logs in the Pacific Lumber Company mill pond, probably taken in the mid-1950s–1960s. Note the tipi burner at the left. (Photo courtesy Clarke Museum collection.)

Figure 214. Pacific Lumber Company logs in 2006. Compare the size of the logs with those in Figure 213. Note also the automation, which is one of the causes of the decline in employment in the industry.

Modern computer-controlled mills waste little. Bark, chips, and sawdust are used in a variety of ways, including landscaping materials, livestock bedding, pulp for paper production, nursery products, filters, and others. Small pieces of wood that used to be burned are glued together to make larger boards. Shavings from the production of surfaced lumber are used to make fiber board. Sawdust can be compressed to form fireplace logs or glued to make particle board. Some companies use mill residue to generate electricity to use on-site. Some mills even generate excess electricity which they sell to power companies. The table below shows the "disposition of sawmill residue" from north coast saw mills in Del Norte, Humboldt, Mendocino, and Sonoma counties in 1992 (Ward, 1992).

Pulp	Boards	Fuel	Miscellaneous	Total used	Unused
22%	23%	41%	13%	99%+	<1%

Teaching Idea

Some mills or timber management companies welcome students and other groups for tours. See the Appendix III and IV for some contacts.

See the activity "Paper Making" on page 270.

Cleanup and Mitigation

Various regulations govern what a logging operation has to do after the timber has been harvested. Depending on the situation, slash might be removed, chopped up to reduce its volume, burned, or, in most cases, simply left in the woods to decompose. Since all forms of pollution are illegal, potential pollution of streams from sediments/silt, slash, chemicals such as oil, or other materials, is a major consideration in the post-logging cleanup operation. The timber harvest plan must include pollution prevention and mitigation plans.

As noted above, roads are a major concern. Preventing erosion is important, and the plans must include both locating and building the roads to try to minimize erosion. **Waterbars** or other means such as ditches are used to reduce erosion from the roads. Some companies even cover the road with the slash and drive tractors over it to crush it so that there is a covering to further reduce erosion.

There are now certifications available to lumber companies that harvest timber "sustainably." In California, certification is done through the Forest Stewardship Council or the Sustainable Forestry Initiative. The main criteria are:

1. Timber is harvested "sustainably," *i.e.,* growth equals or exceeds harvest.
2. The forest ecosystem is maintained and protected.
3. Socioeconomic impacts are such that the area has financial stability.

To receive certification, companies must show that their land use practices meet current environmental protection standards. One study showed that among the reasons that the landowners sought certification were to:

- gain access to or create markets that only sell wood from certified forests
- reduce criticism from environmental organizations
- develop a constructive dialogue with environmental individuals and groups

That study also showed that landowners were more likely to seek certification in areas where “environmental activism” was high (Dicus and Delfino, 2003).

Figure 215.
Millions of seedlings are grown in nurseries for planting in cut areas. As early as the mid-1800s, nurseries were producing 4.5 million redwood seedlings for restocking cut stands annually.

CHAPTER 10
The Coniferous Forests Today

From the 1940s through the 1970s, logging was the major industry in most of California’s forested areas. Since then, the forest products industry has struggled. Regulations, several recessions, the introduction of alternatives to wood products, competition from abroad, and other factors are involved. According *The Forest Products Industries in California: Their Impact on the State Economy* (McWilliams, 1994), the general decline of lumber production in California is due “in part” to withdrawal of public lands from timber production to other uses and to new policies created to protect wildlife. (At the time of the writing of *The Conifer Connection*, harvesting of timber from National Forests by private timber companies has been greatly reduced.) McWilliams also attributes the decline in net volume of saw-timber inventory from 1952–1977 primarily to the reduced cutting of large trees, with the percentage of timber coming from old-growth trees falling from 78% in 1968 to 47% in 1988.

While the forest products industry has been declining in California’s forest regions, other businesses have been increasing. People have been moving from urban areas into forested areas in great numbers. With the people come businesses of all sorts.

In addition to relocating into forest areas, people visit the forests for recreational purposes such as skiing, camping, hunting, photography, and off road vehicle use.

