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Struggle of trees and men

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THE STRUGGLE OF TREES AND MEN

by

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ACKNOWLEDGEMENTS

Mr. Jesse A. Meiser (1870-1939), pictured above, is to be commended on his foresight and dedication in recording on film the activities of the redwood region prior to and immediately following the turn of the century.

I owe a special thanks to Mrs. Vivia O. Dickerson, grandaughter of Mr. Meiser, for her personal concern and protection of the many glass plate negatives down through the years. It has indeed been a delight to select and duplicate scenes from yesteryears from this magnificent collection of glass plates.

Thanks to the Soil Conservation Service, United States Department of Agriculture for providing this year of graduate work.

Likewise, I tip my hat to Dr. Richard E. Shannon, Director of the Master of Resource Administration Program, for his guidance, stimulation and support during this time of study.

To my wife, Faith, I am most grateful for the encouragement and love she displayed during the busy and at times frustrating year.

To the girls in my life I also toss a hearty thanks for their understanding and cooperation.

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INTRODUCTION

The Northern California coast is a unique region of the world which literally contains a growing history in its redwood trees.

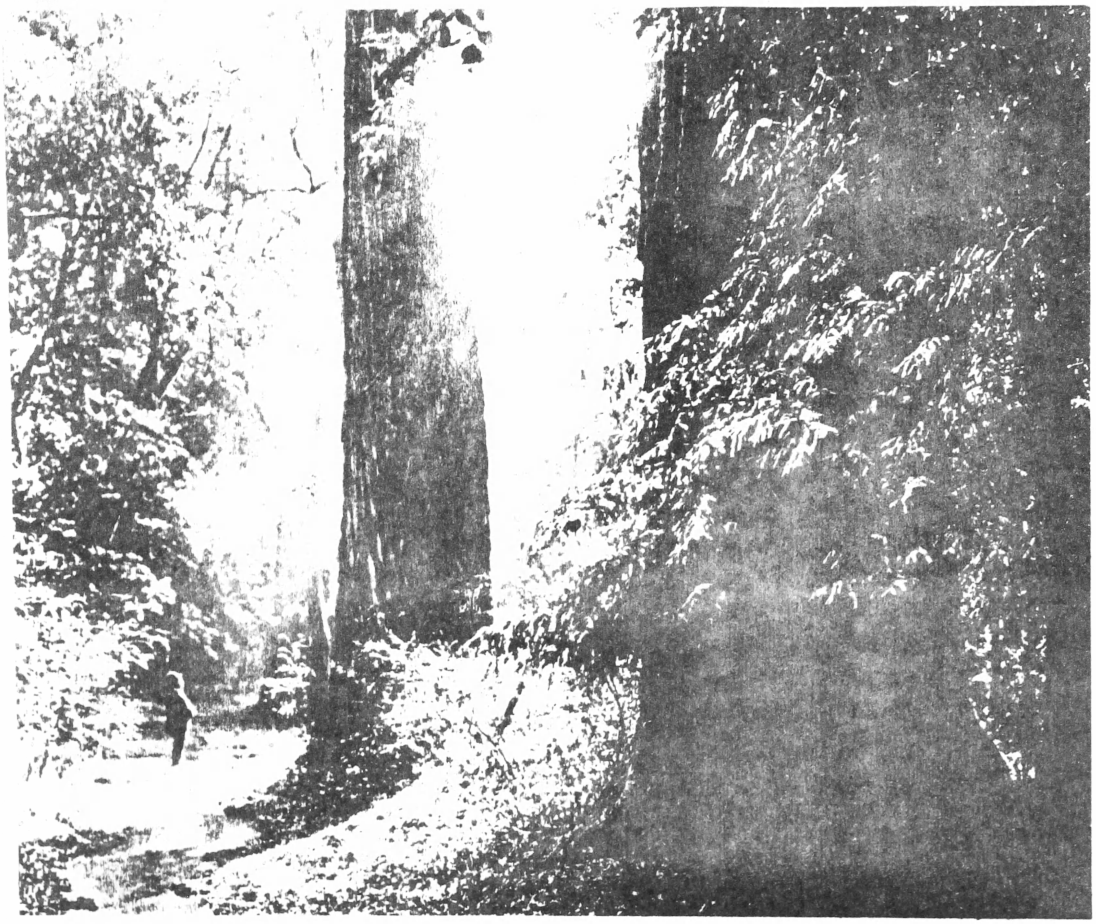

Figure 2. Men have come from near and far to view the redwoods in their foggy environment. (Meiser photo circa 1910)

No American tree has excited man's wonder and imagination to the extent that the redwood has. Man has literally crossed the seas and continents to see how old and how large the redwoods really are.

John Muir once said, "The Big Tree is nature's forest masterpiece, and so far as I know, the greatest of living things. It belongs to an ancient stock. . ." He was obviously speaking of the "Big Trees" of the Sierras, but could just as well have been referring to the coast redwoods. Were it not for John Muir, Gifford Pinchot and a few other men who worked fervently in spearheading the fight to establish our National Parks and Forests, we today might not have the opportunity to observe these magnificent trees first hand and would have to be content to observe photographs such as those taken by Mr. Jesse A. Meiser.

Wisely, the people of America have protected the best and most superb of the old growth timber instead of allowing it to fall in the wake of a few greedy, axe-swinging timber barons. There was a time when it appeared that all the cries of conservationists fell on the deaf ears of an indifferent public and an apathetic government. However, for several decades now the redwoods have been a political battleground. My grandchildren, even more than I, will appreciate the stand taken against civilization in behalf of these majestic trees.

While this paper mentions all three species of redwood, it will be confined almost exclusively to Sequoia sempervirens, the California coast redwood. Past use of the redwood region and history of the species and of its logging will be viewed in an effort to better understand present management problems and current policies.

CHAPTER II

ANCIENT REMNANTS

There are three distinct classifications of redwood: coast redwood (Sequoia sempervirens), Sierra redwood (Sequoia gigantea) and dawn redwood (Metasequoia glyptostroboides). These are all included in the family Taxodiaceae along with bald cypress, pines, firs, and other cone bearing groups of trees.

Dawn redwood is a deciduous cousin of the coast and Sierra redwoods and was long thought to be extinct until 1944 when Tsang Wong, a forester for the Chinese government discovered a tree he could not identify near the Central China village of Mo-tao-chi.[1]

After collecting some leaf and cone specimens he presented them to Nanking's National Central University who later identified them as Metasequoia. This discovery interested scientists who began to make plans for a detailed study of the species. These investigations were soon threatened by a civil war which divided China. However, Dr. Ralph W. Chaney, University of California's professor of paleobotany, was not to be denied. Accompanied by Dr. Milton Silverman, scientific writer for the San Francisco

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[1] Kramer Adams, The Redwoods (New York: Popular Library, n.d.), p. 14.

Chronicle[2] and with financial assistance from the Save-the-Redwoods League, Dr. Chaney trekked to the remote area of China where forester Wong had made the discovery.

There he found several hundred specimens, some of which were over one hundred feet tall, six to nine feet in diameter at the base and estimated to be about three hundred years old.[3] Despite government regulations Dr. Chaney and Wong managed to secure some seed and cuttings before the area was closed by Red soldiers.[4] By 1949 Dr. Chaney had several hundred seedlings in a greenhouse in Berkeley, California.[5] This exotic tree is now thriving under a variety of conditions here in the United States and is common enough to be found in some commercial nurseries.

The virgin dawn redwood had a brief exposure to the outside world before it was thrown back into its mysterious state of limbo but the young trees now in the United States will eventually provide additional information about the species.

The genus Sequoia which contains both of the redwoods located in the United States is one of the oldest in the plant kingdom.

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[2]Alfred Powers, Redwood Country, ed. Erskine Caldwell (New York: Duell, Sloan and Pearce, 1949), p. 5.

[3]Adams, p. 14.

[4]Adams, p. 15.

[5]Powers, p. 7.

Fossil ancestors having nearly identical leaves and cones date back to the Cretaceous period, some one hundred million years ago.[6] It wasn't until the Tertiary period, some sixty million years ago, that the redwoods became widespread. Fossils from this period have been found in North America, Europe and Asia. Fossils in Europe have been located in Austria, Bohemia, England, France, Germany, Spitsbergen, and Switzerland. In Asia they have been found in China and Japan. On this continent redwood fossils have been discovered from upper Canada to Texas, from Alaska to Pennsylvania.[7]

Seventy miles north of San Francisco and five miles east of Calistago in Sonoma county, California is the most fantastic display of petrified redwood ever found. Robert Louis Stevenson, after his visit in 1880, thought it unique enough to deserve a chapter in one of his books.[8] These huge petrified logs were not found until sometime after 1870 when an old Swede sailor named Charley Evans, along with his dog, "Rascal" and inquisitive goat, "Billy" homesteaded the acreage under the Timber and Stone Act. All told, there is about twenty acres of redwood graveyard containing upwards of three hundred trees.

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[6]Ralph W. Chaney, Redwoods of The Past, (San Francisco: Save-The-Redwoods League, 1965), p. 3.

[7]James Clifford Shirley, The Redwoods of Coast and Sierra (Berkeley: University of California Press, 1936), p. 32.

[8]Powers, p. 9.

No tops and only a few petrified roots have been found but some of the boles still have bark attached. Although redwood is quite resistant to pests, some petrified worms have been found imbedded in the stony wood.[9]

Some of these stone cylinders are huge, measuring as much as twelve feet through. The largest is 125 feet long, averages eight feet through and had a ring count of one thousand years when it fell.[10]

Figure 3. Spirit Lake and Mount Saint Helena (Meiser photo, 1902)

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[9]Powers, p. 9. [10]Ibid.

Apparently these trees were growing at the time Mount Saint Helena blew her top and devastated forests in the area, felling trees in its rampage so that all the stony logs point away from the mountain.

Charley Evans uncovered these petrified giants while clearing pasture for his beasts. Being a man of the sea, he did not realize that he owned the only known area where large numbers of fossil coast redwoods occur mixed with living redwoods. He died in 1881 having made a fair living selling petrifactions and photographs along with a fifty cent admission fee into "The Petrified Forest."[11]

The earliest coast redwood fossils found in California are in rocks less than twenty million years old.[12] Fossils returned to the surface in Santa Barbara county in southern California by oil drillers indicate that at the height of the glacial advances the redwood was as far south as southern California.[13] Then as the heat and dryness followed the cool, receding glaciers, the redwoods perished except for their present range.

Naturalist Ivan T. Sanderson believes that the coast redwoods live on one of the oldest sections of the continent. The

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[11]Powers, p. 11. [12]Chaney, p. 3.

[13]Ralph D. Cornell, Conspicuous California Plants, (Pasadena: San Pasqual Press, 1938), p. 15.

redwood range has "acted as a sort of refuge for many things from the past," since it has never been completely submerged as has the adjoining land mass.[14]

Needless confusion exists even today in the minds of the public concerning these large trees and even botanists and naturalists have had difficulty in deciding which trees are redwoods and which are Sequoias. "Redwood" by tradition has been the long favored name for the coastal species Sequoia sempervirens and "Big Tree" for the inland species Sequoia gigantea. Some years ago the California Division of Forestry adopted the names of coast redwood and Sierra redwood, referring to geographical differences, in an effort to clarify the situation. Most authorities now accept this terminology as standard.

A big tree, however, could be either species because they are both gigantic. Names applied to different locations in the redwood region also add to the present confusion. The "Big Tree Park" is found near the coast and features Sequoia sempervirens while Redwood Meadow, Redwood Mountain, and several Redwood Creeks are found in the Sierras and feature Sequoia gigantea.[15]

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[14]Ivan T. Sanderson, The Continent We Live On (New York: Random House, 1961), p. 142.

[15]Hank Johnston, They Felled The Redwoods (Los Angeles: Trans-Anglo Books, 1966). p. 12.

Little does the confusion over names matter to the Save-The-Redwoods League because their interest lies in both species and their fight for preservation has been impartial since their founding in 1918.

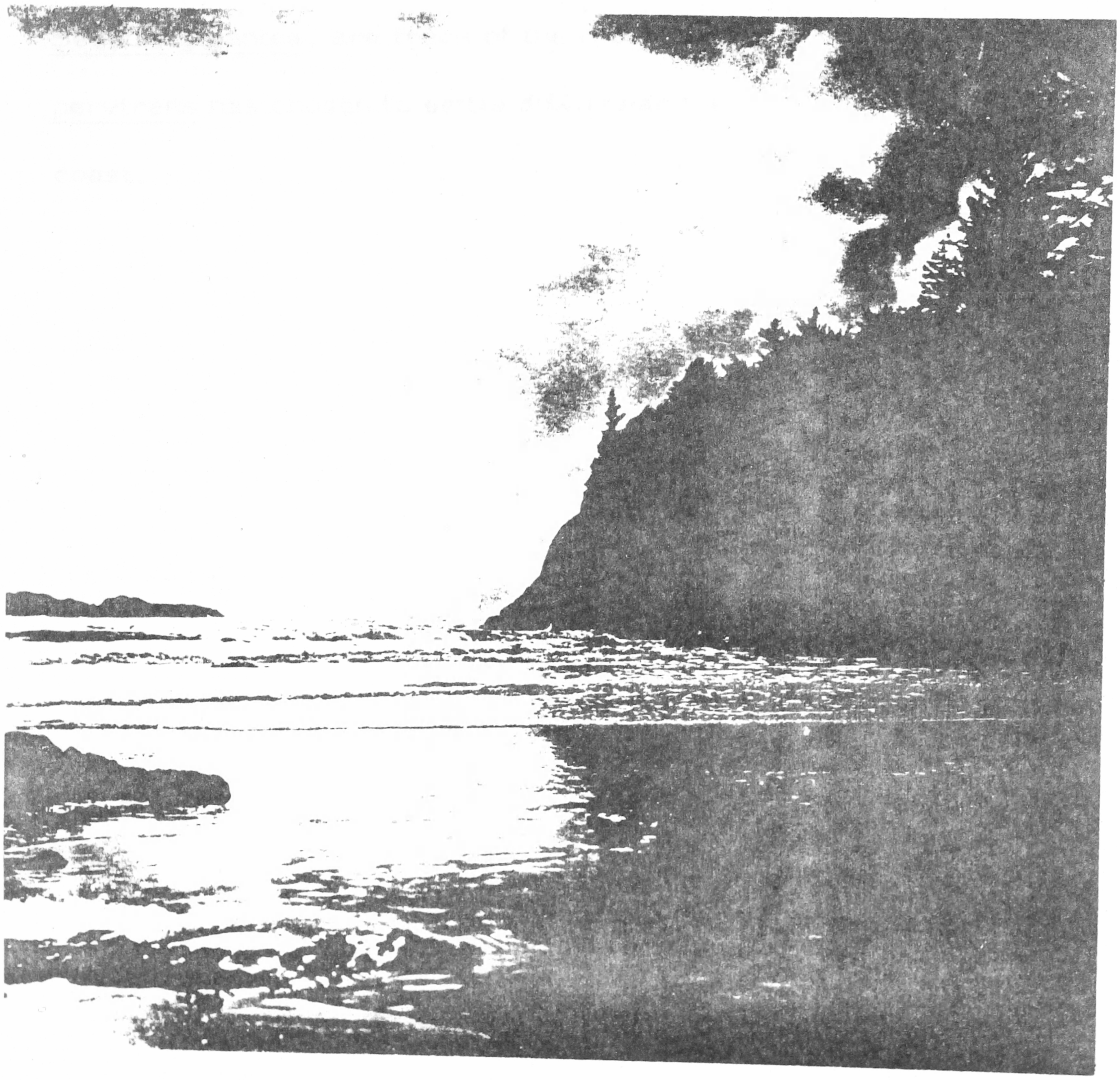

Figure 4. Pacific Coast Near Trinidad, California (Meiser Photo)

The California attorney general ruled in 1951 that the designation of "redwood" as the California state tree referred equally to both species.[16]

So it is today that the Big Trees, Sierra Redwoods or *Sequoia gigantea*, are trees of the mountains while *Sequoia sempervirens* has chosen to settle down near the wild, beautiful Pacific coast.

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[16]Johnston, p. 12.

CHAPTER III

REDSKINS IN THE REDWOODS

The redwood region was an ideal place for early Americans to live due to the mild climate. The first people to live among the giant trees had little or no effect on them. Of course, they started an occasional fire but this resulted in little damage. The fascinating part of the effects of early Indians is that they actually did some logging. They would burn a hole in one side of a redwood using heated rocks. After the burn had cooled they would scrape or chip away the charcoal with crude tools. The process was then repeated over and over until sufficient wood had been removed. At this point the other side of the tree was attacked in much the same way until the giant came thundering down. After falling, the tree was divided into segments using much the same burn and scrape technique.

After the tree was burned into segments, or logs, lumber was made by driving elk horn wedges into the ends of the logs and splitting off boards. Naturally this slow, difficult process made redwood planks a treasured possession, some even being handed down from generation to generation as an heirloom.[1]

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[1] Francois Leydet, The Last Redwoods (San Francisco: Sierra Club, 1969), p. 65.

Figure 5. The redwood region's temperate climate made clothing hardly necessary for most inhabitants; however, women usually wore some form of covering but men frequently did not. Both sexes donned a skin blanket for protection from rain and wind.[2] (Meiser Photo, 1904)

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[2]R. F. Heizer and M. A. Whipple, eds. and comps., The California Indians, 2nd ed. (Berkeley: University of Calif. Press, 1971), p. 4.

The overall impact of early Indians on the forest was very slight considering they had no metal tools with which to work.

Some sixty-two Indian tribes at one time were established in California. Most of these groups lived by hunting, fishing, gathering seeds, fruits, nuts, and edible roots.[3]

Figure 6. Hupa Indian squaw making large basket for collection and storage of food. (Meiser photo)

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[3]California Department of Natural Resources, State Indian Museums, (California State Printing Cffice, 1955), p. 3.

Figure 7. Fish was an important part of the Indian diet. Here small fish, probably salmon headed for the sea, are laid out to dry on the beach near Trinidad, California. (Meiser Photo)

In 1769, at the start of the Spanish colonization, there were about 150,000 Indians living in California. By 1846, the beginning of the American period, the Native Indian population had dropped to 88,000. This decrease was largely caused by diseases and environmental changes introduced by the white man. The majority of these early Indians were peaceful and war was unimportant to all but a few until white man appeared. In 1850 when washed out gold miners pushed into the redwood country they burned two sacred Indian villages. This started twenty years of fighting and ended, finally, when the Original Settlers bowed to the intrusive white man.[4]

Figure 8. Mahach, of the Hupa tribe. (Meiser Photo, 1907)

[4]California Department of Natural Resources, p. 4.

Of the tribes located in northwest California, the Yurok, Karok, and Hupa Indians are probably the most representative. Further south were about eight other nationalities who resembled these three in cultural traits but diffused more and more into the typical Central culture.[5]

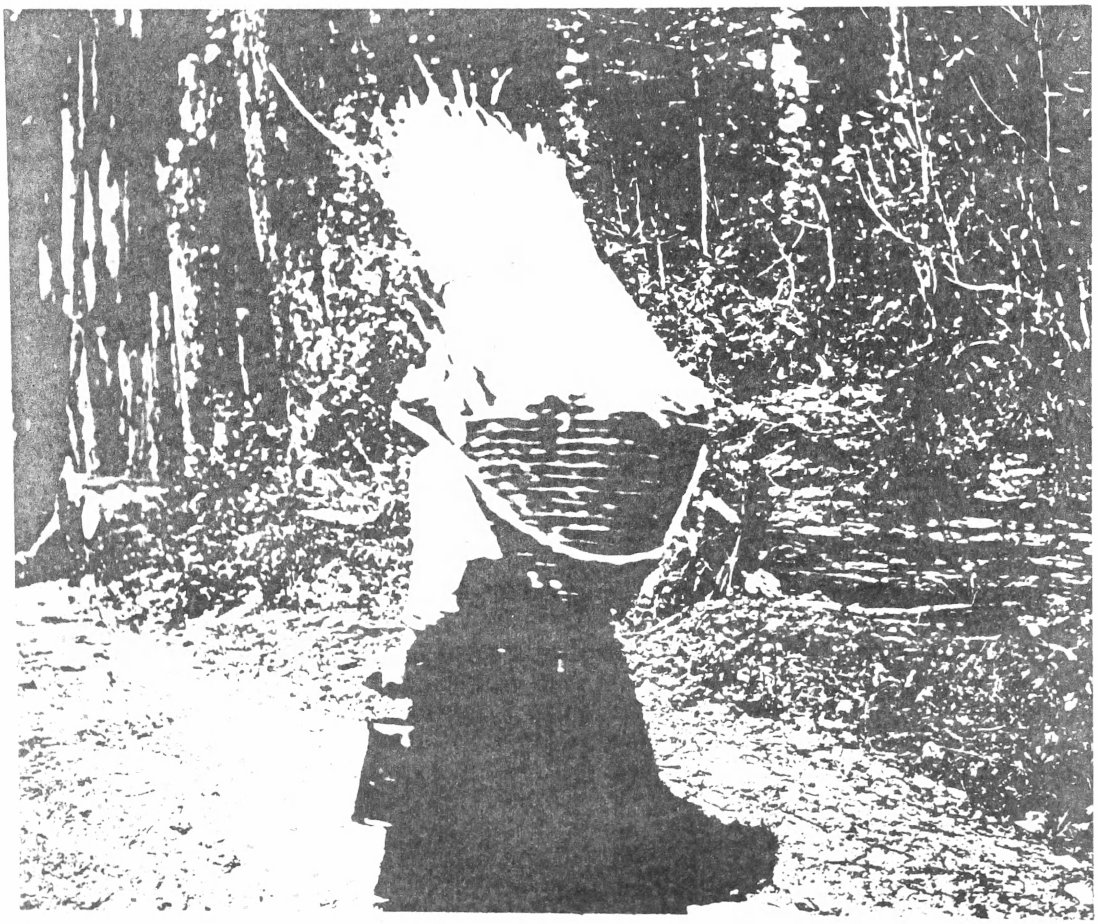

Figure 9. Squaw with heavily loaded basket returning through mixed redwood stand with the day's gatherings. (Meiser Photo)

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[5]Theodora Kroeber and Robert F. Heizer, Almost Ancestors: The First Californians, ed. F. David Hales (San Francisco: Sierra Club, 1969), p. 51.

The Yurok, Karok, and Hupa Indians were primarily hunters and fishermen, practicing no agriculture. They possessed a more advanced technology than the Indians further south and their social organization was on more of a property basis.[6]

Property value was expressed in terms of a few simple belongings. Dentalium shells seemed to be the basis of exchange. A "string" of dentaliums averaged twenty-seven and one-half inches long and was the distance from the end of a man's thumb to the point of his shoulder. A string consisted of eleven large shells or fifteen small ones. One string was rated in value to one slave and two strings of large shells made a man well known.

Woodpecker scalps were rated second only to the dentalium in value with large scalps being worth considerably more than small ones. Figure ten shows a hat band made of woodpecker scalps.

The Hupa tribe built substantial frame houses, many of which utilized redwood planks. The value of such a house with redwood planks was five strings of shells. A small boat was valued at eight to ten strings plus three large scalps while a large boat called for twelve strings plus ten large scalps or sixty small ones.[7]

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[6]Bureau of Indian Affairs, The California Tribes, (n.p.)

[7]Heizer, pp. 395-399.

Figure 10. Spot, a blind Hupa Indian, displays his headband of woodpecker scalps and a quiver full of arrows. (Meiser Photo, 1907)

Figure 11. Indian Jim and squaw in front of their house on Cushon Creek. Hupas built houses of split and hewn planks. Farther south, the planks gave way to crudely made bark homes which were hardly more than a conical pile of bark.[8] (Meiser Photo)

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[8]Heizer, p. 7.

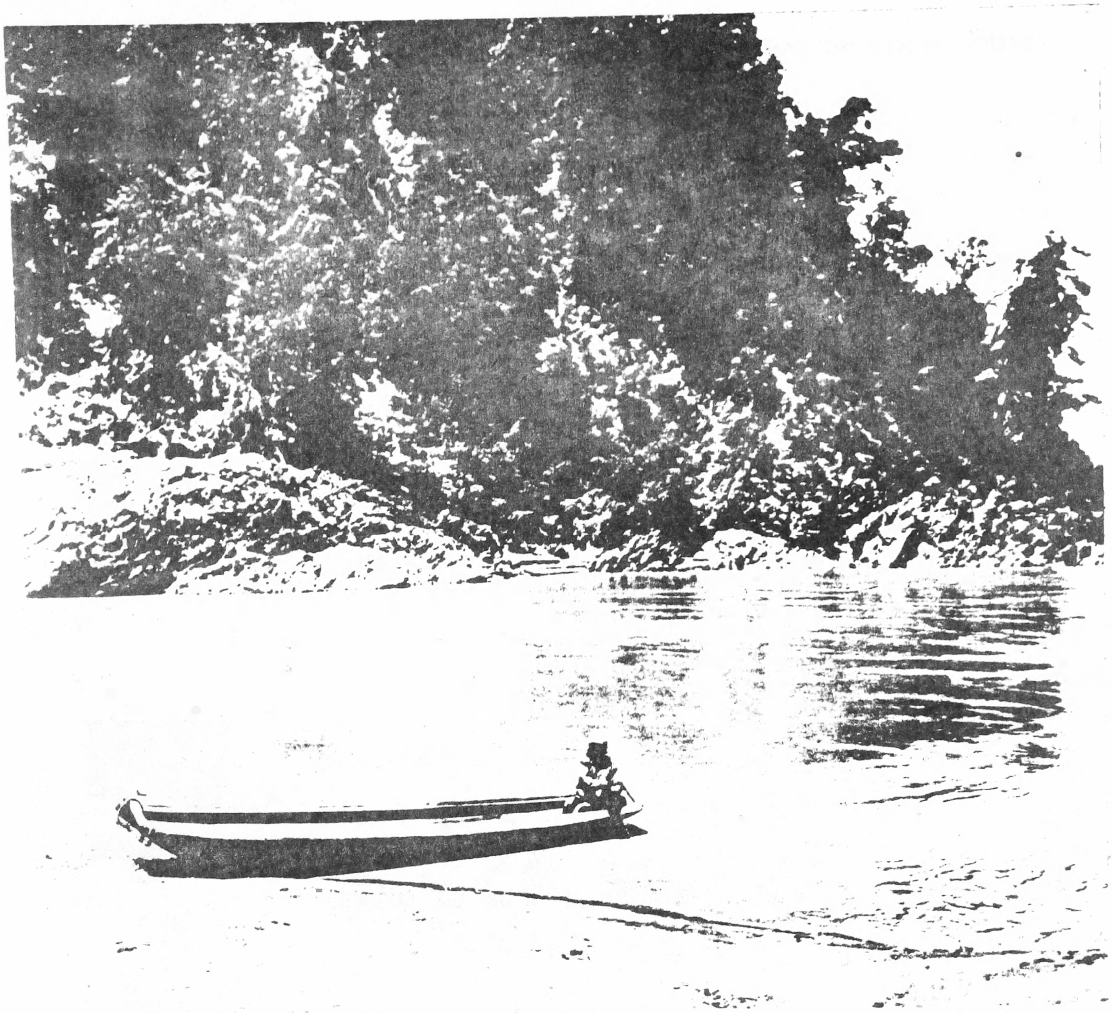

Figure 12. Captain John, born 1837, ran a ferry across the Trinity River with his dugout redwood canoe. (Meiser photo, circa 1905)

The northwest canoe was dug out of half a redwood log, was square ended, round bottomed, and of quite heavy proportions. It was nicely finished with recurved gunwales and carved out seats. These Eurok manufactured canoes were used regularly by Karok and Hupa Indians in and around Humboldt Bay.[9]

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[9] Heizer, p. 9.

Two Yuroks might spend as long as five or six months burning, shaping, scraping and finishing a canoe. When finished, the average canoe was about eighteen feet long with some large enough to handle five tons of fish. One canoe, supposedly made for white man, was forty two feet long.[10]

The paddle used by northwestern tribes was long, narrow and heavy, serving both as an oar and pole.[11]

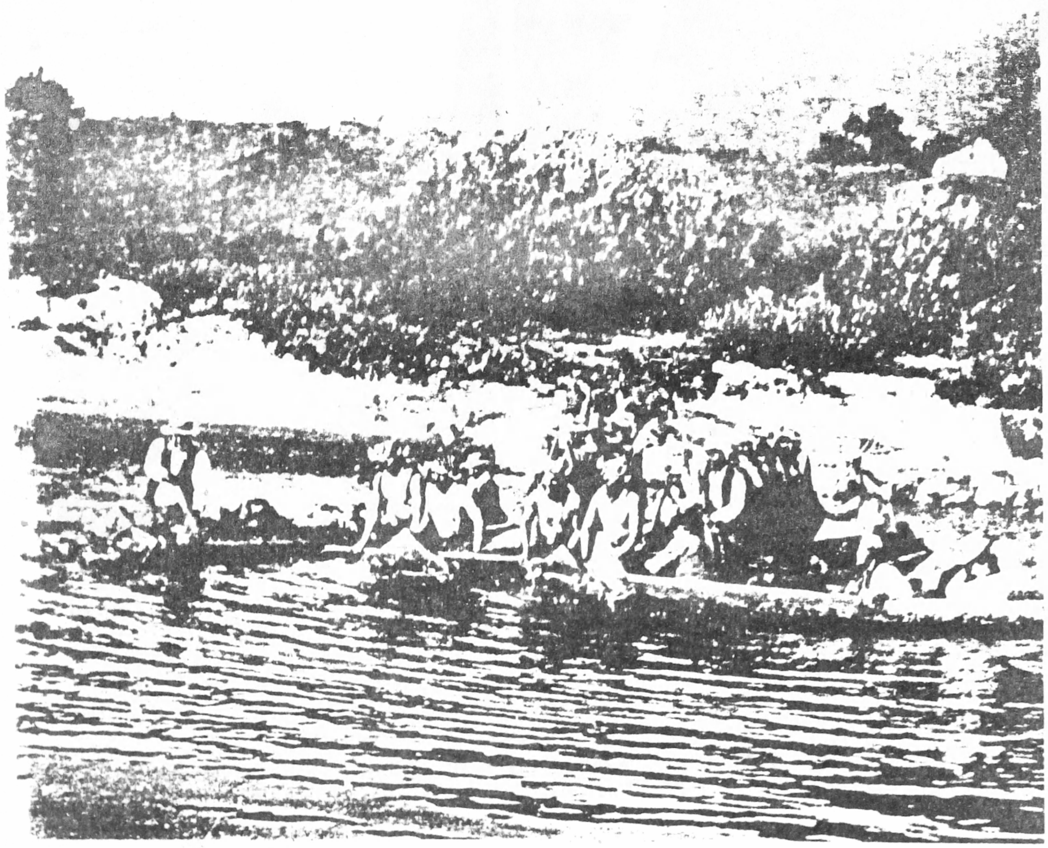

Figure 13. Both Indians and whites, probably on the Trinity River. (Meiser Photo)

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[10]Powers, p. 39. [11]Heizer, p. 12.

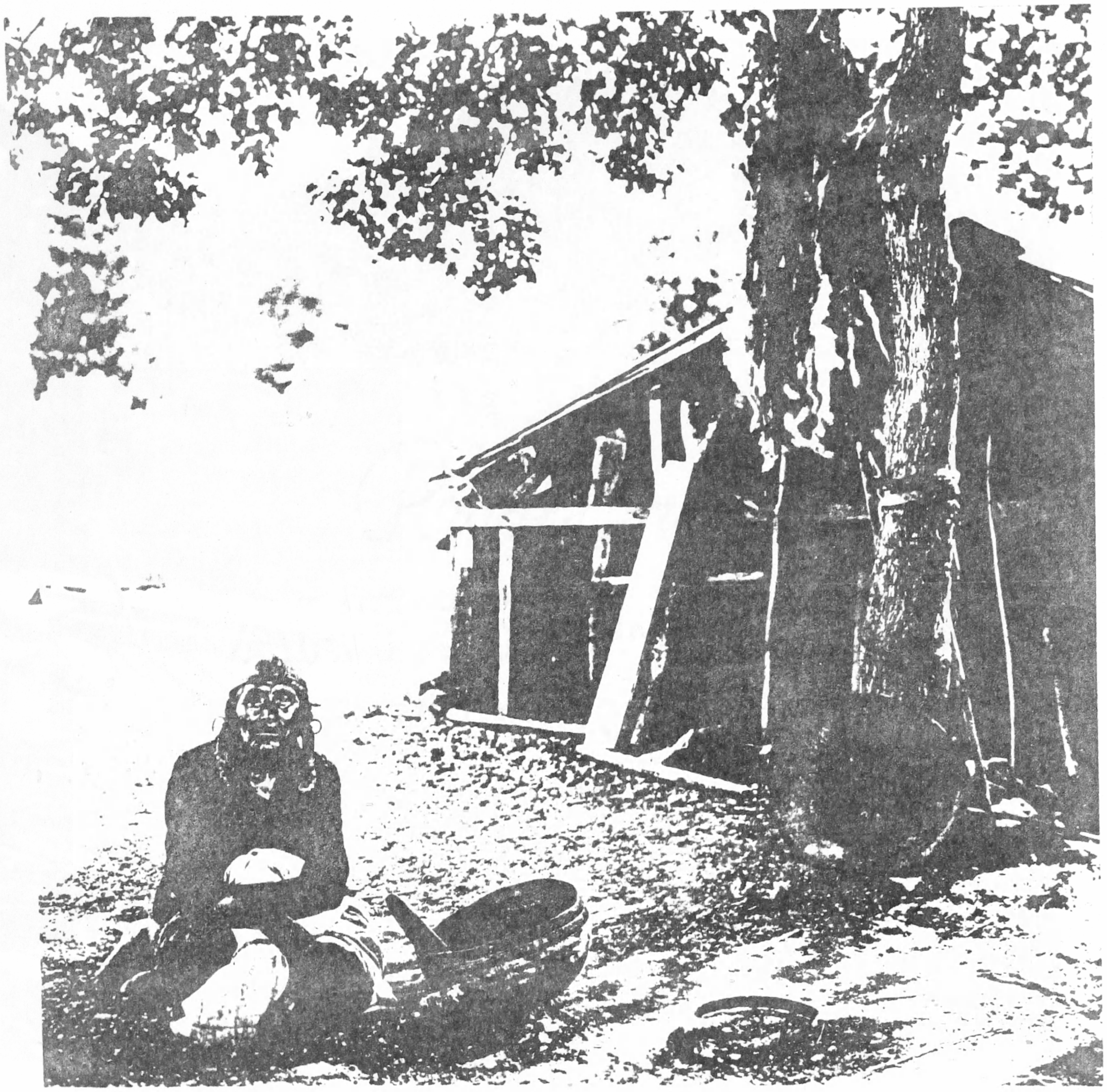

Figure 14. Hupa women gathered acorns in the fall. The nuts were shelled, split, dried and stored in large baskets. When needed for food they were pounded into fine flour by means of a stone pestle a foot or more long.[12] Indian Mary has just completed such a chore. Note also the woven hat worn by the women for protection against the pack strap. Men too wore a similar one for protection when using fish dip nets which were steadied by their heads.[13] (Meiser Photo)

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[12]Robert F. Spencer, Jesse D. Jennings, et al., The Native Americans, (New York: Harper and Row, 1965), p. 233.

[13]Heizer, p. 5.

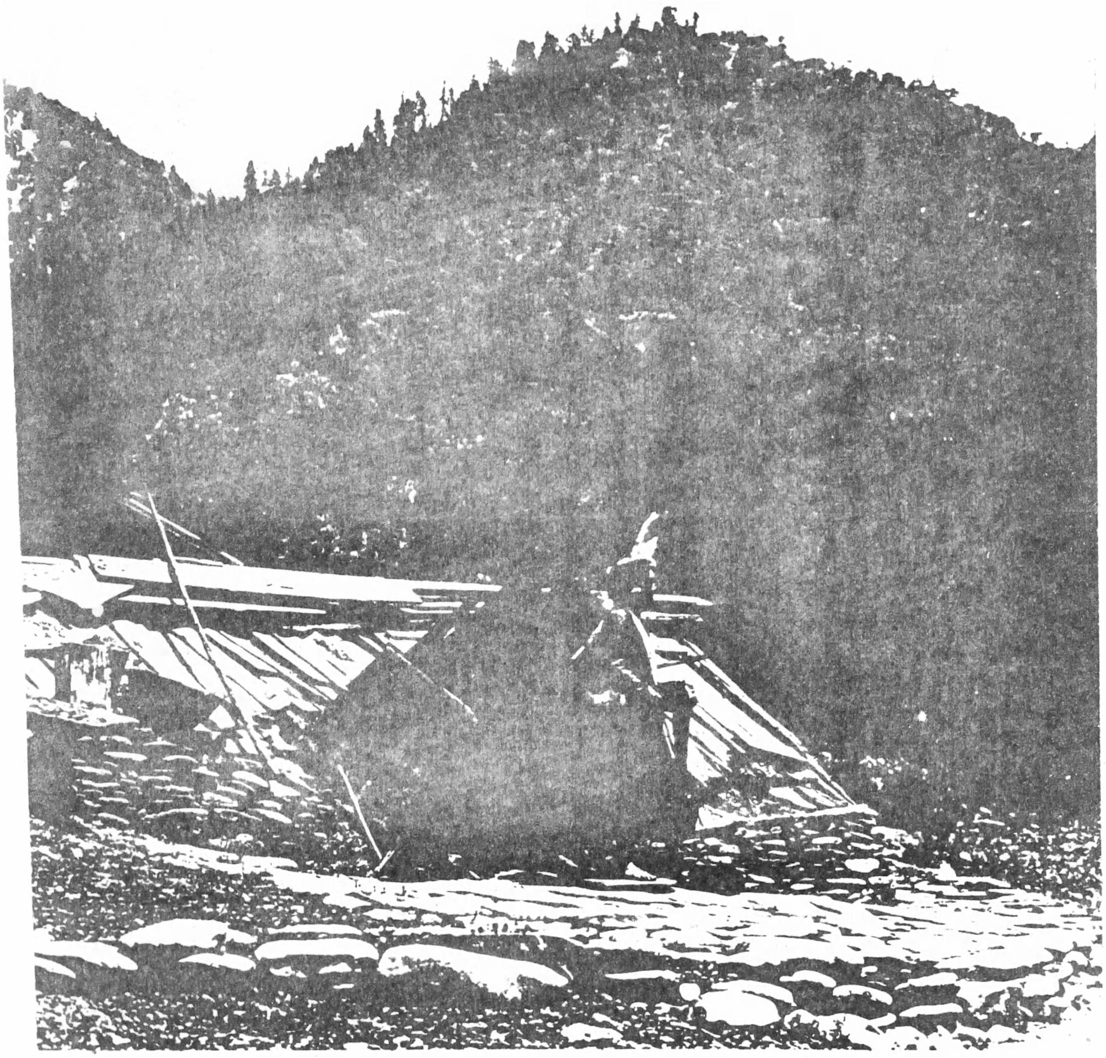

Figure 15. Captain John, a spiritual leader of the Hupa tribe, in front of the sweat house. This house served many of the functions of a club with admission determined by ownership, kinship or friendship. The sweat house consisted of a deep pit covered with redwood planks. It was heated by a fire in the center causing men to lay on the floor to avoid some of the smoke. It was utilized daily by men; some even sleeping there.[14] (Meiser Photo)

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[14]Heizer, p. 8.

CHAPTER IV

DISCOVERY AND NAMING

Extremely early history of the redwoods is somewhat confusing, or perhaps I should say man's recording of this history is somewhat skewed and spotty. At any rate, there is a bit of disagreement on who actually first saw the redwoods.

In June, 217 B.C. Hee-li and ten sailors from China supposedly landed on the California coast at what is now called Monterey Bay and scouted around for a period of about three months.[1] Some say the first literate man to observe the big trees could have been a Chinese explorer, Hui Shan, who sailed the Pacific in A.D. 458 and apparently saw "tall trees of red wood."[2] Some believe the first man could have been Captain Juan Rodriguez Cabrillo in 1542 when he observed the California coast and called it "the coast of pines."[3] Still others claim the first white man to see the coast redwoods were from the Don Gaspar de Portola Spanish expedition. On October 10, 1769, Juan Crespi, diarist for the expedition, recorded seeing "very high trees of a red color, not known to us. . . In this region there is great abundance of these trees and because

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[1]Powers, p. 12. [2]Adams, p. 9.

[3]Ibid.

none of the expedition recognizes them, they are named redwood for their color."[4]

Controversy is a word which seems to pretty well describe the redwoods, not only for their early discovery but one which also applies equally well today. Even the scientific naming of these trees fell into the category of controversy.

The first collection of redwood specimens for botanical purposes was probably made by Thaddeus Hoenke with the Malaspena expedition in 1791.[5] However, the scientist generally credited with the study is English botanist Archibald Menzies who collected specimens while traveling with explorer George Vancouver. For some unknown reason, a botanical paper was not written on the redwoods until 1824 when A. B. Lambert described the characteristics and named it Taxodium sempervirens, believing it to be an evergreen cypress.[6] The specific name sempervirens comes from two Latin words; semper meaning always, and vireo or green.[7]

This classification went unchallenged until 1847 when an Austrian named Stephan Endlicher challenged the generic name and

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[4]Sunset Editorial Staff, Redwood Country and The Big Trees of the Sierras, ed. Robert Iacop (Menlo Park, California: Lane Books, 1969), p. 8.

[5]Adams, p. 10. [6]Sunset, p. 9.

[7]D. W. Cooper, Coast Redwood and Its Ecology (Berkeley: University of California, 1965), p. 1.

called it Sequoia instead of Taxodium.[8]

The generic name was chosen to honor the courage and perseverance of a Cherokee Indian chief who served as a United States soldier in the War of 1812. The chief had acquired the name of George Guess, whose surname was given as an unkind reference to his Indian mother and white father.[9]

Guess was the man who created the Cherokee alphabet. During two summers and winters while working on this task, he received severe harassment from the older men in his tribe because they thought he was making "dark magic." In February, 1918[10] they succeeded in burning his cabin which contained his alphabet carefully carved in pieces of bark. When Guess discovered that his cabin and all his work was now ashes, he determined more than ever to finish the task he had begun. The old Cherokee men gathered around to enjoy his misery shouting, Sequoya, The Lame One, and Sequoya, the maker of spells! The term Sequoya was on the same level as pig or possum in their vocabulary so it is not difficult to see that they had lost respect for their chief.[11]

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[8]Adams, p. 10 [9]Ibid.

[10]Catherine Cate Coblentz, Sequoia (New York: Longmans, Green and Company, 1946), p. 106.

[11]Coblentz, p. 115.

Chief Sequoya, being unschooled and a cripple spent a total of twelve years developing the complete Cherokee alphabet consisting of eighty-six characters that expressed all the sounds of his language. This accomplishment lead to the translation of the Bible and other works and eventually resulted in the Cherokee's purchasing a press for publishing their own newspaper called the Cherokee Phoenix.[12]

Sequoya, although never seeing California or the redwoods, was certainly worthy of the honor of having his name attached to the great trees.

Once the Cherokees realized the value of Sequoya's work they put it to good use. Sequoya did not gain much wealth from his work on the alphabet. The United States government gave him some gifts and 150 dollars cash while the Cherokee Nation provided a silver medal. Sequoya died in 1843 while visiting Cherokee Indians in Mexico but his written alphabet lives on.[13]

The mark of Sequoya was fresh in the minds of the people when Endlicher studied the California redwoods in 1847. Thus, it was only natural that this giant among men, Sequoya, be attached symbolically to the giant among trees, Sequoia.

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[12]Adams, p. 11.

[13]Sunset, p. 57.

All of this early discovery and naming really meant little as far as the redwood era, as we know it, is concerned. However, this all began to change when James Wilson Marshall discovered gold on January 24, 1848 while building a sawmill on the American River in California. This incident started the California gold rush and people responded by the thousands.

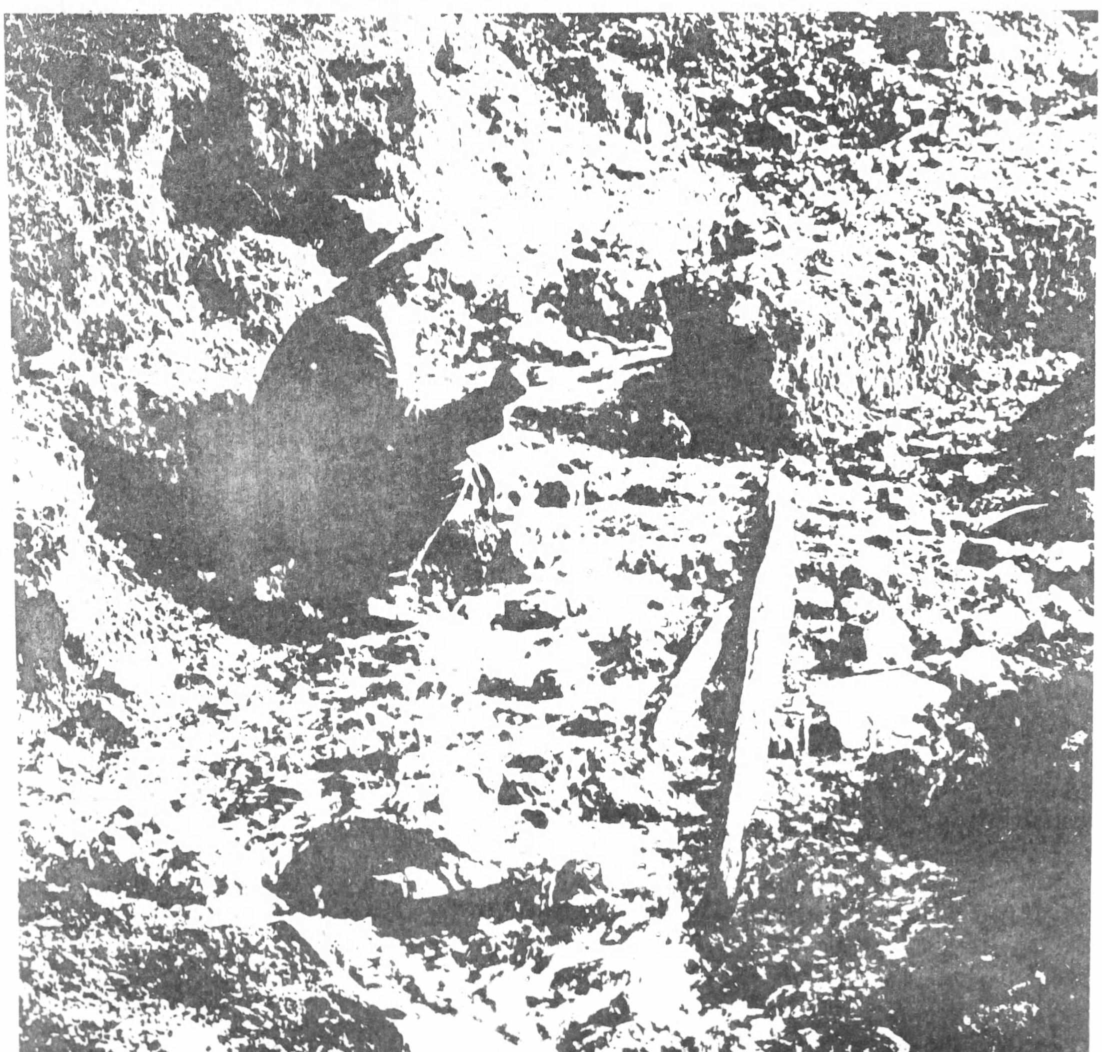

Figure 16. Many gold seekers looked to the streams and rivers for those shiny nuggets they thought should be under every stone. (Meiser Photo)

On February 28, 1849, the steamer, California, carrying 365 people arrived in San Francisco with the first gold rush passengers.[14]

The gold rush rose and fell, leaving many of these people looking for jobs elsewhere. Many did not want to return to the east and consequently ended up with a job in the log woods or on a farm in northern California.

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[14]T. H. Watkins, California (Palo Alto, California: American West Publishing Company, 1973), p. 534.