While diverse uses allow more people to use the resources, they present new challenges, both for maintaining the forests and for the timber products industry.

Concerns: Appropriate Use of the Land

This document includes a lot of information on the logging/timber products industry because of its obvious importance in California's coniferous forest areas. There are numerous other uses to which forest land is put, and many of them are not compatible with each other or with preservation of natural areas. Some are discussed below and elsewhere in *The Conifer Connection*, including the table on pages 49–53.

Teaching Idea

Alternative uses of forest land are good topics for student investigations. Have students do research on the following or other land uses. Consider having them make posters describing the pros and cons of each use, or have a panel discussion or debate on the pros and cons of each. They can compare and contrast appropriate uses of state and national parks, national forests, and private land.

housing developments
off-road vehicle use
scientific research areas
dams for power generation
dams for water supplies to urban areas
leasing of cabins to private parties
firewood production and gathering
gathering of mushrooms and other plants
watershed/water infiltration
roadside development such as fast food, gas stations, motels
horseback riding
snowmobiling
tree farms
cross-country skiing
downhill skiing
mineral mining
mountain biking
wildlife viewing
timber harvesting
camping
river rafting
hiking
hunting
public parks
scenery/views
cattle ranching
fishing
farming

Concerns: Forest Products Industry

When land and trees were inexpensive and logging and milling processes were relatively unregulated, many small mills were able to turn a profit. With increased regulation and competition from larger operations that are able to use more of the tree, many of the smaller mills have gone out of business. Consolidation and modern technology have had a major impact on employment in the forest products industry.

The Western Wood Products Association produces an annual *Statistical Yearbook*. The 2004 *Statistical Yearbook* yields the following information:

> "While employment in the western lumber industry declined by 16% between 2000 and 2004, the production of lumber per plant employee has increased significantly… increasing by 11% between 2003 and 2004 alone. Thus, changes in technologies and efficiencies seem to account for much of the loss of employment…and for much of the increased production."

This conclusion is supported in *The Forest Products Industries in California: Their Impact on the State Economy* (McWilliams, 1994). That report points out that labor

productivity in U.S. sawmills increased by almost 60% between 1973–1991, and by about 30% between 1982–1991. Each worker is producing more lumber per hour.

For many reasons, owners of small tracts of land, or of small mills, may sell their property to multi-state and multi-national corporations. Land that has been owned and cared for by a family for generations is now owned by stockholders who have never seen the land. Large corporations are able to purchase expensive modern equipment that enables them to harvest more efficiently, but also requires fewer people to operate, exacerbating the employment problems in rural communities. Decisions made in far away corporate board rooms to benefit stockholders may or may not be based on what is best for the local population or the long-term maintenance of the forest ecosystem.

Teaching Idea

Those who are interested in statistics about California's forest resources will be interested in the publication California's Forest Resources, 2001–2005, published by the Pacific Northwest Research Station of the U.S. Department of Agriculture. The (free) book includes information, including many graphs and tables that can be used to teach graphing and interpretation of graphs

Concerns: Competition for the Timber Products Industry

Factors affecting the logging industry include a lack of available old-growth timber, changing attitudes within and without the industry, regulations, mechanization, development of alternative materials such as decking made from recycled plastics, metal grape stakes, vinyl plastic fencing, concrete posts and retaining wall blocks, sales of land for parks and development, and fragmentation of forestlands.

Synthetic decking material is in direct competition with redwood and western red cedar. Both the redwood industry and the makers of the synthetics claim that their products are better for the environment. Synthetic materials generally are made of recycled plastic and wood particles. The makers of the synthetic decking claim that staining and sealing chemicals are not needed, trees are not cut, the boards don't rot, and plastics are recycled. On the other hand, producing the synthetic products uses a lot of energy, and produces water and air pollution. Redwood growers point out that trees are a renewable resource that helps to reduce air and water pollution. They claim that using redwood for decks has a smaller "environmental footprint," *i.e.*, has a smaller negative environmental impact over the life of the decking, than other alternatives.