CHAPTER V

DEMOGRAPHIC CHARACTERISTICS OF THE REDWOOD REGION

Life in the temperate redwood region of northern California apparently looked quite attractive to those who washed out of the gold fields with little or no dust in their pouches. These people may have

Figure 17. Part of the frontier life for a family was grubbing a farm out of the dense forest. (Meiser Photo)

been reluctant to admit defeat and return to previous jobs in the East or perhaps they had just not had enough of frontier life. No matter what the reasons, they stayed and the population began to increase in the redwood region soon after the discovery of gold.

The primary redwood region is located in the four counties of Del Norte, Humboldt, Mendocino and Sonoma. Prior to 1850 total population in the region was less than two thousand. By 1860 this number had increased to about 20,500 and has continued at an ever increasing rate, especially since 1940.[1] Figure eighteen graphically illustrates the rise in population for all four counties.

The West has always been a man's world due to the rugged life and dangerous occupations. This was especially true in the early days and can be illustrated most effectively for the redwood region by use of sex ratios which represent the number of males per hundred females. One outstanding example of this occurred in Del Norte county in 1860 when there were 354 males for every one-hundred females. Figure nineteen graphically illustrates the trends and fluctuations in sex ratios for the four counties in the redwood region. High ratios were common to all the counties during this period although Del Norte was much higher than the others. By 1870 these ratios had dropped considerably and averaged about 160.

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[1]Derived from U. S. Census Data.

For the most part, after 1870 sex ratios continued to decline and currently are much the same as the national average.

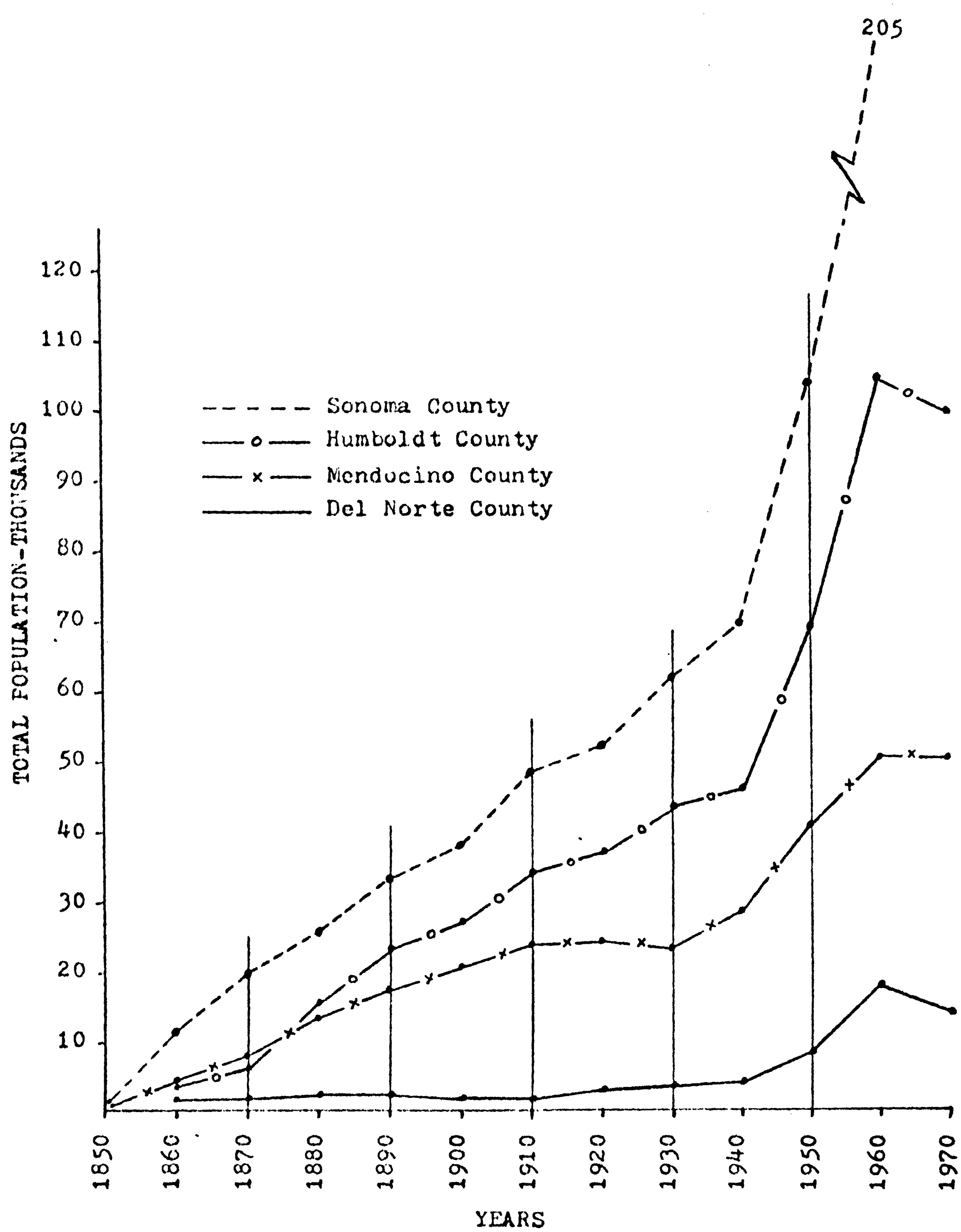

Figure 18. Redwood region population by County/Years. U. S. Census Data.

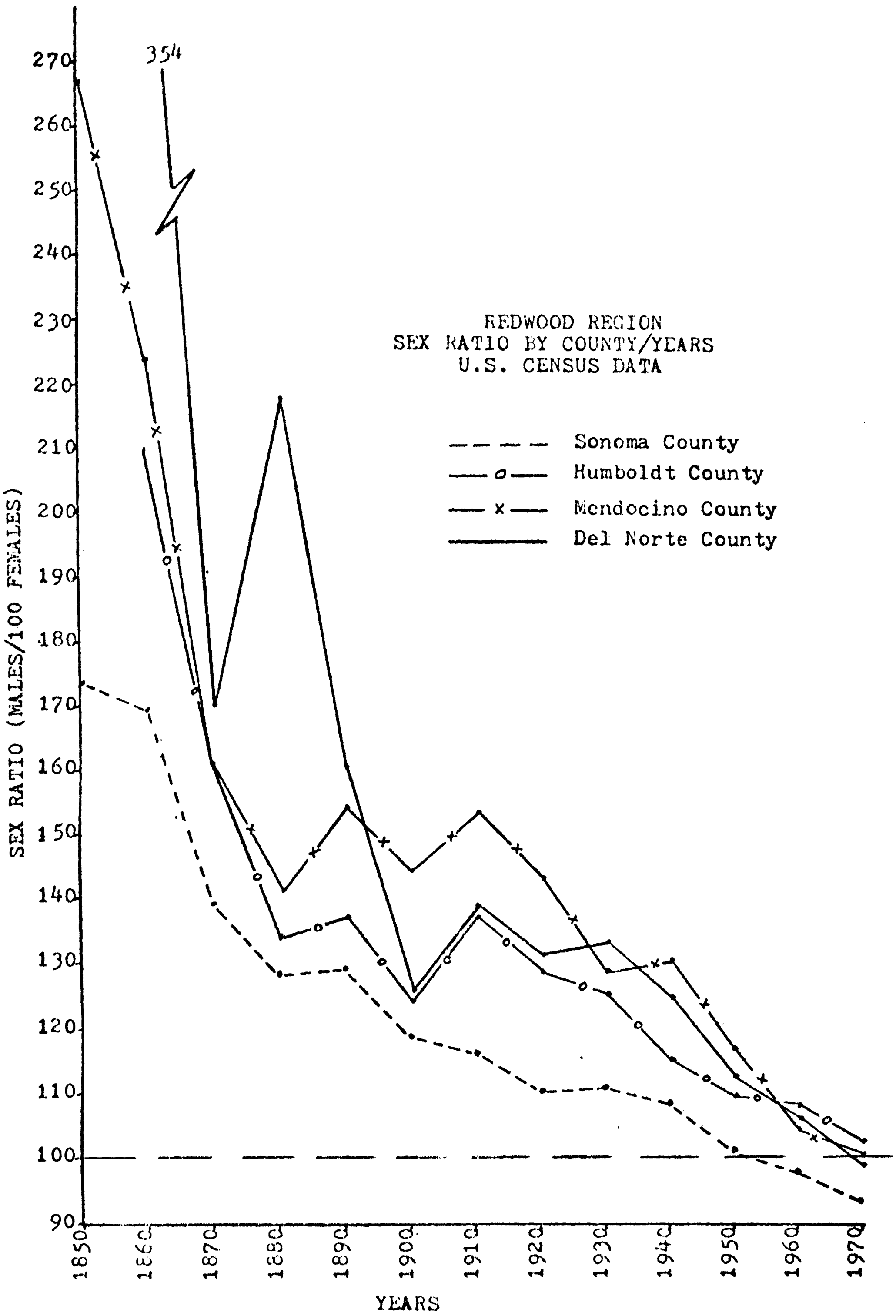

Figure 19. Sex ratio by County/Years.

The increased population, whether they were male or female, spelled only one thing for the redwood trees. That simply was the fact that there were more people to chop, saw, haul and trample, thus changing their ecosystem.

Figure 20. It took a lot of hand labor to change the face of the land, even in smaller timber, but fervent work eventually brought it about. (Meiser Photo)

CHAPTER VI

REDWOOD HABITAT CONDITIONS

PHYSIOGRAPHIC

There is an atmosphere of calm and an unrivaled beauty throughout the Redwood Empire which stretches along the coast of the blue Pacific from the Golden Gate north slightly farther than the Oregon border. Although the redwoods extend into the Santa Lucia mountains in southern Monterey county, California, they are of little consequence south of Sonoma county. The redwood belt is an irregular strip about 450 miles long and generally five to thirty five miles wide with principal streams draining to the northwest.[1]

Redwoods grow from sea level to about 3,000 feet elevation with most being found between one hundred and 2,500 feet. The best stands are found on river deltas, moist coastal plains, on flats and benches along large streams and in valleys opening toward the sea. Redwood cannot tolerate direct ocean winds or salt spray carried inland even though the main bodies of redwood

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[1]U. S. Forest Service, Silvics of The Forest Trees of The United States, comp. H. A. Fowells (Washington D.C.: Government Printing Office, 1965), p. 663.

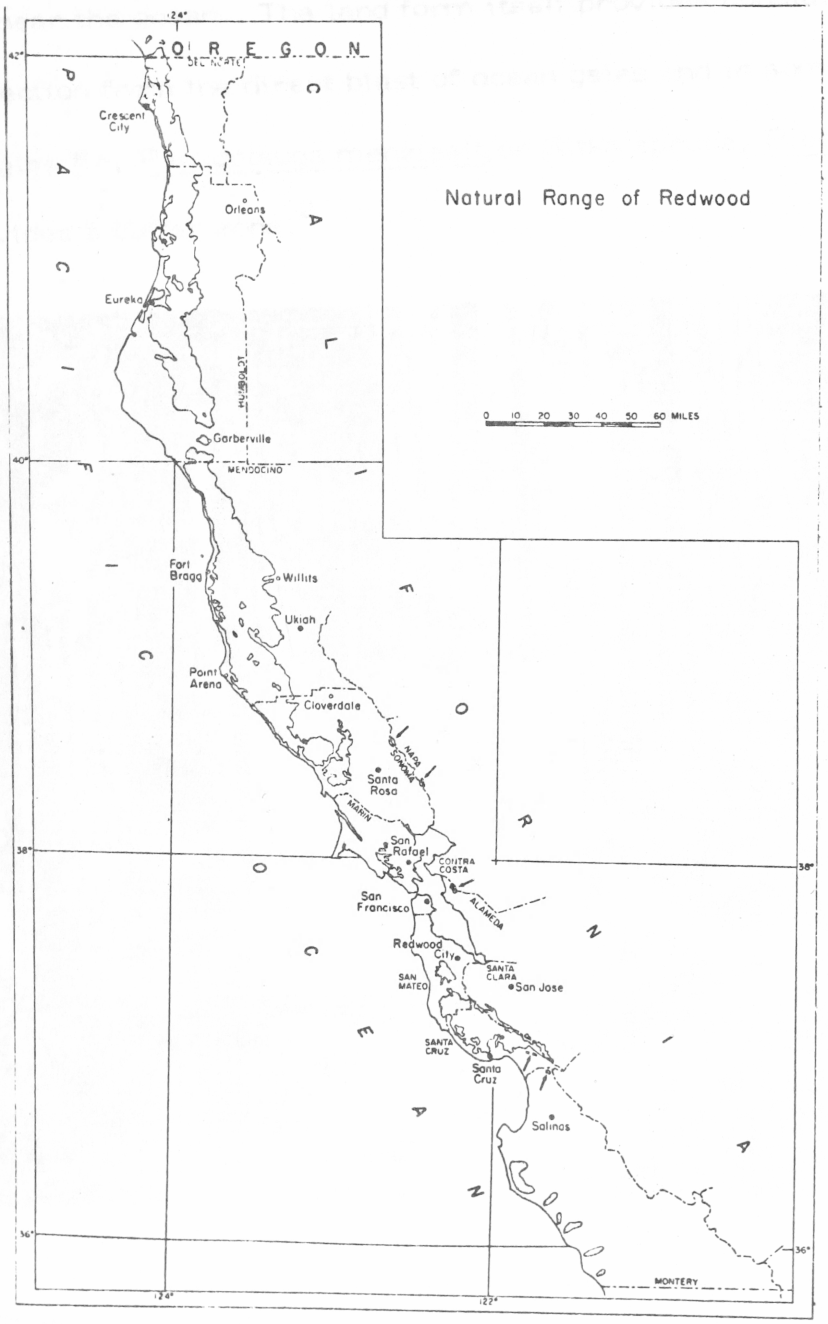

Figure 21. Natural range of redwoods. (Roy, U.S.F.S. 1966)

are near the ocean. The land form itself provides considerable protection from the direct blast of ocean gales and in some cases Douglas fir, Pseudotsuga menziesii, or Sitka spruce, Picea pungens, provides a buffer zone.[2]

Figure 22. Mixed stand or redwood and fir. (Meiser Photo, circa 1905)

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[2]Douglas F. Roy, Silvical Characteristics of Redwoods (Berkeley: Pacific Southwest Forest and Range Experiment Station, 1966), p. 2.

As elevation, dryness and slope increase, redwoods become less dominant and are replaced by other species. In the northern portion of their range redwoods grow on all exposures; however, in the southern part they are confined to the western and northern aspects.

EDAPHIC

Parent rock material in the redwood region is primarily massive marine sandstone formed in the Tertiary and upper Mesazoic periods. Considerable shale and lesser quantities of Mesazoic limestone and Franciscan slates, cherts, limestones, and sandstones are also represented. Schists are common in some locations.[3]

Redwood does not grow on soils high in magnesium or sodium but tolerates soil pH from 5.0 (acid) to 7.5 (alkaline). Soil textures of highly productive sites range from loam to clay loam and are usually derived from consolidated or soft sedimentary rocks. Steep slopes may have thin rocky loams while sandy loams are common in the flats. Occasionally clays are close to the surface and clay loams replace the more typical loams and sandy loams.[4]

Excess nitrates have been found under mature redwoods displaying symptomatic silver-gray foliage while nitrate difficiencies

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[3]U. S. Forest Service, p. 663.

[4]Roy, p. 2.

have been observed in young growth stands with a chlorotic appearance. In the latter case nitrification was blocked, probably resulting from the abundant organic matter produced by logging which in turn provided too many micro-organisms.[5]

On alluvial flats, where redwoods reach maximum development, soils have been built up by deposits of sediment from successive floods. In some areas the ground level has been raised as much as eleven feet in 700 years. Another account records a deposit of about thirty feet in one thousand years with depths of thirty inches being made from a single storm.[6] This increasing deposition over the roots would be destructive to most tree species but the redwoods adapt themselves by originating new and higher root systems. Studies indicate that as much as twenty three percent of an old root system had been replaced in a twelve month period following excavation and backfilling around 28 to 84 inch trees.[7]

Appendix A shows the more important forest soil series in Humboldt county and compares their nitrogen content and water holding capacity.

The various redwood soils derived from various parent materials all seem to have one thing in common: a high water

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[5]Ibid.

[6]U.S. Forest Service, p. 664.

[7]Cooper, p. 14.

holding capacity. Redwood does not occur on soils with less than five inches of water holding capacity in the first four feet.[8]

Figure 23. Rich soil and adequate precipitation produce a lush growth under the redwoods. (Meiser Photo)

BIOTIC

As the principal species, redwood is found in only one forest cover type, Redwood, but is found as a part of the plant

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[8]Ibid.

community in four other Pacific Coast types, Pacific Douglas fir, Port-Orford-Cedar-Douglas fir, Oak-Madrone, and Ponderosa Pine-Sugar Pine-Fir.[9]

Figure 24. Glacial lilies peek through a patch of snow in mixed stand. (Meiser Photo)

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[9]U.S. Forest Service, p. 664.

Pure redwood stands are found only on some of the best sites, usually the moist river flats below a thousand feet in elevation. Douglas fir is the most important species associated with redwood in mixed stands and is scattered throughout most of the redwood type. Other important species of the mixed types are grand fir, western hemlock and Sitka spruce.[10]

Conifers and hardwoods occurring less commonly in redwood stands are listed in Appendix B, page 139.

A great change in flora takes place after a redwood stand has been logged. This is due primarily to invasion of species not commonly found in virgin forests and a great increase in sprouting plants at the expense of the non-sprouting or tolerant species. Appendix C, page 141 lists plant species found on cutover redwood land in Humboldt and Mendocino counties.

CLIMATIC

Climate in the redwood region can be broadly classed as humid or superhumid with the mean annual temperature ranging from fifty to sixty degrees. Temperature extremes rarely drop below fifteen degrees or rise above one hundred. Differences between mean annual maximum and mean annual minimum temperatures vary from ten to fifteen degrees at coastal points to thirty

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[10]Roy, p. 3.

degrees at the eastern edge of the region.

Frost-free growing season varies from six to eleven months. Snow occasionally covers the higher ridges but most of the moisture comes in the form of winter rain. Annual precipitation varies from twenty-five to 122 inches with January being the wettest month and August the dryest.

Seasonal distribution of precipitation at Scotia in Humboldt county is: winter, fifty-five percent; spring, twenty-three percent; autumn, twenty percent.[11]

Summer fog frequently blankets the redwood region and seems to be more important than the amount of precipitation in delineating the redwood type. The range of the redwood is limited to areas of dense summer fog which provides the necessary humid summer atmosphere. The fog decreases evaporation and transpiration losses from the trees and provides some additional soil moisture by condensing on branches and falling to the forest floor.[12]

Climatic factors such as temperature, relative humidity and precipitation play an important role in the germination, establishment and development of seed and seedlings. These factors are particularly significant when it becomes necessary to

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[11]Roy, p. 1.

[12]U.S. Forest Service, p. 663.

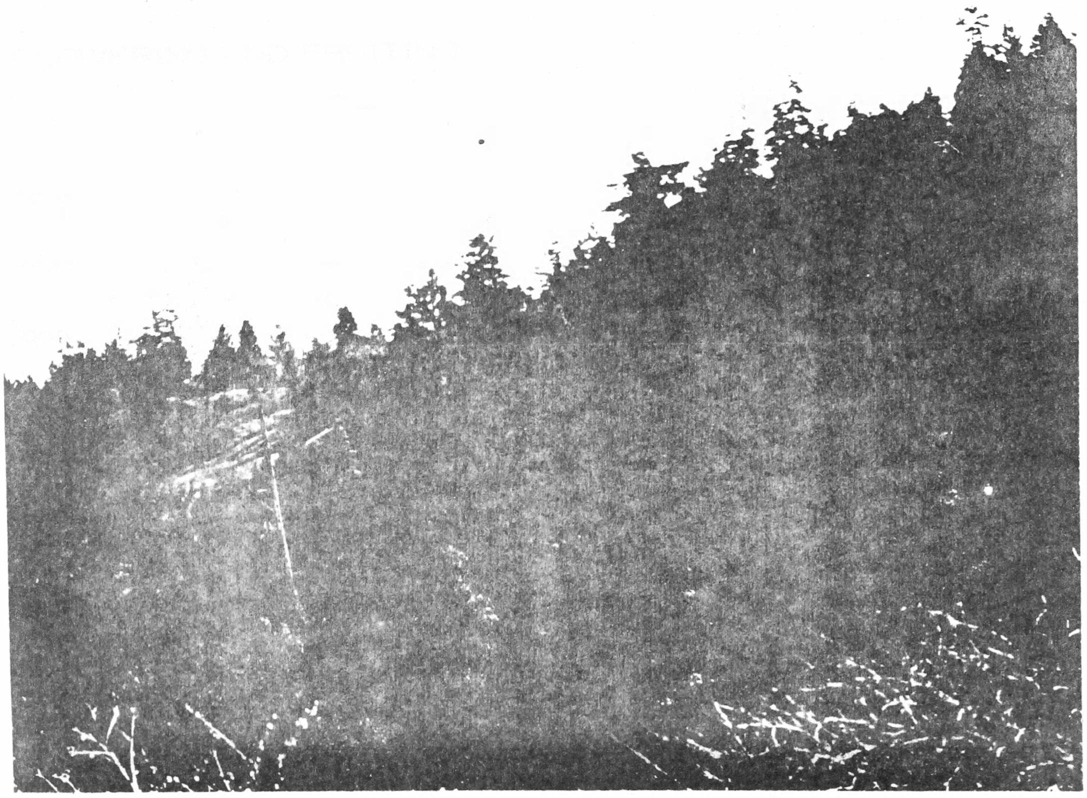

Figure 25. Above the summer coastal fog in the Eel River Valley. (Meiser Photo)

regenerate a cut-over area. Appendix D, page 145 compares means and extremes of temperature and relative humidity for two different silvicultural cutting methods on the Redwood Experimental Forest near Klamath. It also contains information on average precipitation by month and year from 1958 to 1965.

CHAPTER VII

REDWOOD LIFE HISTORY

FLOWERING AND FRUITING

The flowering period of redwood varies from late November to early March but is generally over by the end of January. Weather conditions at the time of flowering have a direct bearing on seed quality. If flowers open during the continuous rainy period pollen is apt to be washed off before reaching the conelets. Dry periods during flowering permit optimum dispersal of pollen and help produce seed crops of high viability.

Redwood cones which are located on the ends of branches are one-half inch to one and one-eighth inches long and mature in the autumn following flowering. They begin to open and shed seed soon after ripening, usually in early September to the latter part of December.[1]

SEED PRODUCTION

Abundant seed is generally produced almost every year, although seed production patterns for individual trees varies

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[1]Roy, p. 4.

considerably. Even trees considered as intermediate in crown-class frequently produce viable seed crops, however, the minimum age for a good seed bearing tree is about twenty years with the optimum being sixty to one-hundred years.

Seed viability usually increases with the age of the parent tree with maximum viability occurring in trees over 250 years old. Trees less than twenty years old yield seed with less than one percent viability and trees over 1200 years produce seed which is either sterile or not over three percent viable.

Many exceptions to these general seed production patterns occur. On one occasion, a cone was found on a three year old tree which was only twelve inches tall. Seedlings seven to eleven years old grown from cuttings have produced cones. Redwood sprouts begin producing cones very early; however, cones produced by sprouts less than ten years old generally contain few seeds. In some cases five year old sprouts produce seed which is four and one-half percent viable.

Some redwoods apparently never produce seed. A few opinions suggest that redwood cone production is determined by permanent features of the root environment and that some kind of root disturbance may be desirable or necessary to induce cone production.

A typical redwood cone has fifteen to twenty scales, each producing two to five seeds with an average of about sixty seeds per cone. It takes about 3,000 cones to produce one pound of seed. The number of seeds per pound averages 123,000 but ranges from 59,000 to 300,000.

The high percentage of empty seeds causes poor average germination rather than dormancy. When obviously empty seeds are removed, germination may be as high as seventy-nine percent.

Redwood seed does not store well. It may be stored for up to three years under optimum conditions but loses all viability after five years.[2]

SEED DISSEMINATION

Redwood cones dry readily when the humidity is low and quickly release seed with slight movements of the cones. Weather conditions are not generally conducive to rapid cone drying during the ripening period. Therefore, seed dispersal may be spread over a considerable length of time. Altitude and exposure have a significant effect on cone ripening and seed dispersal.

In some cases it has been noticed that rain assists in seed dissemination. Seed may be attached to the cone by tannic crystals and thus remain fastened until the crystals are dissolved by rain.[3]

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[2]Roy, p. 5.

[3]Roy, p. 6, citing Howard William Siggins, Dissemination by Wind of Seed of Important Conifers of California (Berkeley: Univ. of California, 1926), Unpublished Master's Thesis.

Many times there is a tendency for much of the seed to be shed during December and January; in some cases as much as eighty percent of the crop. Seed dispersal is quite limited due to the fact that redwood seed has no wing attached and falls at a more rapid rate than most other forest seeds. This fact indicates that the maximum size of clearcut units should be about twenty acres. In partially cut stands seed trees should be left at the rate of four per acre on north slopes and eight or more per acre on south exposures.[4]

NATURAL REGENERATION

Cutting practices during the ox team and light donkey-engine logging days brought about the fine second growth (naturally regenerated) stands now being harvested. The seed sources left standing by early logging operations served well to regenerate the areas. As mechanization progressed and the mills had an ever increasing appetite for logs, clearcutting and burning became wide-spread. Natural regeneration from seed was often totally absent in these burned areas, and regeneration from sprouting was spotty.

Tractor logging, once again made it possible to selectively harvest, thus leaving a residual stand as shade and also as a seed source. In some cases tractor-logged selectively cut areas have

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[4]Roy, p. 6.

dense regeneration.[5]

When a heavy residual stand is left, the bulk of the growth is made by the old trees. Redwood has a marked acceleration in growth after release from competition. This growth is not only significant in volume but is of higher quality than that possible for young trees.[6]

FIRE

Fire can be a factor in setting the stage for or against the establishment of second-growth. A single slash disposal fire is often helpful in holding back competing vegetation, thus giving the newly germinated seeds a better chance for establishment. Early settlers often burned highly productive clearcut sites and converted this land to pasture for their animals. Repeated burning was necessary to keep sprouts, brush and ferns under control. Many times this land, when eventually abandoned, reverted to brush instead of to trees. Other lands not converted to pasture have produced good stands of trees.[7]

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[5]Emanuel Fritz, Characteristics, Utilization and Management of Second Growth Redwood, (San Francisco: Foundation for American Resource Management, 1959), p. 8.

[6]Fritz, p. 8.

[7]Fritz, p. 8.

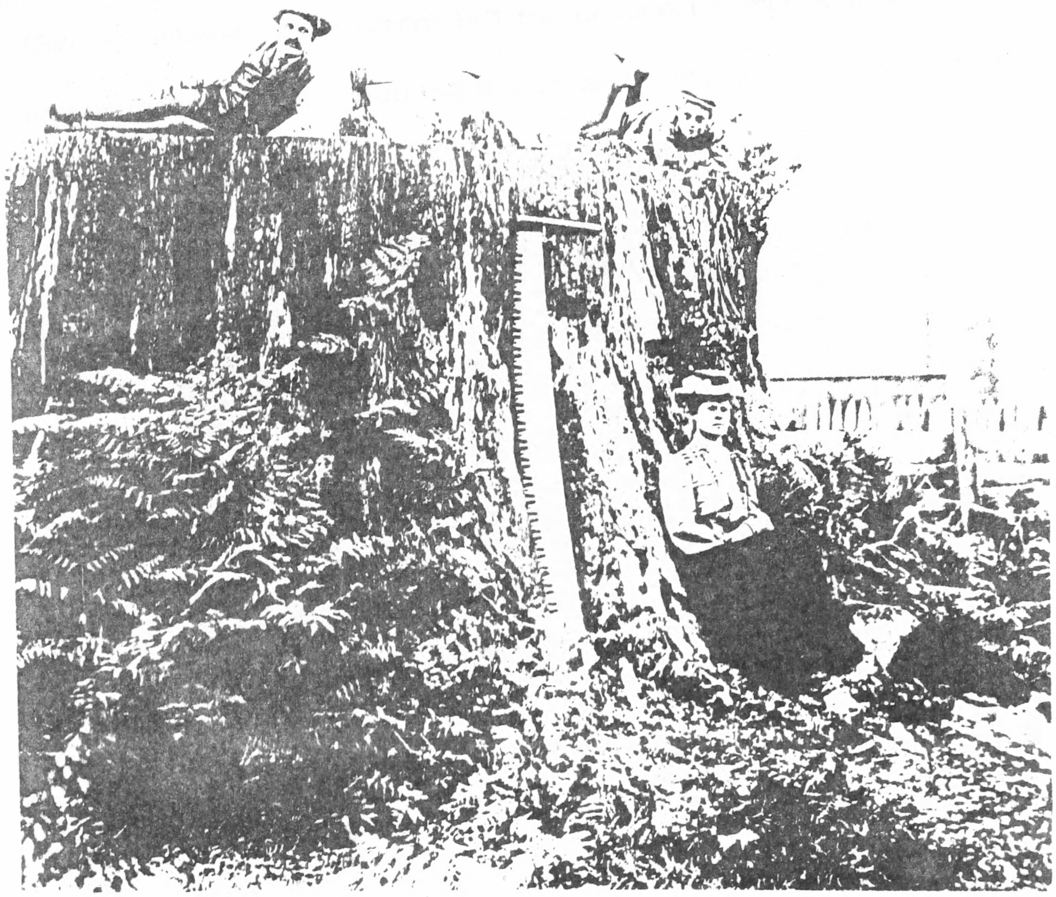

Figure 26. Fertile, highly productive redwood sites were often cleared for pasture by homesteaders. Many of these areas received repeated burnings to keep down the growth of ferns and sprouts. (Meiser Photo)

VEGETATIVE REPRODUCTION

Sprouting is a unique feature of the redwood and is as vigorous among second-growth trees as it is among the larger trees.

This holds equally for basal sprouts on live trees, trunk sprouts following fire or pruning, top sprouting, and stump sprouting after felling. Even when sprouts are removed, they promptly recur. In 1922 an unusual snow storm left the ground littered with broken tops and branches, thus requiring the trees to replace broken parts by sprouting.[8]

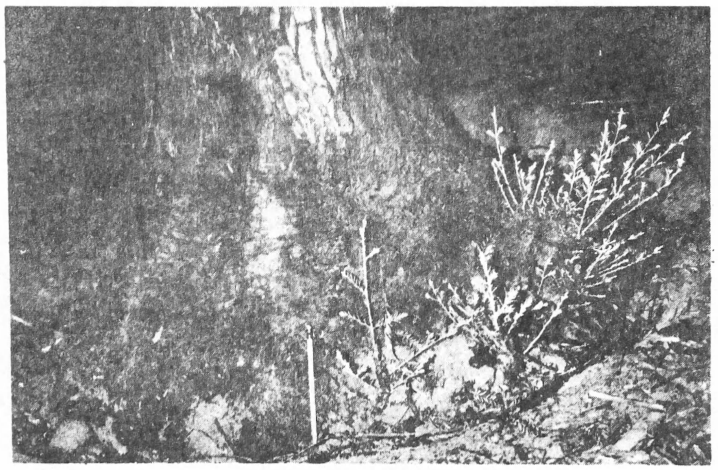

Figure 27. Basal sprouts

The ability of redwoods to sprout at any season of the year within two or three weeks after logging is an outstanding characteristic which no other commercial conifer possesses. It is not uncommon to have fifty to seventy sprouts come up from a three foot stump. All of these sprouts soon develop their own root systems and compete with each other. Within a short time the dominant

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[8]Fritz, p. 14.

sprouts create a circle of new trees around the old stump.

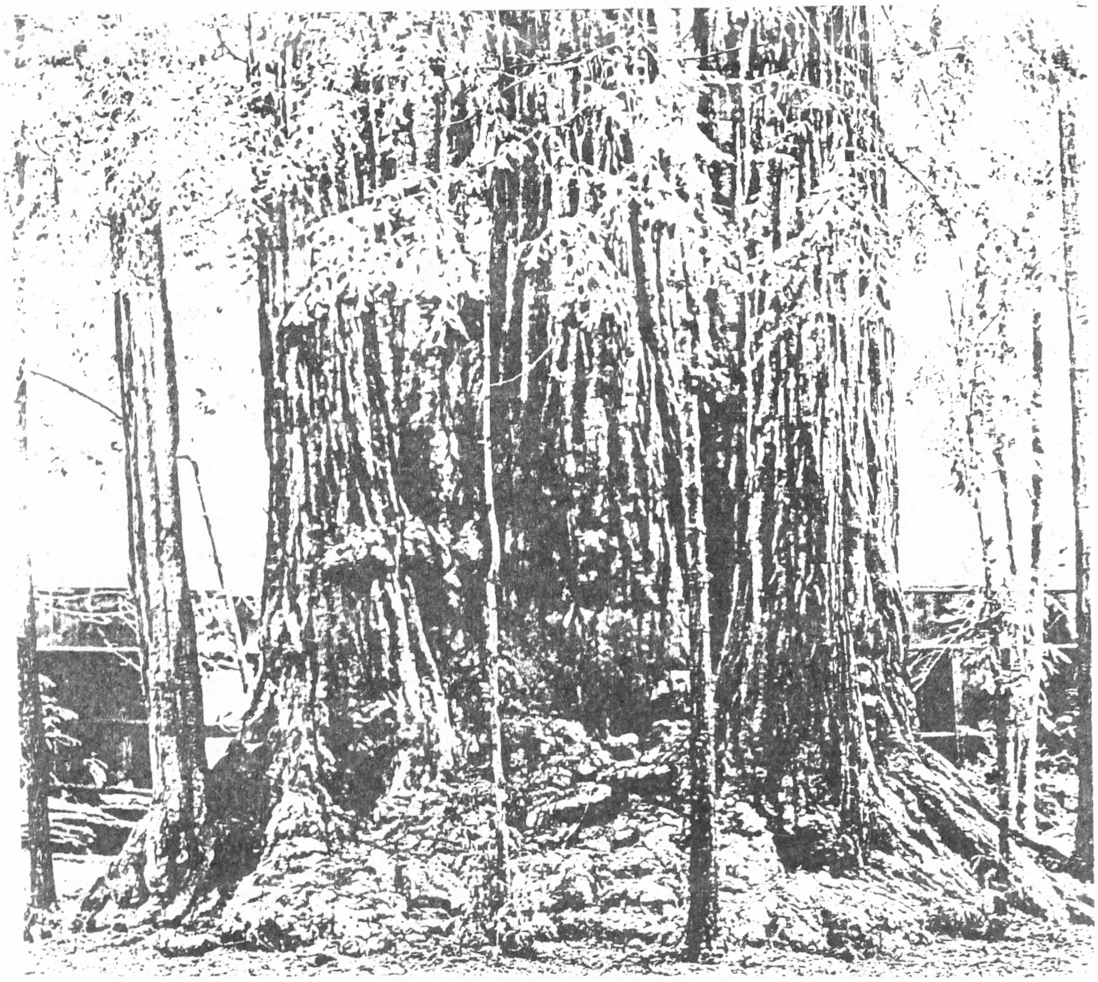

Figure 28. This clone of redwood trees developed from the stump of an old tree. (Meiser Photo)

Sprouting is more abundant on good sites. The tendency to sprout may also be influenced by the size and age of the trees. Eighty-one percent of trees less than fifty-six inches sprouted in one study while only thirty-six percent of trees over 126 inches produced sprouts.

Sprout development is more vigorous around stumps 500 to 700 years old. Trees over 1200 years seldom, if ever, sprout when cut.

A redwood seedling begins to develop a burl around its stem slightly under the soil surface when about six months old. This burl soon produces many dormant buds, some of which will sprout if the seedling is damaged. Occasionally these burls get tremendous in size and are often used in making novelties.[9]

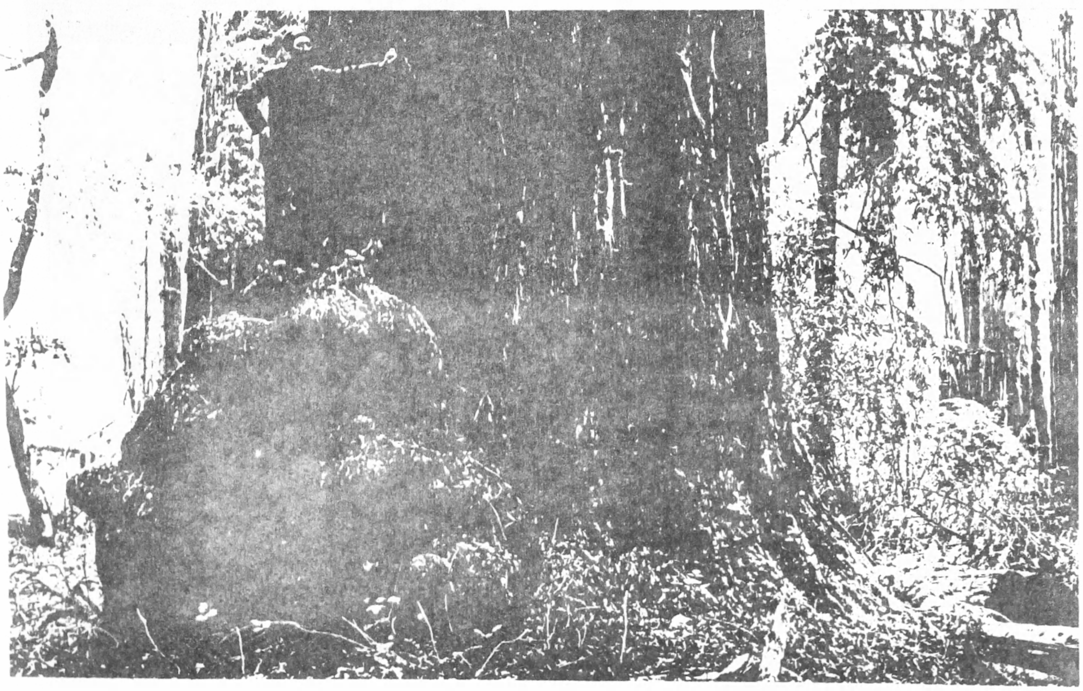

Figure 29. Large Redwood Burl (Meiser photo)

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[9]Roy, p. 7.

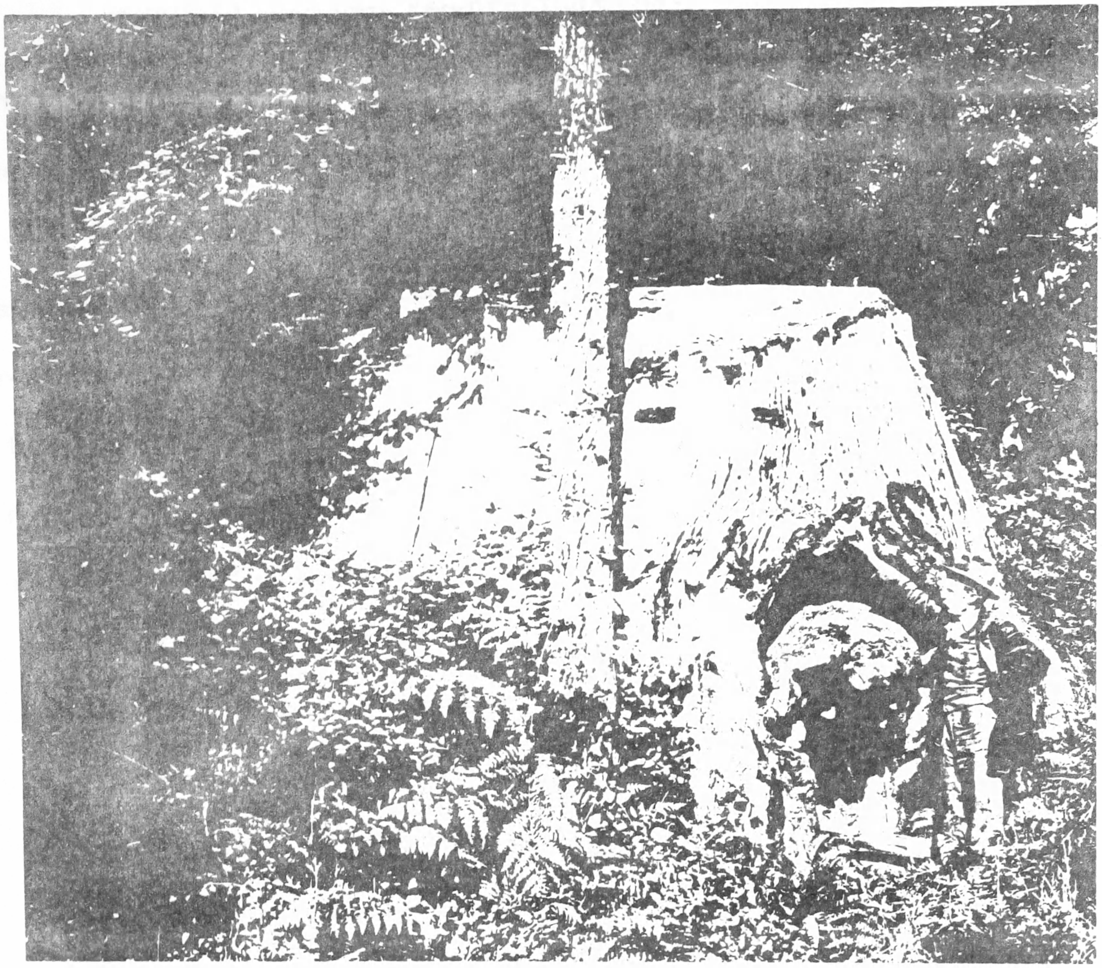

Figure 30. This down redwood log apparently sprouted at the age of 1300 years and produced a redwood tree which was cut at age 1800 years. (Meiser Photo)

SEEDLING DEVELOPMENT AND GROWTH

If the ground is moist and the weather warm, redwood seed is generally ready to germinate soon after it falls. Mineral soil is the best seedbed, but germination will take place in duff, debris, or under other vegetation and in either shade or full sunlight if soil moisture is adequate.

Redwood seedlings require more soil moisture for survival than do most other trees. Consequently, late spring and early fall rains can be critical.

Seedlings on fully exposed soil can withstand considerable surface heat if their roots have penetrated an abundant, permanent moisture supply. Otherwise they die before soil temperatures reach 140 degrees. Since redwoods apparently have no root hairs they do not function efficiently in extracting soil moisture and for this reason require a constant supply.

The first two years following logging are the most favorable for regeneration due to the lack of competing vegetation. Only a negligible amount of stocking is added by new seedlings after the first four years. Seedling mortality is heaviest the first year, especially on south exposures where moisture relationships may not be good.

A height growth of eighteen inches is not unusual the first year of seedling growth but slower growth the first four or five years is more common. Height growth usually accelerates when seedlings reach four to six years old. Sprouts are commonly twenty-four to thirty-six inches high at the end of the first season and grow more rapidly than seedlings because they draw from the parent tree's root system.[10]

[10]Roy, p. 9.

Root growth of seedlings is best in loose soil and may go to a depth of twelve inches the first season compared to only three inches in heavier soil.

Juvenile growth is best in full sunlight but seedlings can endure heavy shade, with a reduction in growth rate.

Radial growth begins in late March, increases to a maximum by late May and declines to a minimum by the end of September. Growth from October first to March fifteenth is neglibible. Height growth generally ends by mid-July but sometimes continues until September.

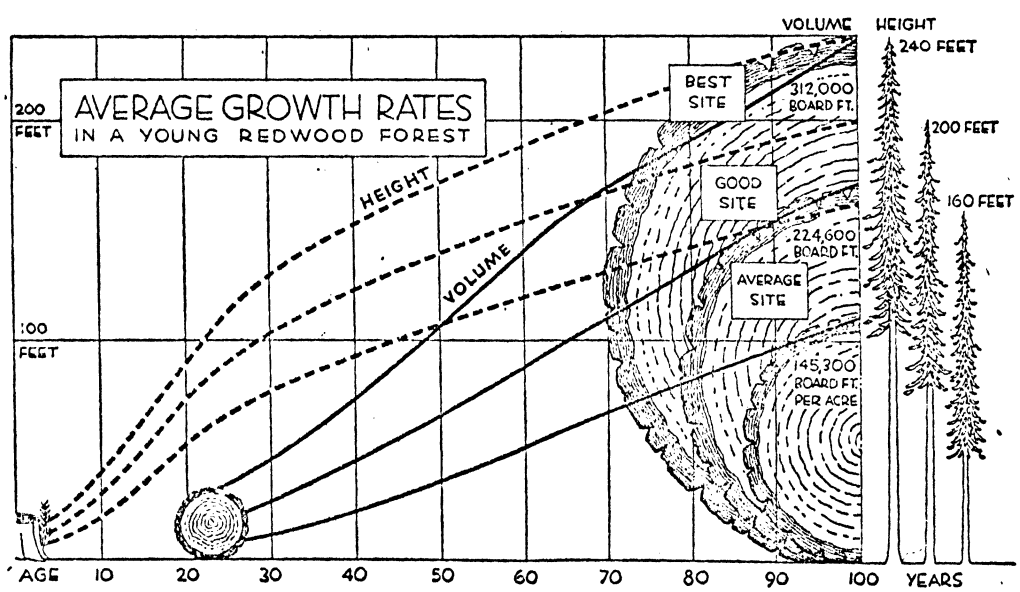

Figure 31. Redwood Growth Curves[11]

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[11]Adams, p. 101.

Redwood is best known for its great size but the average size redwood is smaller than many people realize. Measurements on a thirty acre tract gave diameter distributions as follows: fifty percent in the twelve to thirty inch size class, thirty-two percent in the thirty-one to sixty inch class, eighteen percent in sixty-one and over. Trees with diameters of twelve to sixteen feet found scattered over the range are considered large and diameters of twenty feet or more are rare.[12]

Trees taller than 200 feet are common and some on good sites are over 300 feet in height. The tallest tree on record is located in Redwood Creek Grove in Humboldt county and measures 367.8 feet. The greatest volume of wood in any single standing tree is probably in the Rockefeller Grove on Bull Creek Flat. It measures 356.5 feet tall and sixteen and a half feet in diameter.

One tree from the Maple Creek drainage in Humboldt county scaled 361,366 board feet by the Spaulding log rule, enough to build twenty-two average homes. A yield of 100,000 board feet per acre is not uncommon for redwood, even on slopes.

The yield of young-growth redwood stands at one hundred years is expected to range from 56,000 board feet per acre on low sites to 358,000 board feet on high sites, with much of the acreage now under management producing 2,400 board feet per acre per year.

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[12]Roy, p. 10.

USES

Lumber for building purposes has been the outstanding use of redwood from the beginning. Shingles and lath were also among the early products as was heavy commercial timber. About 1890 the industry began to compete with the Pacific Northwest and the South for the Eastern market. Redwood became known as the specialty lumber because of its peculiar qualities of resistance to fire and decay, its durability and freedom from shrinkage.

In home construction, redwood is used for outside walls, window and door frames, storm sash, interior paneling, shingles, and construction timbers. In industry, redwood is used in cooling towers, tanks, and vats. In those concerns, such as the wine industry, where tanks are needed which will not impart a taste or odor to the product, redwood has filled an important need. Other uses are pumps and pipes, silos, boxes, crates, coffins and caskets, and ship siding. One of the very important uses in the West was its use as railroad ties.

Newer uses for redwood are Presto-logs, insulation made from the fibrous bark, and roofing felt.[13]

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[13]Howard Bret Melendy, "One Hundred Years of the Redwood Lumber Industry, 1850-1950" (Ph.D. Dissertation, Stanford University, 1952), p. 34.