Given that California's forest practice laws are more stringent than most other places, in the big picture, harvesting California's timber may be preferable to logging elsewhere. On the other hand, other forests will probably be logged in any case.

Teaching Idea

The California Forest Products Commission has produced an interesting booklet titled We Care for the Forests (2003). *The booklet contains some useful information, including graphs comparing water pollution and energy use of various building materials. Students can study and interpret the graphs and other information.*

Concerns: Development, Urbanization, Fragmentation

A hot topic in the forest products industry is the **fragmentation** of large tracts of forest land into smaller parcels, especially when those parcels are developed for real estate or other "urban" types of development. While large tracts of timberland are regulated to protect water and wildlife resources, small residential parcels are relatively unregulated. Development not only results in the loss of forest land for the house or shopping mall, but also from the building of roads. While logging a forest tract for lumber removes the trees, they eventually re-grow. Trees cut for development are replaced with pavement, lawns, and structures. Deer, skunks, bears, and raccoons can roam in a tract managed for lumber; they generally can't safely roam a developed neighborhood. Water runs off of pavement and rooftops into storm drains; a forest allows water to enter the natural ground or surface water systems. Santa Cruz County, for example, has had more than 12,000 acres broken into smaller parcels with homes since 1990, and nearly 60% of the former forest land has been **urbanized**.

Teaching Idea

Part of "The American Dream" has been ownership of a large house on a large piece of property. Discuss with students the pros and cons of that concept. People have to live somewhere, but more dense development in urban areas may be more environmentally sound. Include in the discussion financial, ecological, and cultural aspects.

Private forest landowners such as ranchers, tree farmers, and timber companies have to deal with regulations and tax policies that sometimes encourage them to sell their land for development. Taxes, the high cost of meeting logging regulations, and the money to be made by selling land for development all contribute to conversion of timber land to other uses and fragmentation. How can we balance resource protection for the public good and the rights of private landowners?

An important aspect of urbanization of the forests is that people moving to the newly developed former forest land often don't know very much about forest management or the forest products industry. The population of the Sierra Nevada region grew 130% between 1970 and 1990, as compared to 49% in California as a whole. Some communities continue to rely on timber or mineral extraction for their economic base, but tourism and recreation are increasingly important (Duane, 1999).

Sometimes communities draw their water from wells that diminish water flow in local streams, but complain that timber companies are affecting the fish. Their property may disrupt the habitat of many animals, but they assume that nearby logging operations are the reason that they see fewer deer, birds, or raccoons. Thus, education of the general public about modern forest management and the impact of development and urbanization is an important issue. As people move to the mountains from towns and cities, the makeup of the communities is changing. Commuters or retirees may not understand the importance of the resource industry to local economies.

In *Shaping the Sierra* (1999), Timothy Duane describes a number of problems associated with development and fragmentation of forest lands, which he describes as "Ecological Implications of Exurban Growth." Among those implications:

- reduced total habitat area through direct conversion
- reduced habitat patch size and increased fragmentation
- isolation of habitat patches by roads, structures and fences
- harassment of wildlife by domestic dogs and cats
- biological pollution from nonnative vegetation (both nonnative invasive species and nonlocal stocks of native species)
- increased impervious surface and runoff
- increased heavy metal and oil runoff
- increased risk of water pollution from septic tanks
- decreased groundwater supplies due to pumping
- modified surface water flow

Teaching Idea

Satellite images are available from several sources. Have students view the area that you will be visiting, zooming in from a wide view to as close as they can. Have them locate the park and look for such things as roads and parking areas and campgrounds and other development*

Have the students find some clear-cut areas and:

- use the scale on the image to estimate the area of the clear-cut
- look for evidence of roads
- look for evidence of streams and the "buffer zones" around them
- look for evidence of trees or snags left for wildlife
- zoom out and note the number and pattern of clear-cuts

Have them look for an area that was burned recently and another that was burned some years ago. Have the students look for signs of recovery or erosion.