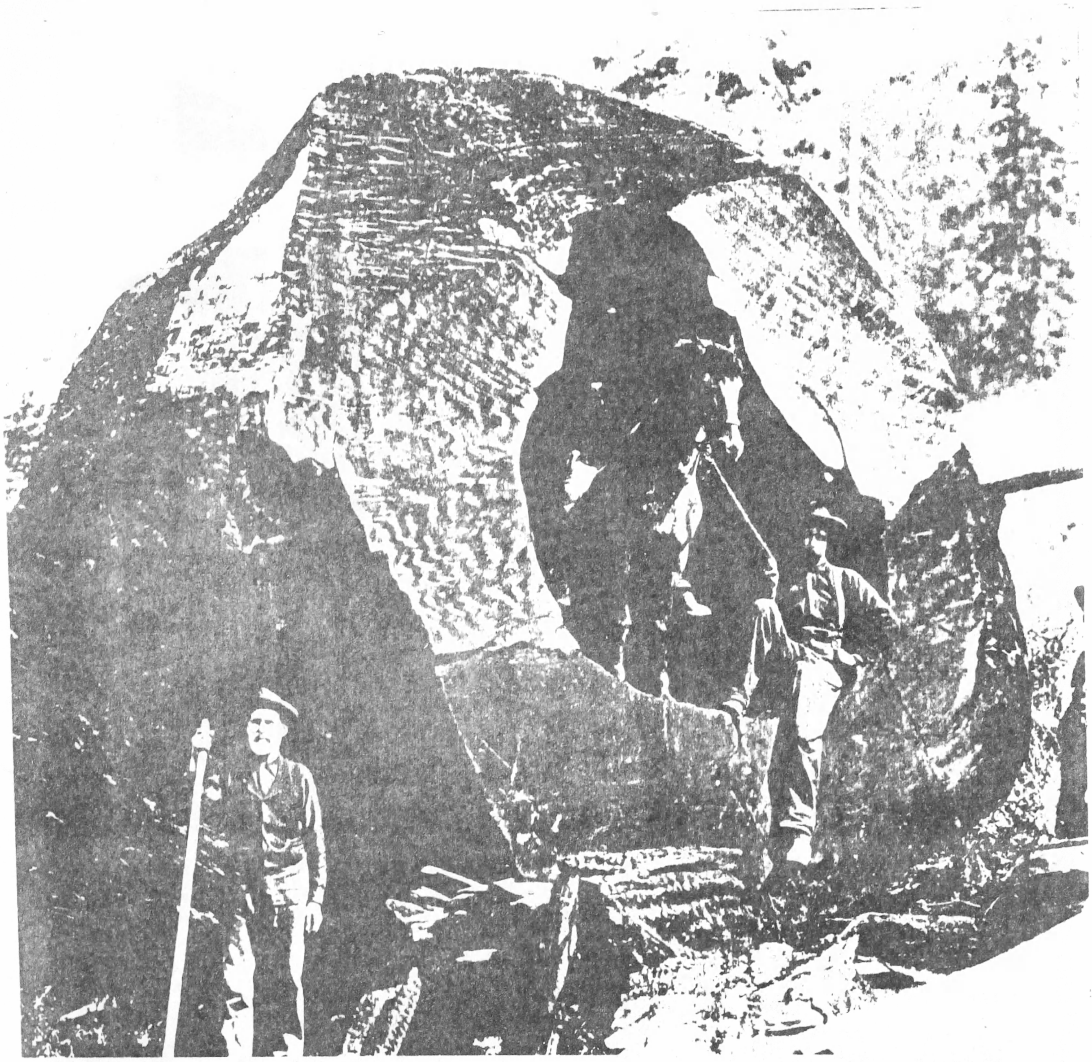

Figure 32. Redwood had many specialty uses. This one was to be a museum in San Francisco, but would not go through the railroad tunnel at Table Bluff ridge south of Eureka so it wound up as lumber. (Meiser Photo)

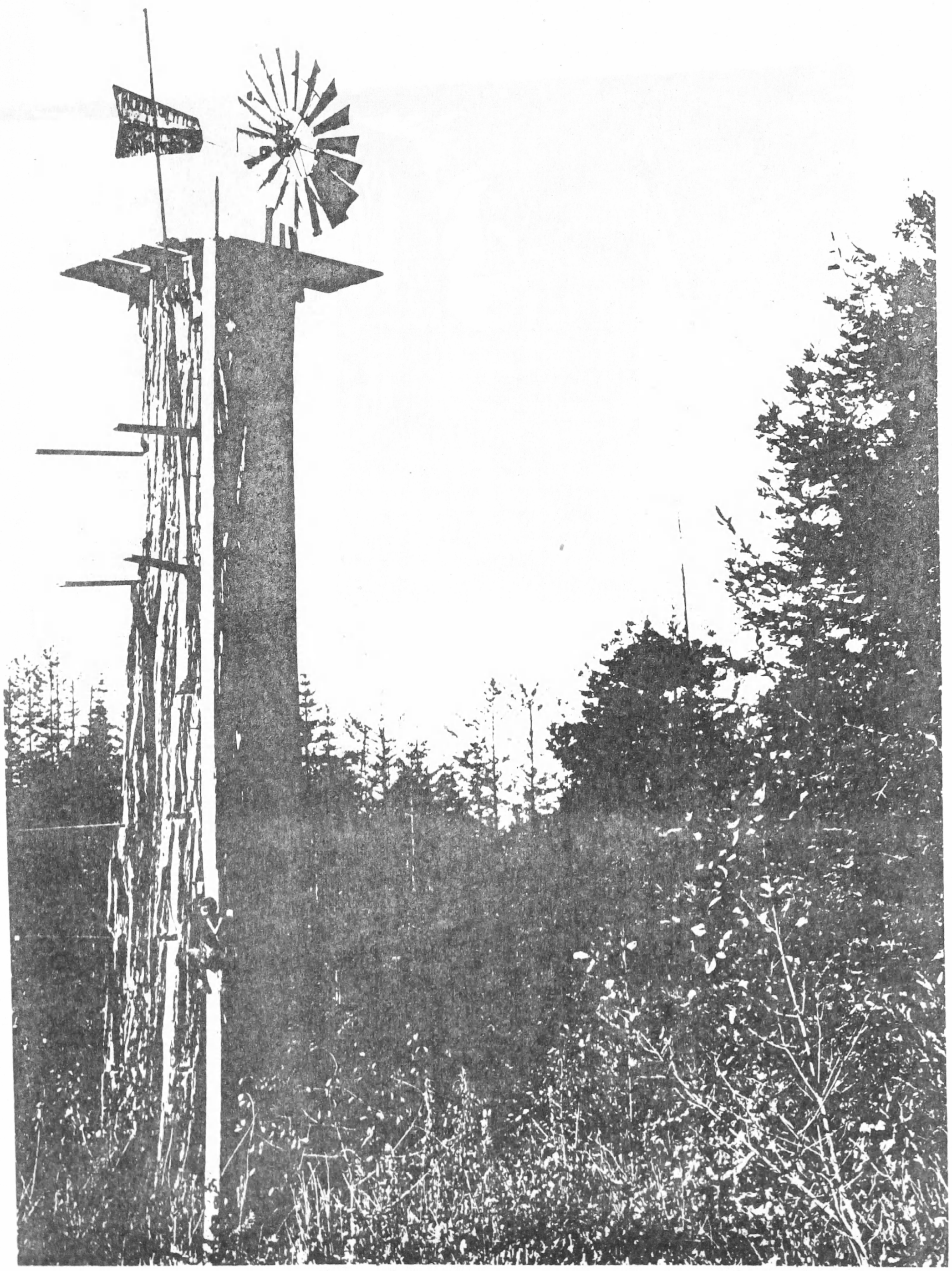

Figure 33. Some redwood trees had highly specialized uses. (Meiser Photo)

Figure 34. This nineteen foot diameter redwood is being made into railroad ties and shingle bolts. (Meiser Photo, 1905)

CHAPTER VIII

EARLY LOGGING AND EXPLOITATION

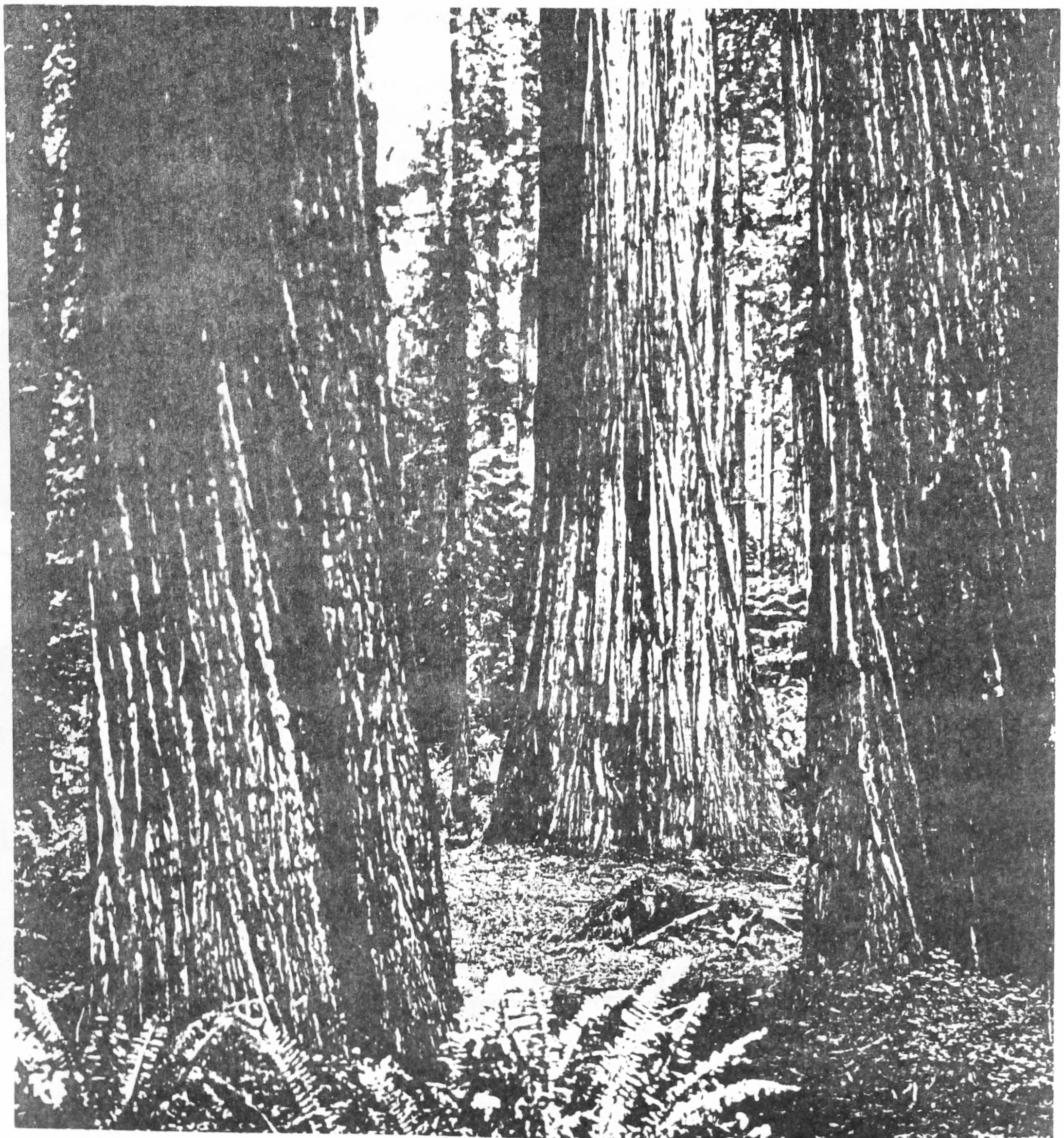

Figure 35. Timber sites in the redwood region looked like this before the logging crew arrived. (Meiser Photo)

LOGGING CREW

The self-styled "timber beast" who works in the woods today does not appear much changed from his nineteenth century predecessor. He wears the traditional spiked boots and suspenders that hold up a pair of stagged pants. He packs a hefty sized lunch bucket, still called a nose bag from the days of horse logging, and he chews tobacco because smoking is usually prohibited on the job.

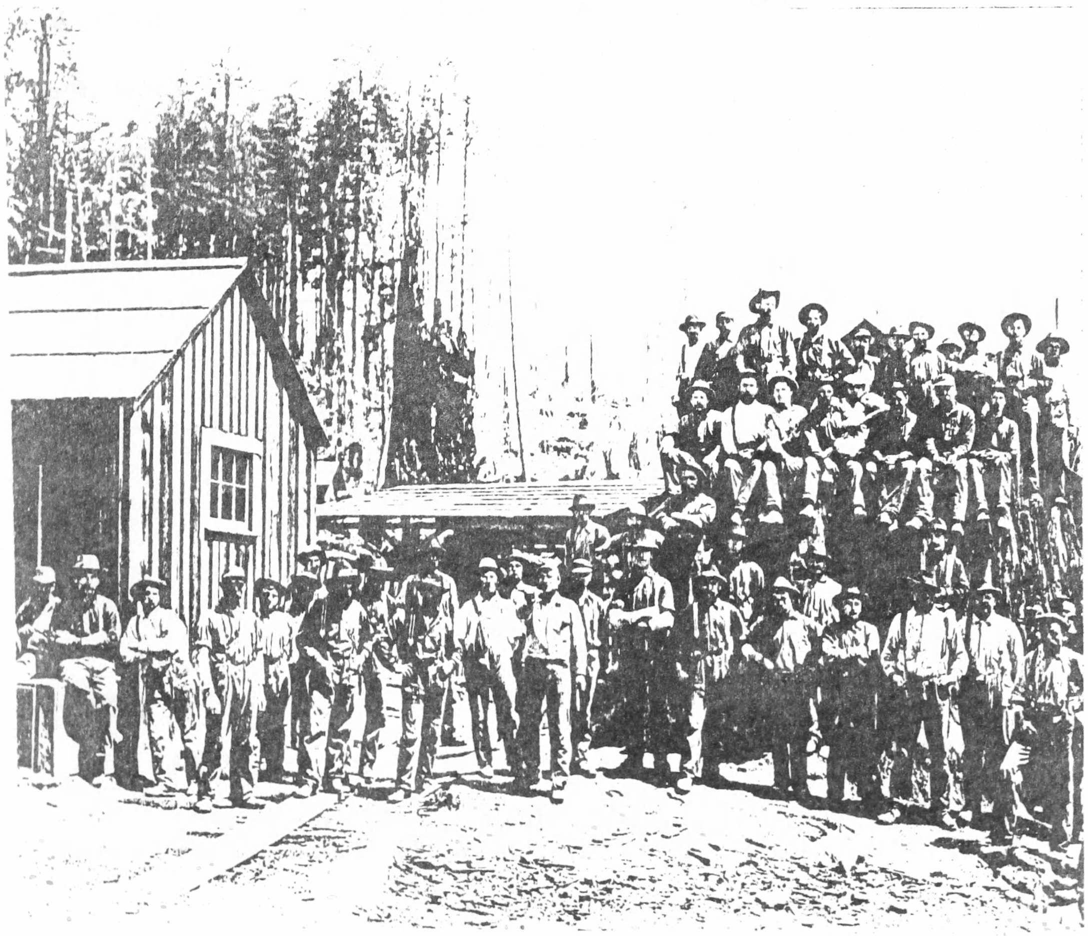

Figure 36. In the spring the original logging crew, which had been in the woods since the beginning of the year, was increased until it numbered forty to sixty men. (Meiser photo)

One outstanding difference is that the early woods workers seldom, if ever, wore hard hats.

Standard procedure in most early logging camps was to open up shortly after the Christmas holidays if the winter had been mild.

Preferably falling was done during the rainy, winter season when the ground was soft, thus minimizing breakage. The trees were left until spring when the area was burned. The fire destroyed much of the brush, branches and bark, but did little damage to the tree bole which was still too wet to burn.[1]

As the industry grew and developed, the standard procedure in the woods during the spring and summer was to cut a one-year's supply of logs in advance of the needs of the sawmill. In late fall the entire area was burned over to get rid of all slash that had accumulated from the bucking operation. Early loggers did not pursue this clearcut and burn procedure nearly so much as did later ones. The procedure became common only when the mills were able to cut up the logs as fast as the woods crew could supply them. After the area had been fired, the logs were left for the rainy season which washed off most of the soot and ashes, thus making them ready to transport.[2]

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[1]Henry Gannett, "The Redwood Forest of the Pacific Coast", National Geographic Magazine 10, (May, 1899): 156.

[2]Melendy, p. 15.

A crew of about twelve men was sent to a camp when it was opened up. These men consisted of a cook, several choppers, a few sawyers and peelers, who peeled the logs and ringed the trunk for the sawyers.[3]

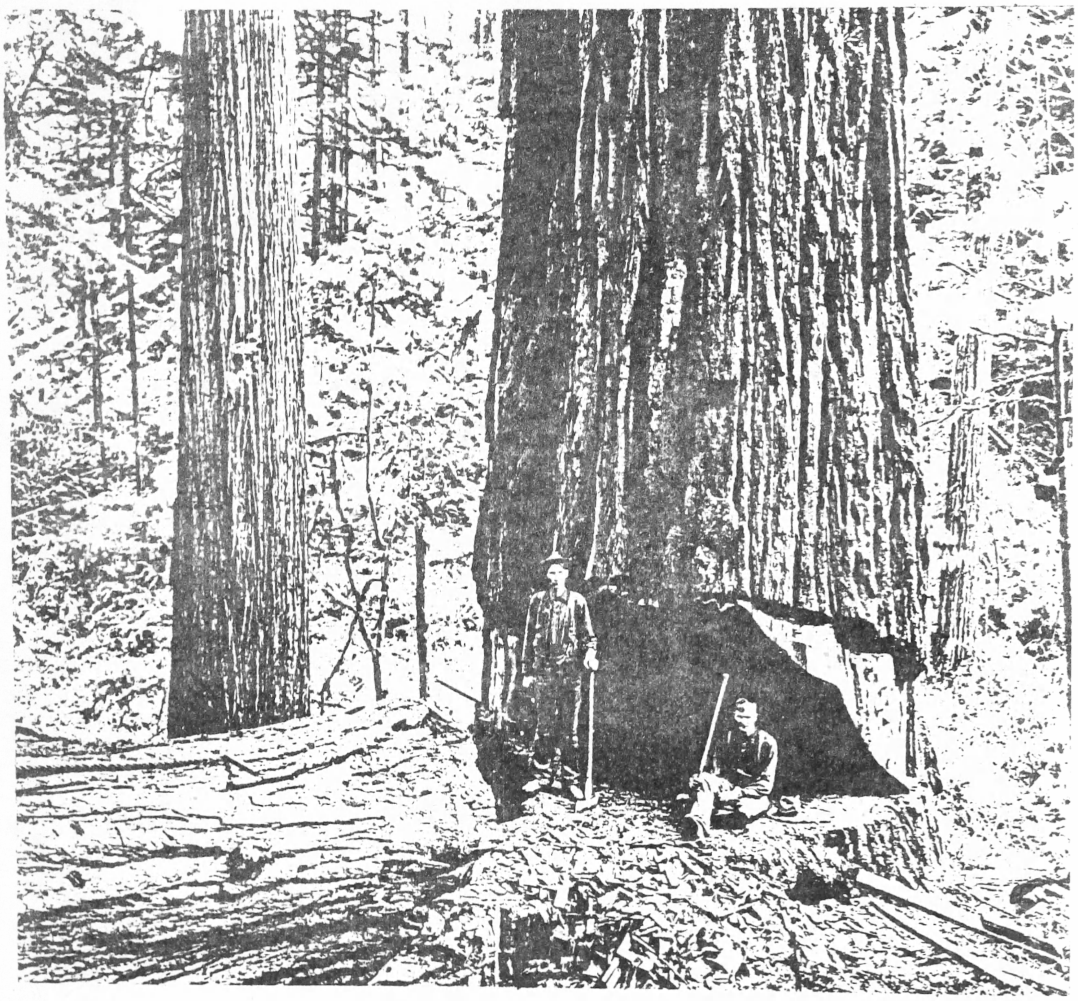

Figure 37. In 1860 it took four to five days for a pair of choppers to lay the bedding and fall a redwood. (Meiser Photo)

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[3]Melendy, p. 32.

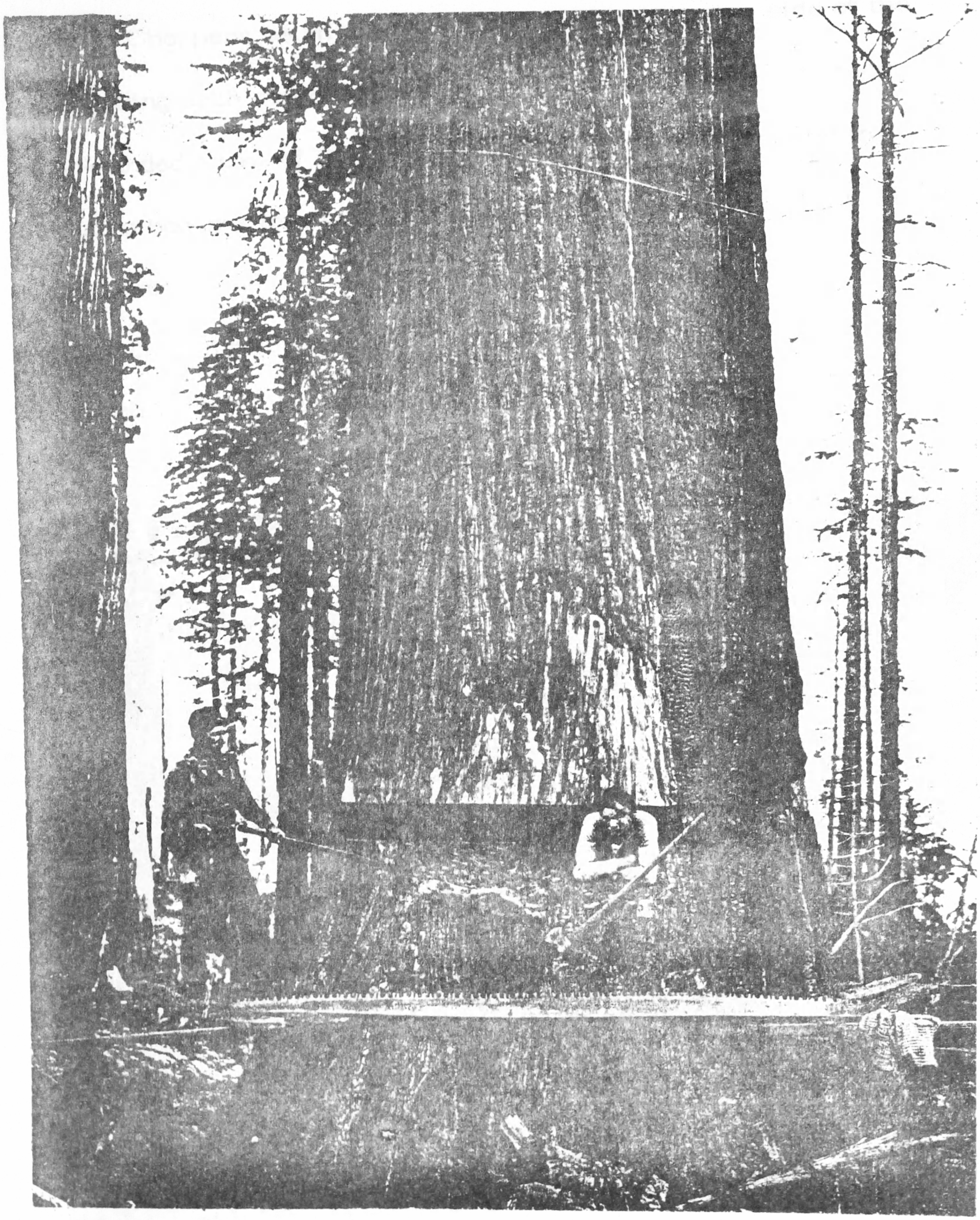

Figure 38. Ducket brothers work on a Humboldt undercut near Eureka. This kind of undercut took the notch out of the stump and left a square end on the butt log. (Meiser Photo)

Choppers usually worked in pairs on the same side of the tree, facing each others. One chopped left-handed and the other right-handed. One of these, the head chopper, took the lead in directing how the tree was to be felled. Considerable responsibility rested with the head chopper since he selected the direction of fall which would minimize splitting and damage when the huge tree came thundering down. He also had to bear in mind that many other trees

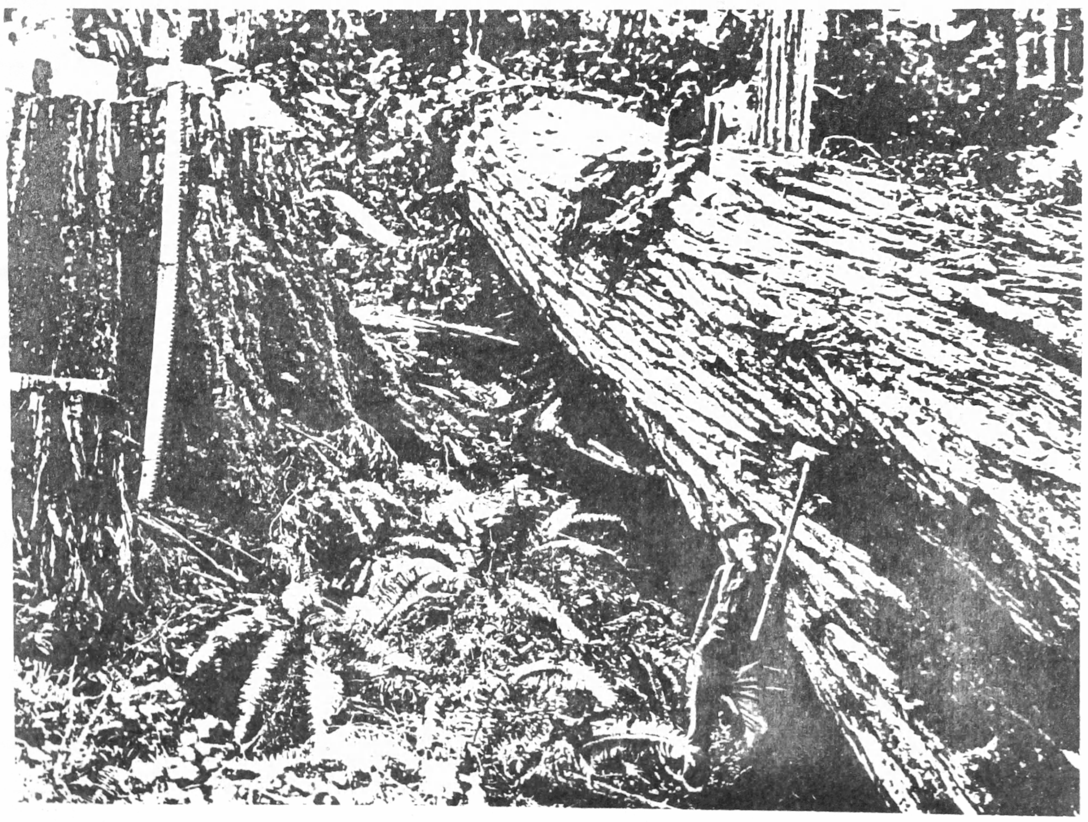

Figure 39. After the tree was felled, the peelers came to strip off the bark so that it could be more easily bucked into logs. (Meiser Photo)

must be felled in the same area before any timber was removed from the site.[4]

After the huge undercut was made, they moved the spring-boards to the back side of the tree where the sawyers began sawing. After the tree was felled, others in the logging crew came in to assist in stripping off the bark and cutting the tree into logs.