*(**Note**: Students will want to locate their towns, school, and home. Consider allowing them a few minutes to do this before asking them to concentrate on the park area.)*

**Some sources of satellite imagery:*

www.flashearth.com
www.maps.google.com
(also check out Google Earth)
www.bing.com/maps
www.maps.yahoo.com
www.mapsnationalgeographic.com

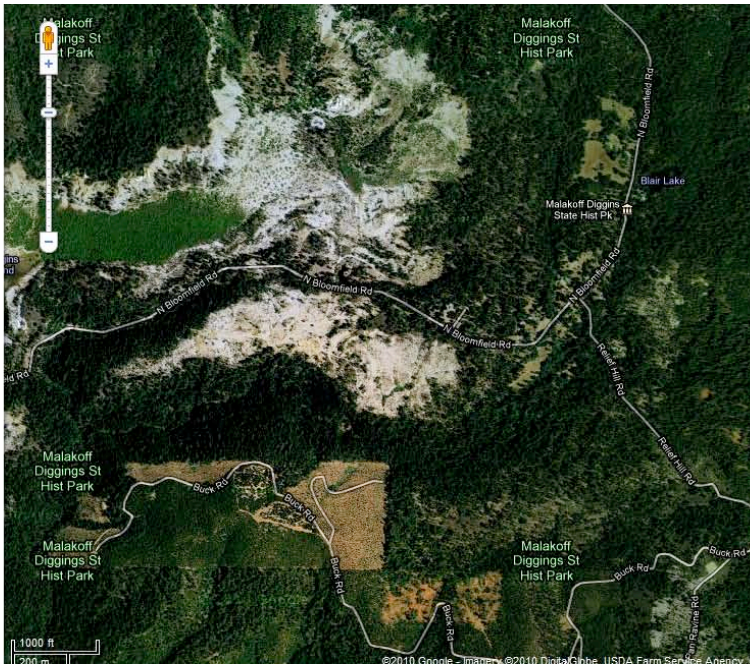


Figure 216. Google Earth view of the area around Malakoff Diggings State Historic Park.

Concerns: Park Use and Management

Another issue is concern about the protection of existing parks. Not only do more visitors expect more accommodations such as parking spaces and trails, but compaction of the soils on trails and around trees threatens both the understory vegetation and the trees themselves. Some parks are trying to alleviate the problems by re-routing trails, building elevated walkways, and separating visitors from the trees.

Human park users can cause problems for wildlife. Sometimes people feed raccoons, birds, deer, and other animals. Usually the food is “human food,” which is not good for the animals, and if the animals become too tame they are more likely to be injured by cars or pets, or to become pests.

Concerns: Funding of Parks

The limited amount of funds available for the purchase of land requires judicious use of those funds. Few old-growth stands are available for purchase, and decisions must be made about the allocation of funding. Some advocate using available monies to connect currently protected stands. Others suggest purchasing whatever old-growth stands are available, or purchasing large tracts of second-growth trees rather than small groves of old-growth. Funds must also be allocated to provide long-term protection for stands already in parks and other reserves. Such decisions are not easy, and different people and groups have different priorities. While there is no easy answer, it may be useful for teachers to discuss these issues with the students and with park personnel.

Concerns: Introduced Species

Another concern is the introduction of exotic species of plants and animals, which threaten the natural ecological communities. Even species that are native to California can be a problem when introduced into different ecosystems. There is some evidence that crows, for example, have learned to follow people into the redwoods to feed on scraps of food dropped by visitors. Once in the forest, the crows may attack the young of endangered species such as the marbled murrelet.

Cattle and sheep are intentionally introduced species. “Multiple use” is official policy for the U.S. Forest service, and cattle grazing is one of the allowed uses. When cattle have access to streams they not only pollute the water, but damage streamside vegetation and promote erosion. See pages 47 and 83 for additional discussion of introduced species.