In sawing the trunk into logs, a single man used a cross cut saw eight to twelve feet long. In the early days a sawyer not only did the sawing but had to be able to file and set his own saws. By the 1890's most camps employed a filer to keep the saws in good working order.[5]

When the bull teams arrived in camp to begin skidding logs, the teamster, or bull puncher, was the most important person there. His importance was based on the fact that the bulls were the ones who determined the output of the entire camp, and he was the only one who could get the work out of them. This feature made the teamster the highest paid person in camp.

An average load of logs numbered from three to seven, depending on their size, and were attached one after the other by dogs with the largest logs first in line. In the early days, if a log

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[4]Ibid.

[5]Melendy, p. 34, citing Humboldt Times, October 24, 1889, 2:2.

was over six feet through, it was split with wedges or blasting powder before the load was made up for the haul.

When a team started for the landing with a load of logs, the work of the teamster and water packer began. The water packer was all important to the success of the team, for he protected the life of the teamster and oxen. It was the packer's duty to accompany the team and throw water just in front of the first log to make the road slippery so the load would pull with a minimum of resistance. Trouble could come if a packer made the road too slick on a steep slope, causing the load to slide down on the oxen and injure them. If he did not keep the road wet enough, the load would hang up and be difficult to get under way again.

The roadway was lined with five gallon kerosene cans which had the tops cut out and a handle attached. These cans were filled with water and were available to the packer as the load went along. The packer tossed water with great skill as he ran along with the moving load of logs. If the load began moving too rapidly, he threw dirt in front of the logs to slow them down. The tin cans were usually refilled on the return trip to the woods. The packer's job was considered a dangerous one because one fall meant he would probably be run over by the load of logs. When the load reached a level spot in the skid road the packer got a rest because the road was covered

Figure 40. Prior to 1881 all the labor of handling logs in the woods was done with bull teams or horses. The bull whacker was paid one hundred dollars a month for driving eight or ten yoke of oxen down the slippery skid road. (Meiser Photo)

with a heavy crude oil or lubricating grease.[6]

The teamster, or bull puncher, was a colorful person. He led his oxen into position and then started to talk in low tones to each of his animals until each one was pulling into his yoke. Then he started shouting and poking with his four foot goad until the oxen began to move slowly ahead, the logs jerking forward and sliding down the road. The teamster ran along side the load shouting encouragement to the animals as they kept moving toward the landing.[7]

Life in the old time logging camp was a hard one at best. The hours were long and the work dangerous. The men lived close to the cutting operation in shanties which surrounded the all important cook shack. The redwood camps furnished their loggers with a high protein diet which was necessary because of the tremendous output of energy. A typical breakfast would include hot cakes, eggs, meat, fried potatoes, bread and butter, pie or cake, and coffee. The other meals consisted of pork and beans, fresh meat, bread and butter, stewed dried fruit, pies, gingerbread, cake, tea and coffee. The cook shack was the center of life in the camps and woe be the company who provided a poor cook. The shanties were

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[6]Ralph W. Andrews, This Was Logging, (Seattle: Superior, 1954), pp. 52-53.

[7]Melendy, pp. 42-43.

crowded bunk houses with wooden floors and a pot-bellied stove in the center, and usually a heavy layer of dust over everything.[8]

EARLY EQUIPMENT

Tools used in the early logging industry were very simple. They consisted primarily of a couple of teams of bulls with necessary chains and snatch blocks, some manila rope, a few screwjacks and wedges, some pointers and, of course, axes and cross cut saws. Some operators claimed that five-thousand dollars worth of equipment would produce fifty-thousand feet of logs a day.[9]

Bulls

Ox teams, or bulls, as they were commonly called, could move tremendous loads and were much preferred to horses because they were not so flighty. In 1877 one of John Vance's ox teams hauled six logs from the cut to the log pond, over a half mile distance. These six logs scaled 14,000 feet.[10] In 1881 a ten ox team hauled four logs scaling a total of 26,902 feet a distance of three-quarters of a mile.[11] A good daily average for a team was thirty logs from

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[8]Melendy, pp. 38-39, citing Wood and Iron 27 (February, 1897): 99.

[9]Andrews, p. 52.

[10]Melendy, p. 44, citing Humboldt Times, September 8, 1879, 3:2.

[11]Melendy, p. 44, citing Humboldt Times, September 10, 1881, 3:1.

the woods to the landing. Once on the landing the logs could be jacked onto cars or into the water.

Axes

In making the undercut, both choppers worked together, using double bitted axes weighing three to four pounds. The helves generally used were manufactured in Pennsylvania, especially for the industry. They were second growth hickory, strong and elastic and thirty-eight to forty-two inches long. This made the biggest and heaviest axe used in the United States. This was necessary for as work progressed the choppers had to reach as much as five or six feet into the tree to complete the undercut.[12]

Saws

Saws, of course, were tremendously important in the redwood industry. Many of the cross cut saws were sixteen to eighteen feet in length. Larger cuts were made by cutting a sixteen foot saw in the middle and brazing in another saw.[13]

Screwjacks

As the timber receded from around the mills, logging began to move up the many rivers and streams where work became more difficult. The ox teams still pulled the string of logs to the

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[12]Melendy, p. 32

[13]Andrews, p. 43.

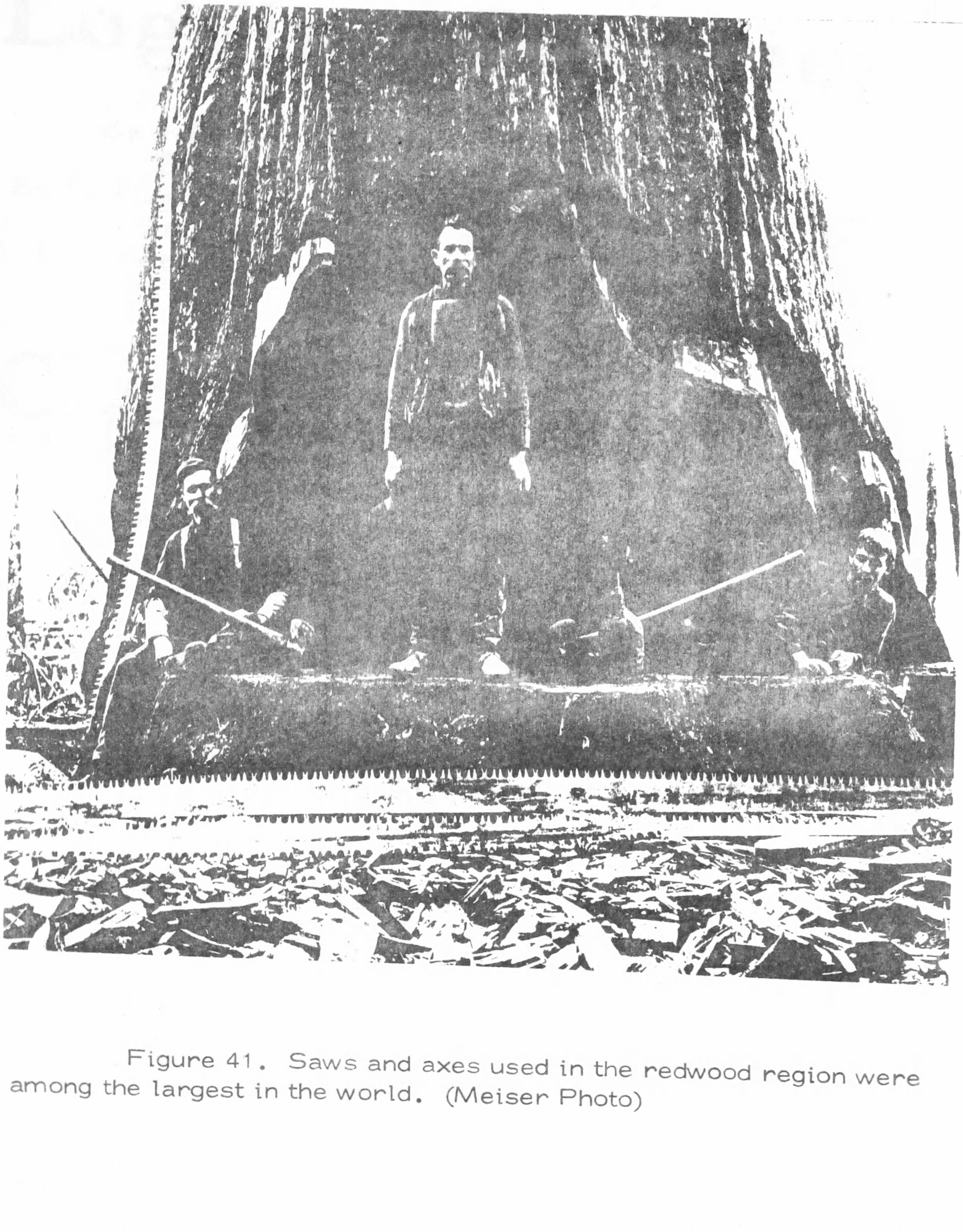

Figure 41. Saws and axes used in the redwood region were among the largest in the world. (Meiser Photo)

Figure 42. Advertisement for equipment.[14]

river, but the logger had no easy way of getting the logs out of the ravine, except by manual labor and a screwjack at each end of the log. The jack was used to turn the log, raise it up the steep bluffs or to roll it into the skidroads for the teams.

A screwjack can be seen setting on a stump near the springboard and wedges on the left side of figure forty-three. By the turn of the century log jacks looked like the one shown below in this advertisement from the Willapa Harbor Iron Works, South Bend, Washington.[15]

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[14]Timberman, Western Railway and Logging Railroad Directory, (Portland, 1917), p. 46.

[15]Timberman, p. 46.

HERCULES Logging Tools

(Patented)

Awarded Grand Prize and Gold Medal at
A-Y-P Exposition

HERCULES LOGGING JACK

WILL WORK IN ANY POSITION

The frame is made of the very best plow steel, with the sides riveted to a 1x2-inch steel standard, thus insuring great strength; and the bottom of the lifting bar is fitted with a claw for handling small logs.

No. 2 Hercules Log Jack

In the early logging days, a good screwjack could be purchased for about seventy-five dollars and was well worth the money.

<u>Gun or Pointer</u>

The pointer was a simple but highly effective instrument that assisted the head chopper in determining exactly where the tree would fall. Its two legs were placed against the back side of the undercut, thus allowing the other end to point the direction of the fall. So exact were these preliminary measurements that a tree in falling seldom varied a foot from the line laid out for it.[16]

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[16]Melendy, p. 23.

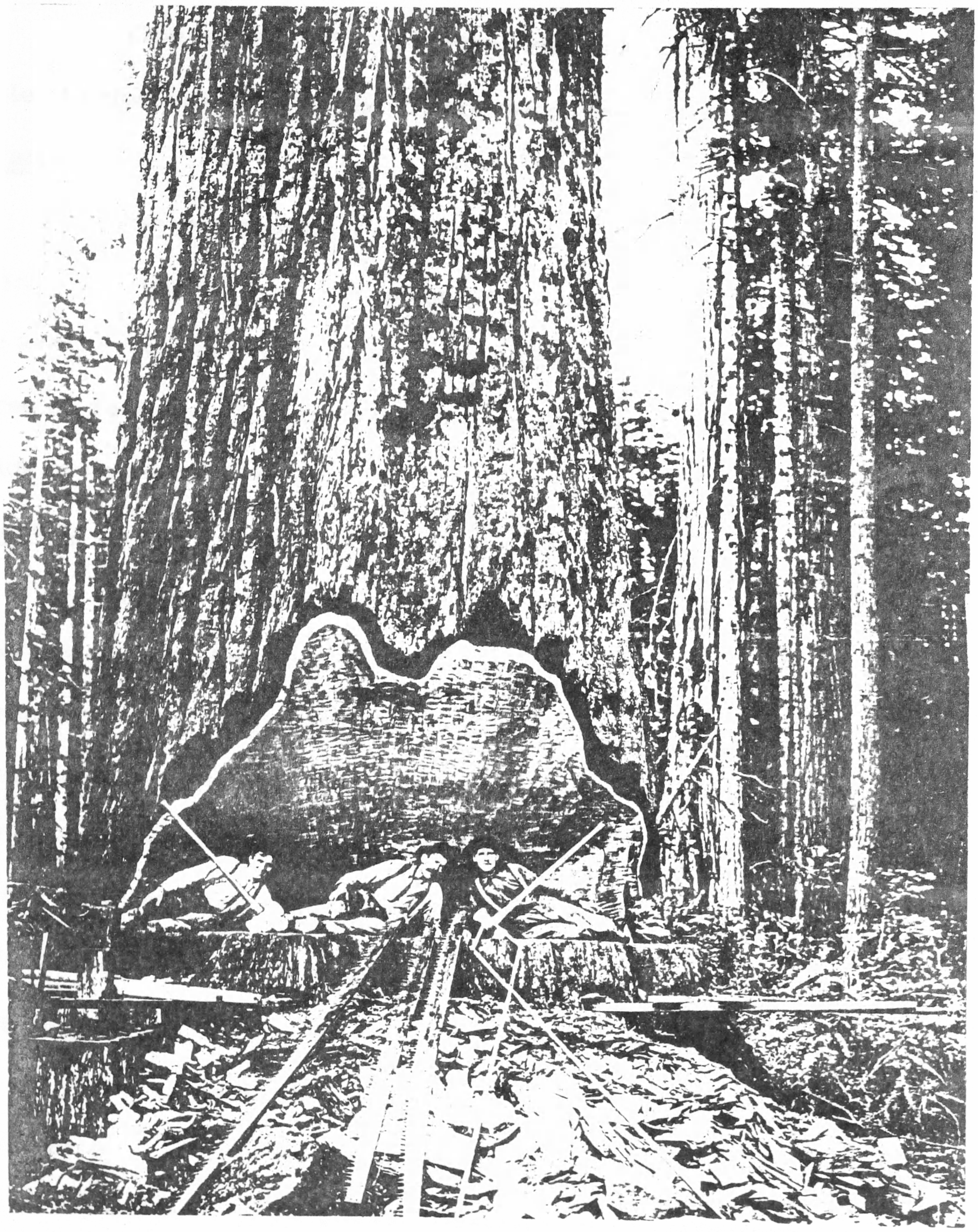

Figure 43. Tools of the trade, left to right: wedges (sticking in stump), screwjack (behind springboard), axe (in undercut), saws and a pointer. (Meiser Photo)

In the center of figure forty-three is a pointer lying on a pile of chips with the legs extending toward the bottom of the picture.

Wedges

Steel wedges were used to assist in the sawing of the backcut during felling. The wedges were driven in behind the saw to keep it from binding. They also served as a means to tip the tree off balance. Wedges are shown sticking in a stump on the left side of figure forty-three.

Augers

Another tool occasionally used in logging redwoods was the long stemmed auger bit. It was employed after the felling operation to split logs too large for transporting. When in use the operator would stand on top of the log drilling down to its center in several places. Explosives were then placed in these holes. When detonated they split the log into sections more easily handled. Figure forty-four shows auger bits ready for use on a large log.

MECHANIZATION

The large redwoods have posed many problems to the lumberman. The immediate problem facing the logger was that of felling and bucking the giants. Next was the transportation to the mill.

Waterways

Once the logs were hauled to the landing and rolled into

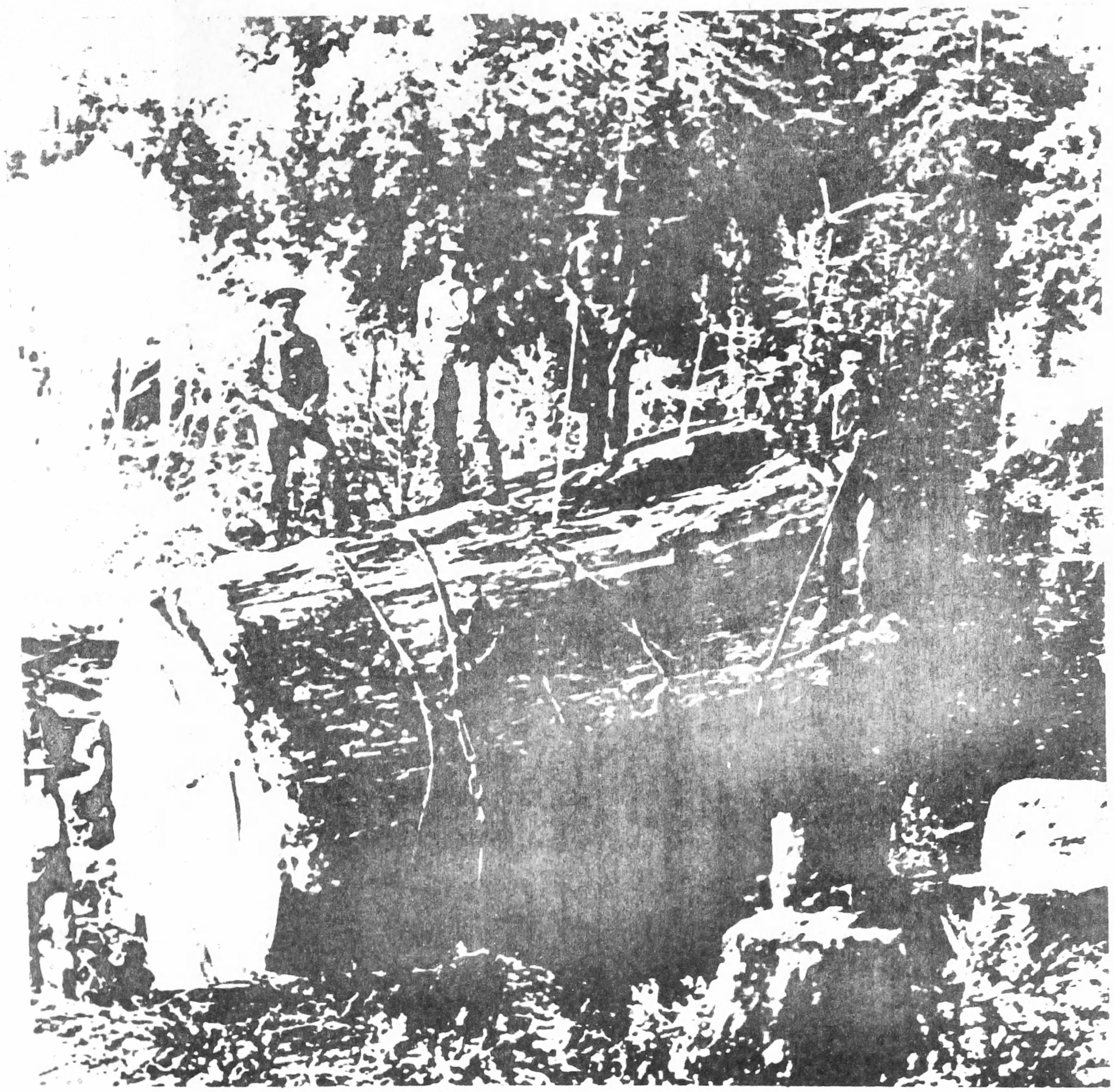

Figure 44. Powder holes were bored with long stemmed auger bits. (Meiser Photo)

Figure 45. In the summer thousands of logs were rolled into stream beds. Winter rains floated them down to the mills.[17]

the stream bed, they remained there until the winter rains provided enough water to float them to the mills downstream. No matter when the rains came, day or night, the log drivers were routed out to drive the logs down the swollen stream to the bay. In Humboldt county this system lasted until about 1880 when the railroad became widespread enough to supersede this uncertain method.[18]

In Mendocino county, however, the log drives lasted for a considerably longer time. Logging on the various claims was generally done by logging contractors who put their brands on the logs. Payment was not received until the logs arrived at the mill

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[17]David Warren Ryder, Memories of the Mendocino Coast (San Francisco: Taylor and Taylor, 1948), p. 17.

[18]Melendy, p. 36, citing Humboldt Times, March 20, 1902, 8:2.

Figure 46. When everything worked right on the river log drives and mill ponds were filled to capacity in anticipation of the next year's cut. (Meiser Photo)

pond. If the winter rains were not enough to float the logs, the contractors did not get paid. If the season was exceedingly wet and too much water came down, the booms would break and the logs were carried on out to sea. Occasionally logs would become saturated and sink to the bottom of the stream and maybe take two or three years to reach the mill. One example of the uncertainty of this method of log transportation occurred in Humboldt in 1879 when a sudden rise in the Elk river brought down all the old logs, which totaled thirty million feet, and all the new logs, totaling about four million feet, making a total of thirty four million feet.[19]

Roads

In the redwood region, there were three or four types of logging roads used in connection with animals. One kind was a wagon road on which four horses pulled crude trucks or wagons about sixteen feet long. These wagons carried small diameter logs and were equipped with wheels made of sections of logs thirty-six inches in diameter and about twelve inches thick. The edges were then banded with a strap of iron.

The second kind of road used was a pole road. It was made of logs about twelve inches in diameter which were joined end to end by overlap joints. These were strung over sleepers or ties. The

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[19]Melendy, p. 37, citing Humboldt Times, March 8, 1879, 3:4.

wheels of trucks were made concave to fit the size of the logs and thus moved along them to the mill.

Still another type of road was the strap road constructed by nailing strap iron to two by fours, placed end to end. Wagons were then pulled over the tramway.

Figure 47. This type corduroy road was common in both oxen and steam donkey operations. Note steam donkey working at the end of this road. (Meiser Photo)

The most important logging road in the redwood region was the corduroy skid road. The main part of these roads were called bull roads and were reinforced with cross logs on flat ground.

This enabled the loads of logs to be moved more easily. On steep ground the skid road was just plain dirt. This kind of road was maintained even after the steam donkey appeared.[20]

Steam Donkey

With the development of the railroad, it soon became apparent that woods operations would have to be speeded up considerably to keep the mills supplied with logs enough for full time operation.

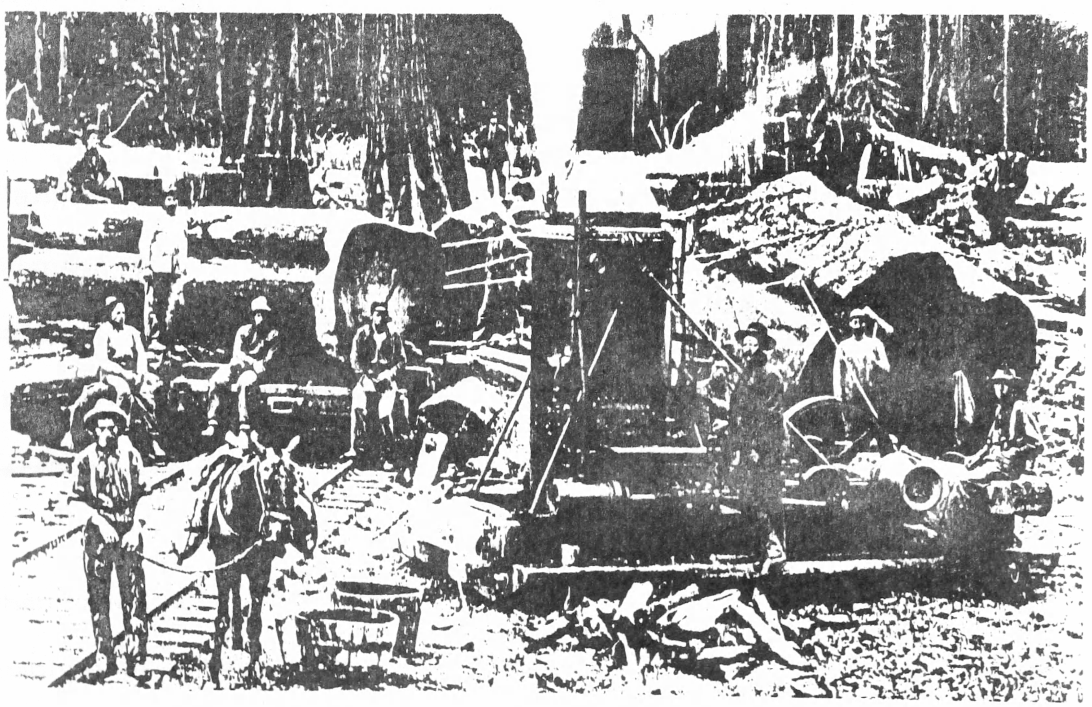

Figure 48. The steam donkey was the first invention designed to speed up woods operations. (Meiser Photo)

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[20]Melendy, p. 40.

The first invention which assisted in greater woods production was the Dolbeer Steam Logging Donkey, which appeared in August, 1881. This machine totally revolutionized logging in the United States and paved the way for modern logging. The donkey pulled logs from the ravines and hillsides and assembled them for the ox teams. The first donkey, invented by John Dolbeer of the Dolbeer and Carson Lumber Company, had an upright boiler with a horizontal shaft. A patent was issued on the machine April 18, 1882. The first machine worked so well that a second one was put into operation in 1882 and another in 1883.

On December 25, 1883 a patent was granted to Dolbeer on an "Improved Logging Engine" which had an upright spool. The first machine of this type was used by John Vance in Lindsey Creek. Both types of machines were used in the redwood region until about 1915 when more modern equipment took over. Some small operators, however, still used the donkey engines as late as 1928.[21]

The donkey engine was mounted on a wooden skid platform. When desiring to move, the manila rope was secured to a tree, thus enabling the donkey to pull itself into position.

The donkey crew consisted of an engineer, a spool tender, and someone to feed the hungry boiler fuel and water.

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[21]Melendy, p. 45, citing The Timberman 34, (March, 1933): 9.

Both the horizontal and vertical models of the donkey were equipped with four and one-half inch line which was given two or three turns around the spool and then played out to the log. A system of blocks and tackle was used to increase the power when moving large logs into position. The line was about 140 feet long

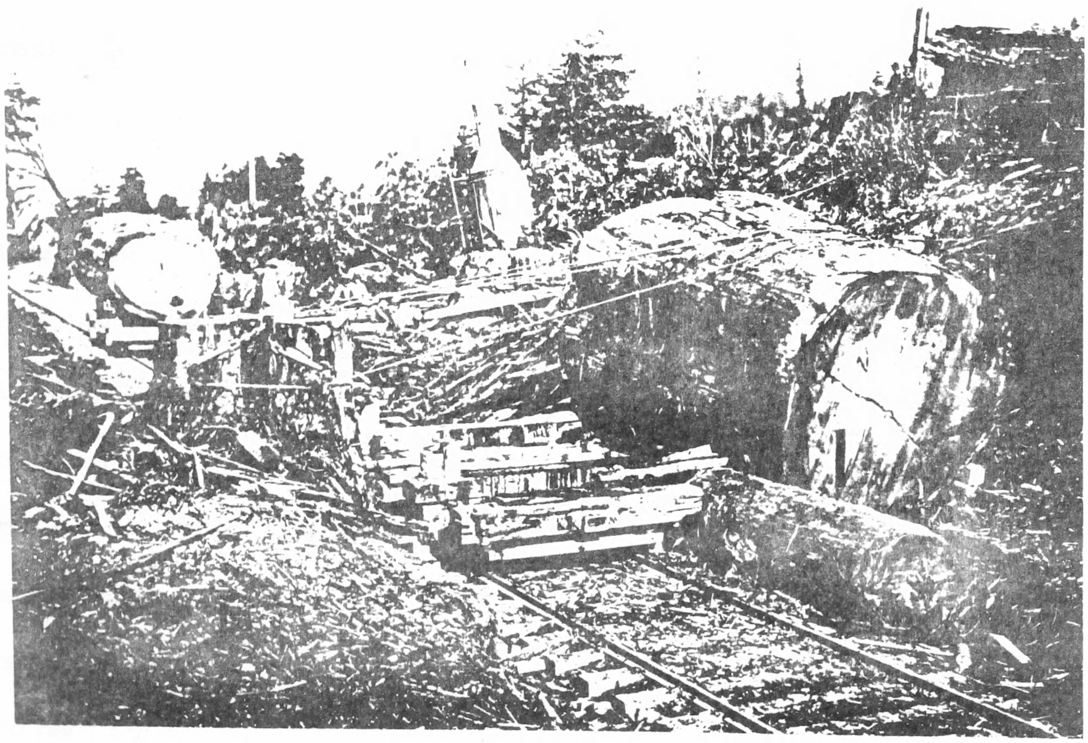

Figure 49. Blocks and tackle were used in order to obtain enough power to move and load large logs. (Meiser Photo)

and, as the line was pulled in, it was played off the spool onto the ground instead of being wrapped onto the spool.[22]

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[22]Melendy, p. 46, citing Humboldt Times (October, 24, 1889): 2:2.

In August, 1892, David Evans, E. H. Percy, and Bethune Perry were granted a patent on a skid road which had snatch blocks at the turns in the road to keep the lines in place. This skid road was carefully constructed with cross timbers on a gradual slope whenever possible.[23]

By this time wire rope had entered the scene and made it possible to skid logs from a considerable distance. This made practicable the introduction of the bull donkey, a machine invented by N. H. Pine of Eureka. This new donkey was equipped with enough line to skid logs over a quarter mile. The bull donkey was a portable machine with an upright boiler. The working parts consisted of two large drums behind two upright and two horizontal spools which slid back and forth on a spiral geared shaft to feed the line on and off the drums. The main drum held 4,350 feet of three-quarter inch steel cable which was used as the mainline when hauling logs. The smaller drum held 11,000 feet of one-half inch wire which was used to haul the heavier line back to the top of the skidway. The bull donkey soon made a name for itself and was scattered throughout the region.[24]

The procedure used with the bull donkey was to fasten as

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[23]Melendy, p. 47, citing Wood and Iron 16 (Sept., 1891):124.

[24]Melendy, p. 47, citing Wood and Iron 25 (April, 1896):130.

many as twenty logs together with dogs and heavy chain and fasten the hauling line to the first log. The half-inch haulback line was run through a block at the head of the skidroad and then fastened to the mainline. As the heavy line pulled the load of logs in, the lighter line was played off its drum at the bull donkey. The heavy mainline was kept in place by snatch blocks along the skidway. As a load of logs approached a turn in the road, the tender had to run along and open the blocks to allow the cable free passage to the donkey engine. Once at the landing the smaller Dolbeer donkey was used to load the logs onto cars while the bull donkey was bringing in more logs to the landing.[25]

Ships and Schooners

From the beginning it was lumber that brought white settlers to the redwood coast. There was some fishing and quite a bit of agriculture but it was converting timber into lumber, shingles, posts, ties, piles, etc. that chiefly occupied the people. When timber products were in demand the whole coast prospered; when they were not, everyone felt it.

The forest provided the raw material for lumber products and the ocean provided a highway to market. It was somewhat of a symbiotic relationship, for without the forest there was little to ship,

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[25]Melendy, p. 48.

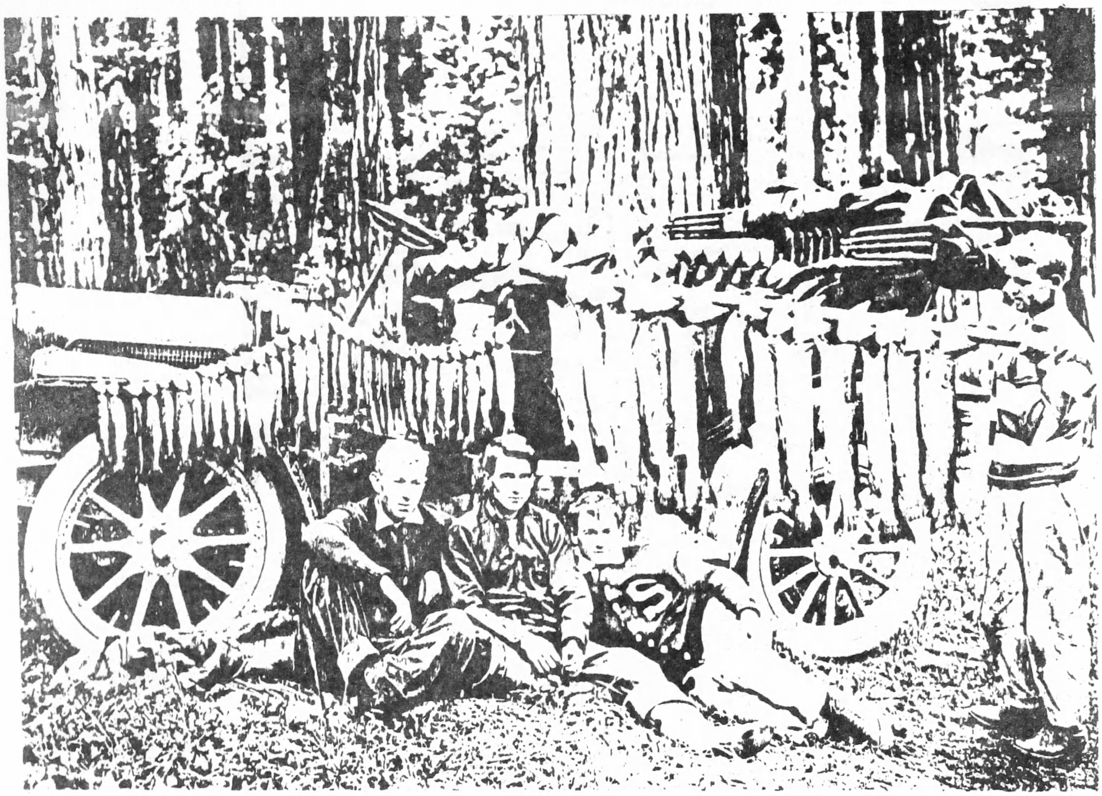

Figure 50. The redwood region not only produced good lumber but also good recreation. This is one day's catch at Big Lagoon. (Meiser Photo, June 1908)

and without the ocean there was no way to market until the railroad system was more fully developed about 1914.

All along the coast mills were built where the sea bit into the shoreline to make a small harbor. In many of these locations ships could not come into dock so chutes were built whereby products could be cabled out to waiting ships.

At several locations along the coast ships were built to serve these ports. Small lumber schooners, capable of getting

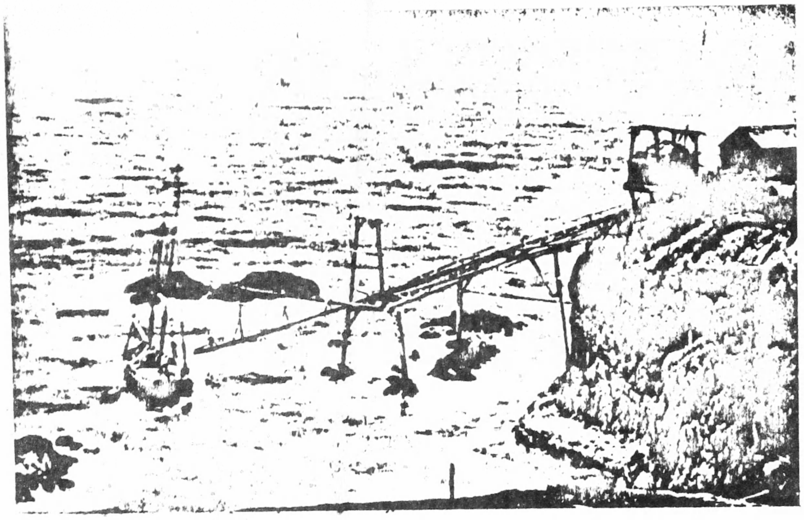

Figure 51. This wooden chute at Newport allowed small lumber schooners to load from Stewart, Hunter and Johnson's mill.

into the "dog-hole" ports, were in high demand. Captain Thomas H. Peterson and his crew at Little River built twenty lumber schooners and sold them as fast as they could turn them out. Charles Fletcher at Navarro built six or eight as did others along the coast. These, of course, were not sufficient to serve the entire coast so shipyards in San Francisco, Oakland, Benicia and Vallejo turned out scores of these small schooners to meet the demand.[26]

Loading from the chutes along the coast was very tricky business. Sometimes schooners waited off the coast for days until the sea calmed and they could load or unload. At other times loading had to be interrupted and the ship taken to sea if the wind blew or the sea got rough.

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[26]Ryder, p. 24.

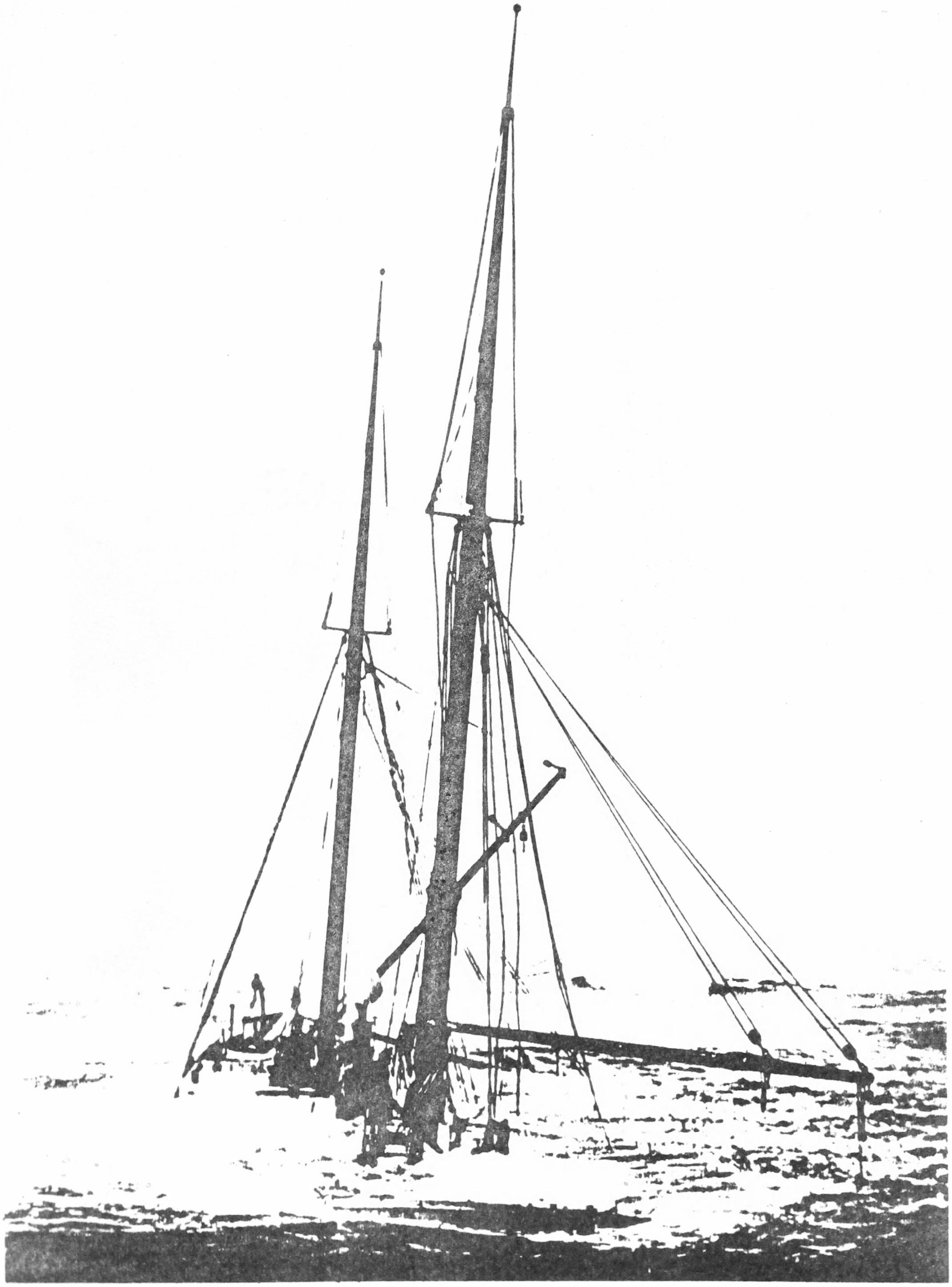

Figure 52. Not all the small schooners made it in and out of the dog hole ports safely. The Corona is shown here on her way down. (Meiser Photo)

Figure 53. Eureka became an important waterfront for the redwood coast. (Meiser Photo)

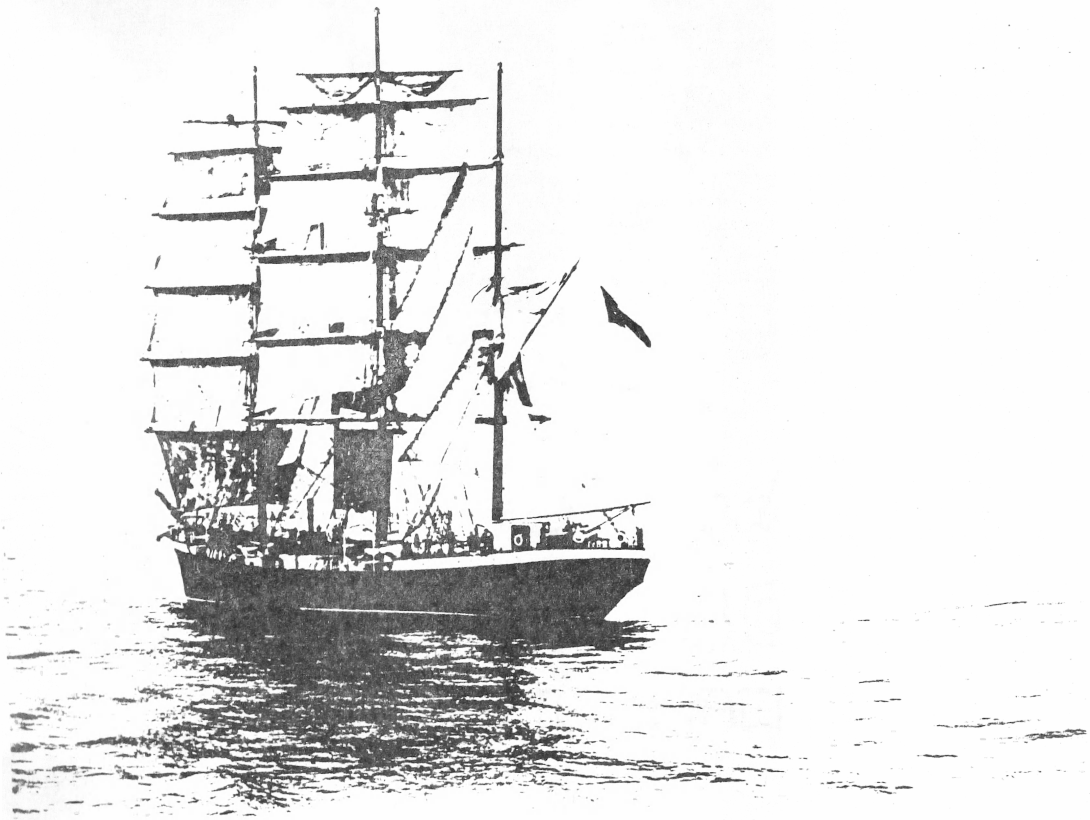

Figure 54. Loaded and outward bound. (Meiser Photo)

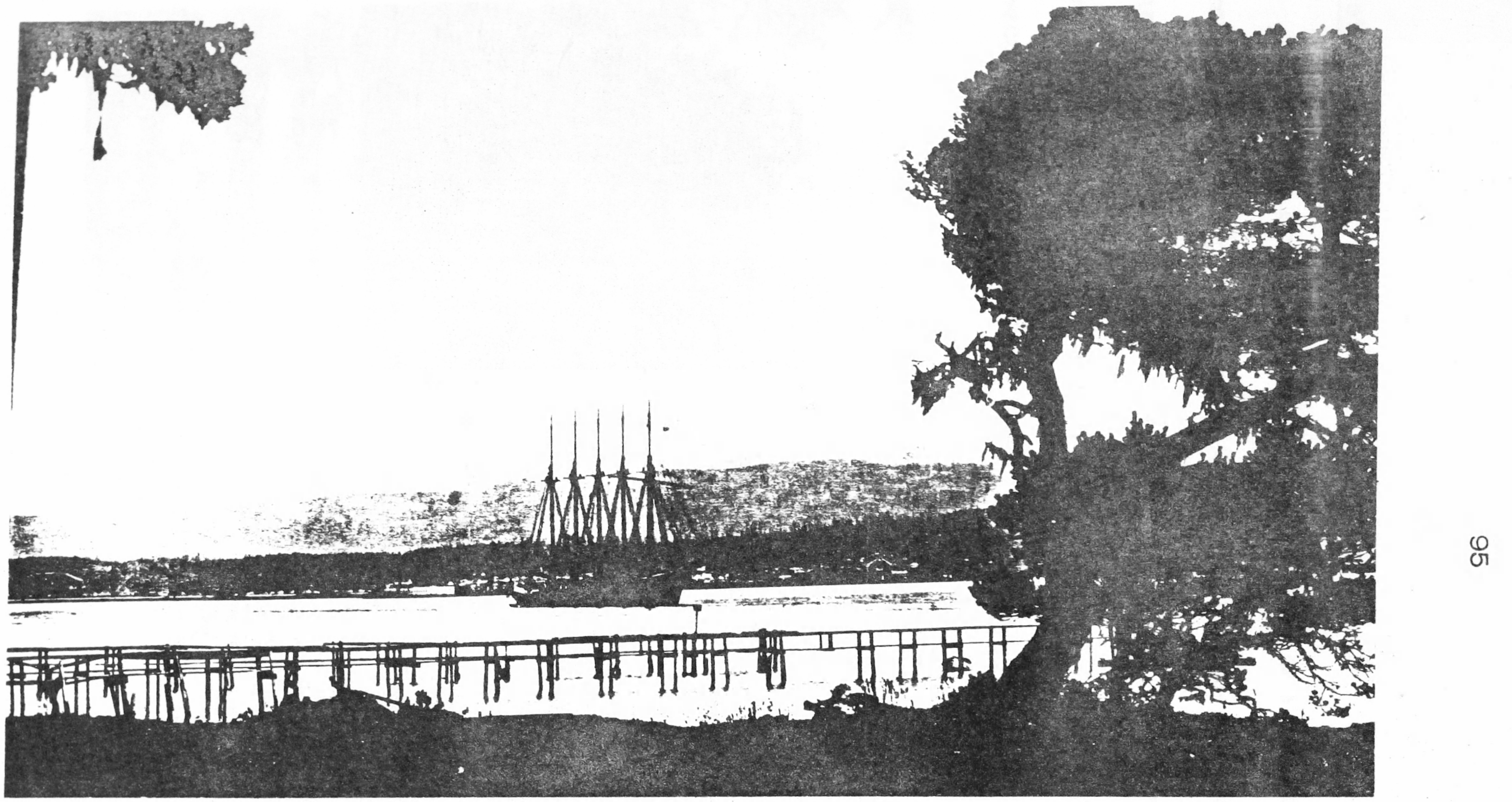

Figure 55. Sundown on Humboldt Bay finds this sailing vessel waiting for a load of lumber. Prior to 1857 sailing vessels depended entirely on the wind to bring them to the lumber docks.[27] (Meiser Photo)

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[27]Edwin T. Coman, Jr. and Helen M. Gibbs, Time, Tide and Timber (Stanford: Stanford University Press, 1949), p. 67.