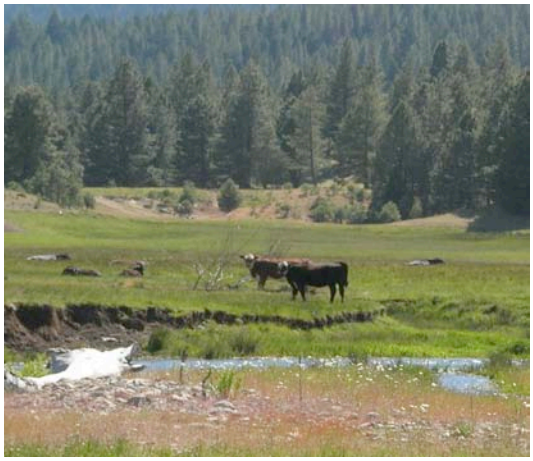


Figure 217. Taken near Graeagle, California. Cattle and sheep not only feed on forest and meadow vegetation, but they pollute streams and damage stream banks, increasing erosion.

Figure 218. Compaction around the base of trees can harm the roots, so boardwalks have been built around some of the more visited trees. The Founders Tree, in Humboldt Redwoods State Park, commemorates the founding of the Save-the-Redwoods League. Note that even the presence of the boardwalk doesn't always keep people from walking on the base of the tree.

Figure 219. Camping in Yosemite Valley, circa 1925. (Photo courtesy Yosemite National Park Research Library.)

Concerns: Dams, Flood Prevention and Electrical Generation

Floods are a natural part of the ecology of some areas and provide nutrient-rich silt. Most rivers have been dammed to prevent flooding, to provide a constant water source, and/or to generate electricity. Not only do the dams affect the area behind the dam and the downstream riparian communities, but they also affect salmon and other fish.

When electricity is generated, power lines must be built to transmit the electricity to distant users. Since most dams are built in the mountains, those power lines pass through forest areas. Trees must be cleared for the lines, and because of the possibility of fire and for maintenance, the land under the lines must be kept free of trees and tall brush.

The reservoirs behind some dams, such as Shasta, are available to the public for recreational use. Others, such as Hetch Hetchy are off limits to the public.

Figure 220. Shasta dam and electric power generating facility.

Figure 221. Power transmission lines near Burney, CA

Concerns: Carbon Sequestration

Global climate change (sometimes called global warming or the greenhouse effect) is another topic on which there is some disagreement with regards to cutting trees. There is no doubt that trees help combat climate change by absorbing carbon dioxide, which is a major “greenhouse gas.” Obviously, cutting trees immediately reduces the photosynthetic uptake of carbon dioxide. When used as lumber, the carbon is stored or “sequestered,” at least for a number of years, rather than re-entering the atmosphere. Some studies show that a stand of rapidly growing young trees absorbs carbon dioxide at a faster rate than an older stand. Thus, a temporary loss of older trees may lead to replacement by younger trees, resulting in more rapid removal of carbon dioxide from the atmosphere. Other studies show that old growth forests store significantly more carbon than young forests (Russell, 2010). As is so often the case, the issue is more complex than it first appears.

See the activity “Global Warming” on page 267.

Concerns: Fire Suppression and Exclusion

Fire is a natural part of the forest ecosystem, and fire prevention may favor some species to the detriment of species that are fire resistant, such as the coast redwood and giant Sequoia. Even if other species don't invade, crowding causes competition and the weaker trees may die.

Fire suppression has resulted not only in a change of the forest species composition but also the accumulation of fuel loads. Many forest types would be relatively open at ground level if small fires burned through every 15–30 years or so, as would occur naturally. It is impossible to keep all fires out of the forests forever, so with the accumulated fuel load, when a fire does burn through a forest, it is likely to burn hotter and also higher into the trees. Such a hot high fire is more likely to kill mature trees. See pages 42–45 for additional discussion of fire suppression.

Teaching Ideas

Make an overhead transparency of the Yosemite Valley images on page 155. Cover the caption. Ask students to describe the difference between the two images and to discuss (a) what might have caused the differences and (b) what the valley might look like in another 100 years.

See the activity "Living with Fire" in the Project Learning Tree Pre K–8 Guide.

Preservation and Conservation

Groups such as the Sempervirens Fund and the Sierra Nevada Conservancy continue to raise funds for the purchase and protection forest land. Now that little old-growth land is available, the emphasis is on connecting fragmented parcels, protecting watersheds, and purchasing lands that will help expand and protect existing parklands for both the plant and animal species within them and for human recreation, education, and enjoyment.

The large organizations have been joined by many local groups that work with parks to help with conservation efforts, interpretation, and fund-raising. These "cooperating associations" provide invaluable services to the parks and also opportunities for students and others to become involved at a local level. See Appendix III for contact information.

The California Department of Parks and Recreation continues to manage parks and acquire new park land, often in cooperation with non-governmental organizations as described above. Given financial constraints, it is often difficult to balance the needs for maintaining and improving existing facilities, developing new facilities, and acquiring new land. While these and other issues will not be resolved simply or soon, it is important for students and other park users to be aware of the complexity of the issues.

In *The Redwood Forest*, 2000, Noss sets forth five general goals for conservation planning:

1. Protect representative samples of all kinds of natural communities.
2. Maintain or restore healthy populations of all native species in natural patterns of distribution and abundance.
3. Sustain or restore ecological and evolutionary processes to their natural state.
4. Create a network of areas that can withstand natural and man-made changes.
5. Encourage human uses that are compatible with conservation goals while discouraging human uses that are not compatible with conservation goals.

While public ownership of park lands is important, when the state (or local or federal) government experiences financial difficulty, parks are often among the first to suffer budget cuts. If private landowners can profitably use and care for their forests, they can provide significant public benefits. As in so many areas, it is important to consider both short-and long term factors, and both public and private interests. The rights of the private land owner must be balanced with the need for regulation for the public good. See the table of environmental issues on pages 49–53.

Figures 222 & 223. Yosemite Valley from Union Point, 1866 (above) and 1961 (below). Note that suppression of fire has resulted in a much denser population of trees than is "natural" for the area. (Photographs courtesy Yosemite National Park Research Library.)

Conclusion

The interrelationships between people and the forest have changed throughout history.

Native peoples not only used trees in a variety of ways, they actually used fire to manage forests and clearings. While the first Europeans were too few in number and too limited in technology to have a major impact on the vast forests, the population explosion that followed the gold rush brought with it the development of large-scale logging operations throughout California. The mid-1800s were a time when people thought nothing of rapidly exploiting natural resources with little regard for the future. The forests seemed almost infinite, especially considering the simple technologies available.

As trees were logged in the late 1800s, some people became concerned about the disappearance of California's magnificent forests, and efforts to protect some areas were undertaken. California's State Park System resulted from such efforts.

The early 1900s brought new technologies and large scale logging as well as the beginnings of concern for conservation and preservation of forests. By the 1950s, many of the most impressive stands of trees had been either logged or acquired for protection in parks or other types of reserves. Continued demand for lumber and ongoing development of logging and milling technologies increased the harvesting of the trees. In less than 200 years, 95 percent of the ancient redwoods have been logged, and much of the cut-over land is now covered with stands of second- or third-growth redwood forest. Less than 20% of the old growth forest in the Sierra Nevada remains as old growth (University of California, Davis, 1996), with even less in national forests (Warbington and Beardsley, 2002). Much is still forest and is growing a new crop of trees. Much has been paved over, built upon, or developed for agricultural uses, and there is constant pressure for more conversion of forest land to other uses. Private landowners sometimes have difficult choices to make with regards to the trees on their land. Resource companies had largely grown dependent on cutting trees on public lands such as National Forest land, and restrictions on access to those forests has had a great impact on not only the companies but many local economies.

Since the 1960s and 1970s, the timber industry has developed a resource management approach that is very different from the cut-out and get-out approach taken by many earlier logging operations. Increased understanding, public concern, and regulation have produced a forest products industry that seeks to manage the land and trees for long-term productivity, habitat protection, and other uses. At the same time, public and private groups seek to protect and preserve remaining groves and stands for future generations to enjoy. Our understanding of how best to meet these goals of productive forests and protected stands continues to evolve.

Both scientific research and public education need to be part of the process as decisions with long term consequences for the future of California's state, national, and local parks and forests are made. Decisions about forests and watersheds must be based on greater understanding, both in the scientific community and in the general public. Future generations will judge whether we make wise decisions today.