Railroads

In the beginning rails supplemented the oxen but as technology improved, the expensive oxen slowly disappeared. Railroads were first used for short hauls, as from the landing to the mill. Their importance was in the speed they possessed. Soon the iron horse became even more important as it enabled loggers to get into places

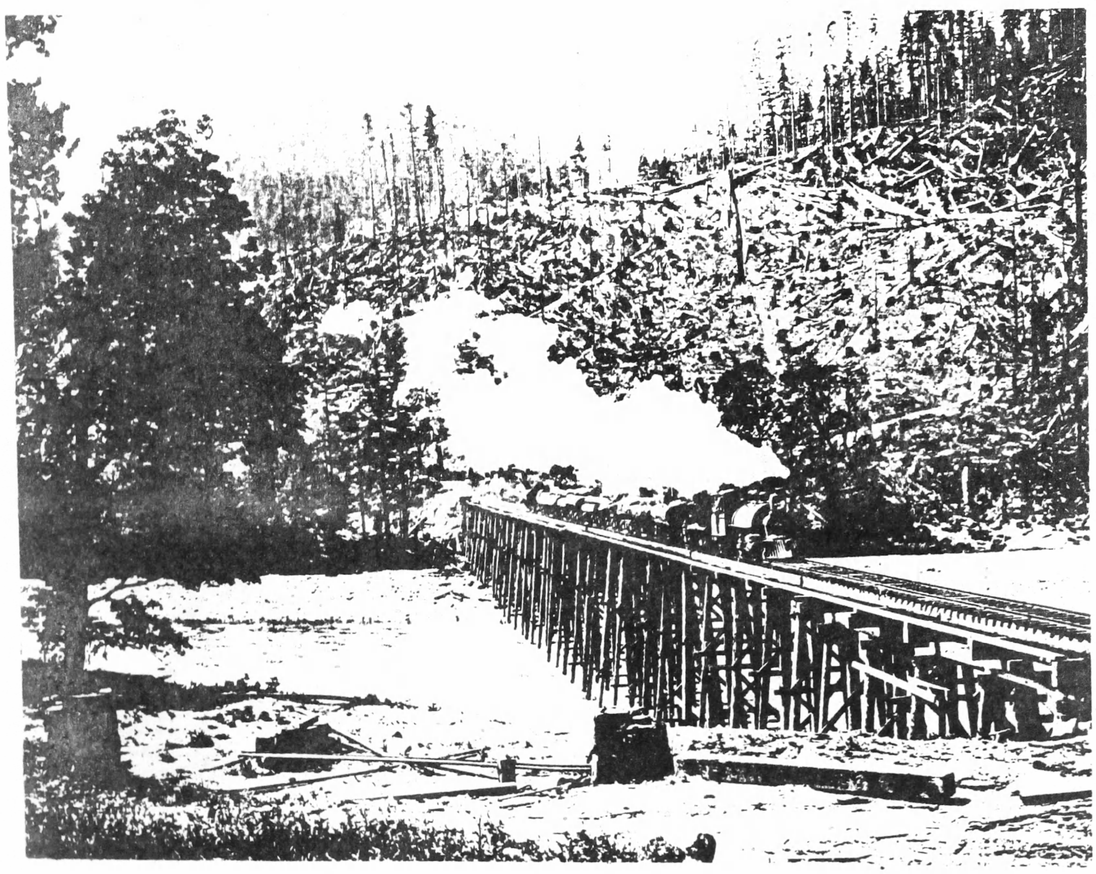

Figure 56. Shay locomotive pulling a load of redwood logs. Note the clearcut hillside in the background. (Meiser Photo)

which had been inaccessible to previous equipment.[28]

By the 1880's railroads in the redwood region had proven successful in moving logs from the landing to the mill. Logs traveled faster by rail than by water and at much more predictable rates. This allowed mills to locate away from streams and also put pressure on the woods crews for higher production.

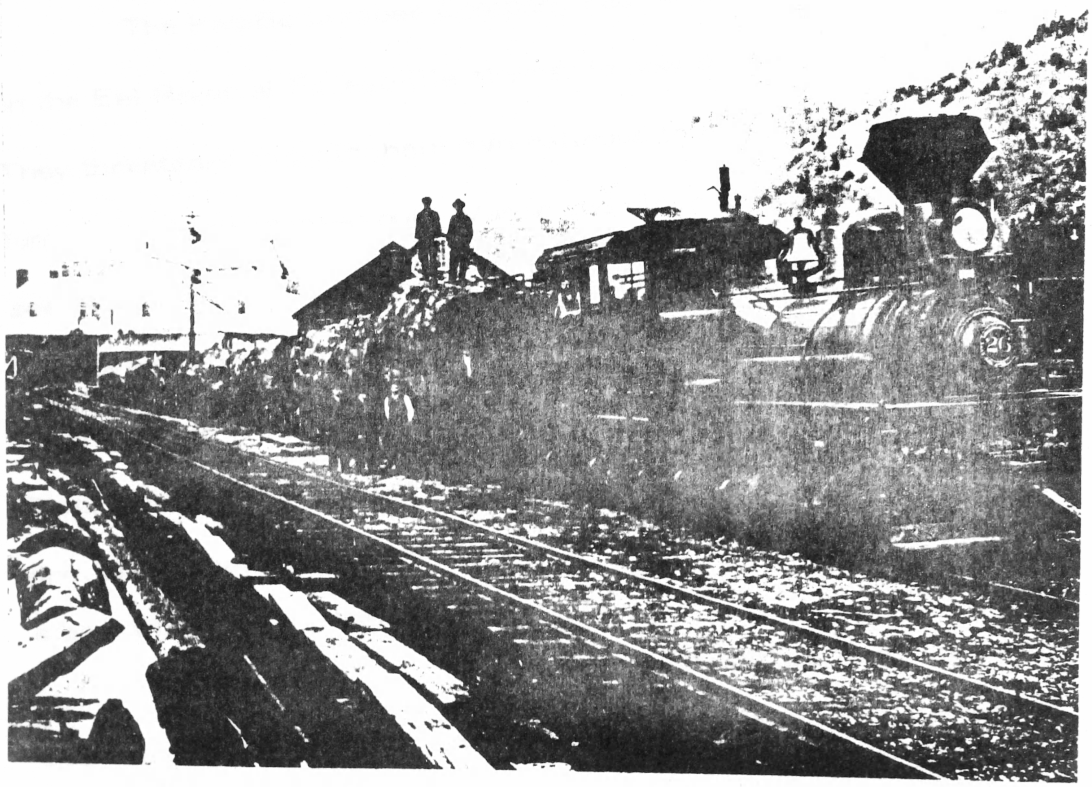

Figure 57. The shay gear driven locomotives were used on steep grades. This one has pulled a load of 56,000 feet of redwood to the mill. (Meiser Photo)

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[28]John Raymond Delong, "The Ravaged Rem nant: A History of the Logging and Preservation of the California Coast Redwood" (Master's Thesis, San Francisco State College, 1968), p. 30.

California's first railroad was built in 1854 when Captain Ulysses S. Grant was at Fort Humboldt. Some twenty miles of primitive but substantial logging railroad was in use.[29]

In 1868 General Pat Connor promoted a railroad from San Francisco to Humboldt Bay. John Vance who was a big redwood operator followed Connor and in 1871 made a political issue of a road from Eureka to the Eel River Valley, but it was voted down.

The Pacific Lumber Company had secured extensive holdings on the Eel River at Forestville at what is now the town of Scotia. They threatened to build their own railroad to Humboldt Bay so their lumber could be shipped out. Vance and other lumber tycoons could see the handwriting on the wall so they negotiated for the Eel River-Eureka Railroad. They made a survey in the summer of 1882 and incorporated in November of that year. Construction of the Eel River and Eureka began at Fields Landing, a small port on the south arm of Humboldt Bay some fifteen minutes from Eureka via the steam wheeler Oneatta.

This construction displeased the Pacific Lumber Company who tried to buy the Eel River and Eureka. Pacific Lumber finally built a road called the Humboldt Bay and Eureka from Scotia to Alton where they hooked up with the Eel River and Eureka.[30]

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[29]Gilbert H. Kneiss, Redwood Railways (Berkeley: Howell-North Press, 1956), p. 91.

[30]Kneiss, p. 92.

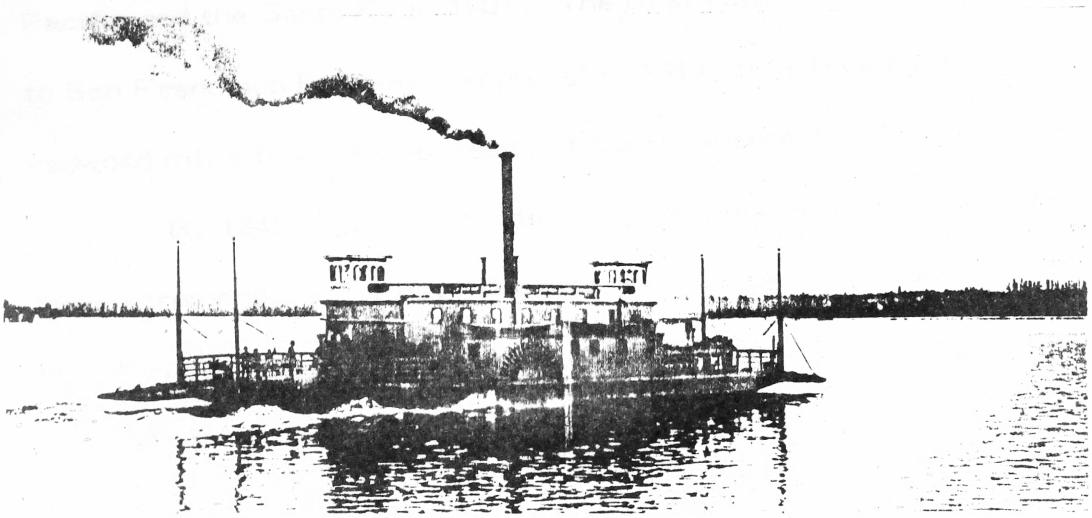

Figure 58. The steam wheeler Oneatta, perhaps similar to this one, ran from Eureka to Fields Landing from 1882-1885. (Meiser Photo, 1903)

The biggest obstacle in connecting the Eel River valley with Humboldt Bay was the Table Bluff ridge which called for a 2,000 foot tunnel. Vance, who was now Vice President and General Manager of the Eel River and Eureka, ordered day and night shifts on both sides of the tunnel until it was completed.

The first of Vance's locomotives arrived from Baldwin in May, 1884 and the Eel River and Eureka opened for business between Fields Landing and Hydesville on November 24, 1884. It wasn't until July 1885 that the track to Eureka was completed.[31]

Eventually the road was incorporated into the network of the Northwestern Pacific, a company organized jointly by Southern

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[31]Kneiss, p. 94.

Pacific and the Santa Fe in 1907. The first railroad from Eureka to San Francisco Bay was completed in 1914, thus freeing the redwood mills from the necessity of ocean shipments.[32]

By 1940 logging methods in the redwood region had undergone a tremendous change. The most serious problem now was not, how do we get logs out, but where do we get logs. It was about this time that the industry developed the theme, "Logs for Today; Trees for Tomorrow."

In 1949 the Union Lumber Company converted its railroad into a heavy truck road and now uses large diesel tractors to move logs rapidly to the mill. Other private roads have also been constructed for heavy, off-the-highway trucks.

Thus, logging in the redwood region has been completely mechanized and logs come out of the woods year round.

[32]Melendy, p. 175.

CONCENTRATION OF OWNERSHIP AND EXPLOITATION

In order to operate successfully, many mills found it necessary to acquire large tracts of timber. Their holdings did not come entirely from public domain but also from many people who, for investment purposes, secured a timber claim and later sold it to one of the lumber companies for a nice profit. In 1913 a Bureau of Corporation's survey found that twenty-three holders owned seventy-nine percent of the redwood timber.[33]

It is difficult to know just how large the original redwood timber stand was. The earliest survey of the entire area appeared in 1886 when John Dolbeer, the San Francisco partner of the Dolbeer and Carson Lumber Company, gave an estimate of the amount of redwood timber standing in 1881. Excluding Del Norte and the Klamath River Area the estimate was 23,650,000,000 board feet available. This first figure grossly underestimated the total timber stand in northern Humboldt and ignored all the stands in Del Norte.[34]

In 1894 Del Norte county had a total of 204,340 acres of timberland. Various companies and individuals owned 57,140 acres; the largest holder being the Northern California Redwood company

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[33]Melendy, p. 99, citing John Ise, The United States Forest Policy (New Haven: 1920), p. 319.

[34]Melendy, p. 140, citing California State Board of Forestry First Biennial Report 1885–1886 (Sacramento: 1886), p. 140.

with 13,091 acres.[35]

In 1897 Humboldt County had 492,000 acres of redwood timber remaining out of an original 538,000. By 1902 this acreage had fallen to 410,000. By this time eastern capitalists had purchased a total of 286,000 acres.

By 1902 the eastern capitalists had pretty well brought to an end the era when small operations in the redwoods consisted of a single man or a partnership capable of operating the mills. Not only were these easterners investing in timber but they shortly took over the lumber mills and formed holding companies along the lines of modern corporations. Table one on page 103 shows how the timber was distributed in 1902 and again in 1904. It is quite evident that the large companies, assisted by eastern capital, began to buy more timberland.

In 1897, Del Norte County had 67,000 acres of virgin redwood forest standing according to an estimate by the Redwood Lumber Manufacturing Association.[36]

Mendocino county at this same time had a redwood belt eighty-five miles long that ranged from fifteen to thirty miles wide. In 1897 this county had 640,000 acres of redwood timberland still unlogged.

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[35]Melendy, p. 101, citing Wood and Iron 21 (February, 1894) 61.

[36]Melendy, p. 101, citing Redwood Lumber Manufacturers Association, The Home of the Redwoods, (San Francisco): 1897), p.55.

TABLE 1

HUMBOLDT COUNTY TIMBER HOLDERS, 1902-1904[37]

Name of the Holder	1902	1904
Lumber Mills	In Acres	In Acres
Vance Redwood Lumber Company (A.B. Hammond)	30,000	50,000
Pacific Lumber Company	30,000	50,000
Dolbeer & Carson	20,000	20,000
Excelsior Redwood Company	20,000	------
Freshwater Lumber Company (Purchased Excelsior holdings)	------	25,000
Isaac Minor	2,000	4,000
Eel River Valley Lumber Company	2,000	2,000
McKay & Company	2,000	2,000
Elk River Mill & Lumber Company	5,000	8,000
Bayside Mill & Lumber Company	2,000	2,000
Humboldt Lumber Milling Company	7,000	-----
Riverside Lumber Company	4,000	-----
Northern Redwood Lumber Company (Purchased the two above companies)	-----	12,000
Total	124,000	175,000
Eastern Capital Investments Before 1900		
David Ward, Detroit	30,000	30,000
C. A. Smith, Minnesota	30,000	30,000
J. E. Henry & Sons, Lincoln, N.H.	30,000	30,000
Henry Swart and Other, Marinette, WI	10,000	10,000
Hamilton & Marryman, Marinette, WI	12,000	12,000
Vance Redwood Company, Eureka, CA	6,000	------
McClure & Rupp, Saginaw, WI	------	15,000
Kane Lumber Company, PA	------	20,000
Warren Timber Company, PA	------	15,000
Total	118,000	162,000
Eastern Capital Investments After 1900		
Noyes, Alger & Company, MI; Alger, Bliss & Company, MI	20,000	Not Given In 1904
American Lumber Company, IL	50,000	
Little River Lumber Company, NY	3,000	
Miscellaneous Small Holdings	95,000	73,000
Grand Total	410,000	410,000

[37]Melendy, p. 103, citing Humboldt Times, Souvenir of Humboldt County, 1902, pp. 44-46; Ibid., 1904, pp. 43-44.

By this time it was quite obvious that the available timberlands in the redwood region were being concentrated in a few hands. This was particularly true where the timber ran 100,000 to 150,000 board feet per acre. It was claimed that in the four counties of Del Norte, Humboldt, Mendocino, and Sonoma there was as much timber as in the states of Minnesota, Wisconsin and Michigan. Indications were that the ownership of redwood timber was the most highly concentrated of all timberland in the United States. Seventy-two percent of all the cypress stand was held by owners of a minimum of sixty million feet. Eighty percent of the white and Norway pine was held by owners with sixty million feet or more. In the redwood region, ninety-three percent of the timber was held by owners with sixty million feet or more.[38]

In 1912 the California State Forester gave the figures for the ten largest holdings comprising 2,448,094 acres or about forty-two percent of all privately owned timber and cut-over land in the state. Table 2 shows the size of these holdings.

In 1913, the Bureau of Corporations made an investigation of the lumber industry in the United States. It was found that 96,000,000,000 feet of redwood timber was located in the four northern counties of California along the coast. This was ninety-

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[38]Melendy, p. 104, citing Ise, p. 319.

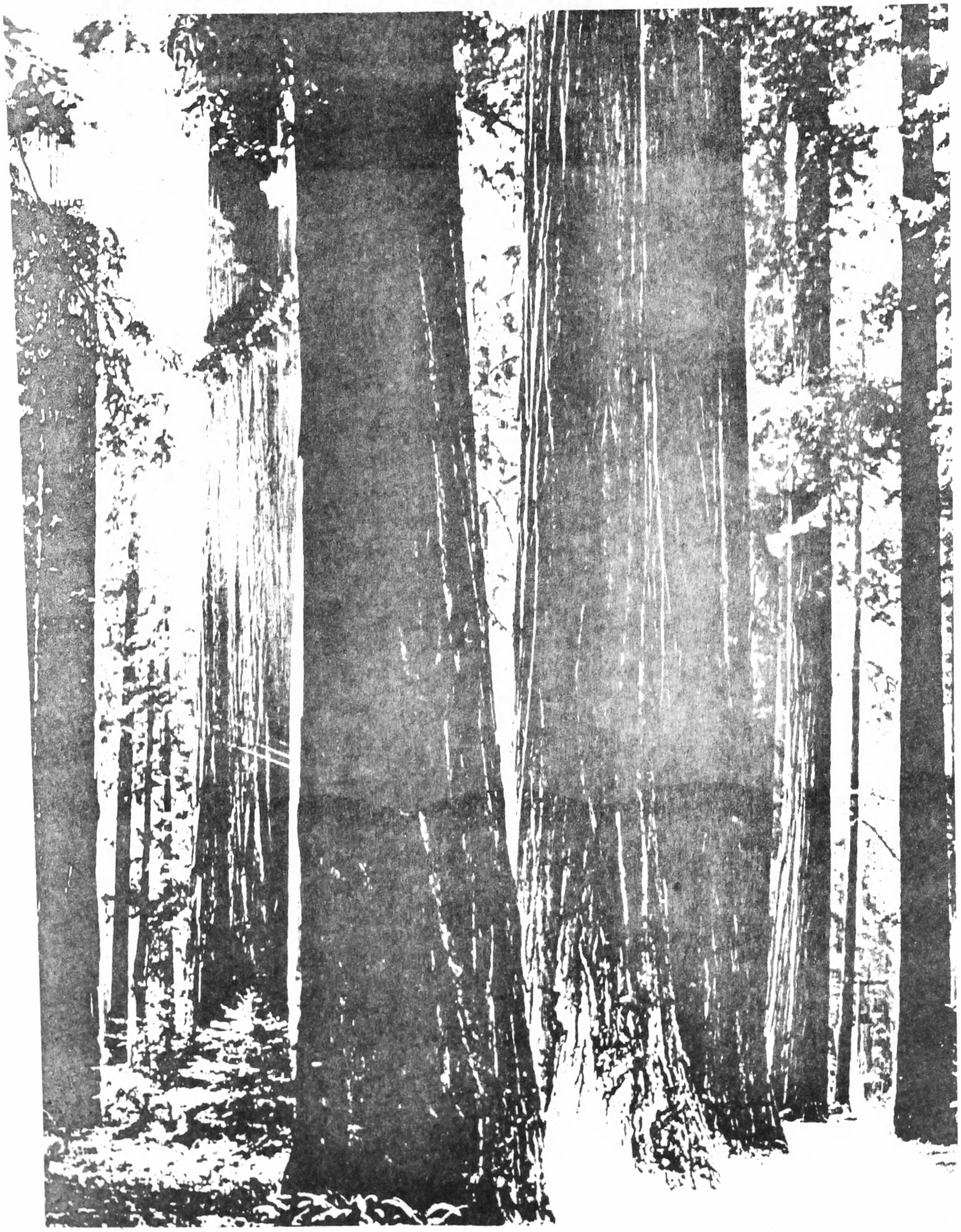

Figure 59. Timberland like this was of prime interest to the early lumber companies putting together their holdings. (Meiser Photo)

four percent of the total redwood volume. The other six percent was scattered in other counties.

TABLE 2

TEN LARGEST TIMBER HOLDERS IN CALIFORNIA, 1912[39]

Name of Company	Holdings In Acres
1. Central Pacific Railroad (Southern Pacific Co.)	921,311
2. T. B. Walker and Associates*	673,665
3. McClous River Lumber Co.	232,063
4. Diamond Match Company	159,499
5. Hammond Lumber Company*	94,760
6. Union Lumber Company*	80,350
7. L. E. White Lumber Co.*	79,540
8. Weed Lumber Company	71,458
9. C. A. Smith*	69,768
10. Sierra Nevada Wood & Lumber Co.	65,680

*These companies had land entirely or partly in redwood timber.

The Bureau first measured concentration of timber by establishing eleven groups according to the holdings of the companies.

The six holders in group one held forty-one percent of all the standing redwood. (Table 3) These six holders were 1) The Lagoon Lumber Company, or the Wheeler interests of Pennsylvania, 2) The Pacific Lumber Company, 3) the A. B. Hammond Companies, 4) the Union Lumber Company, the Glen Blair Redwood Company, and the Mendocino Lumber Company, 5) the Del Norte Company, and 6) the Spanish-Hickory Timber Company.

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[39]Melendy, p. 105, citing Calif. State Board of Forestry, Fourth Biennial Report 1912-1913 (Sacramento, 1912), p. 17.

TABLE 3

CONCENTRATION OF TIMBER HOLDINGS, 1913[40]

Group No.	Holdings Expressed in Board Feet	Redwood Holders in each group
1	26 Billion or more	6
2	13 to 26 Billion	9
3	5 to 13 Billion	8
4	3.5 to 5 Billion	
5	2 to 3.5 Billion	9
6	1 to 2 Billion	
7	500 Million to 1 Billion	
8	250 Million to 500 Million	10
9	125 Million to 250 Million	21
10	60 Million to 125 Million	12
11	Less than 60 Million	21

Interrelations between these groups shows that the concentration of ownership is really greater than what appears at first glance. This was especially true in the case of the Hammond companies. These companies were the A. B. Hammond Company of New Jersey, Hammond Lumber Company of Delaware, Hammond Lumber Company of New Jersey, Vance Redwood Company, Curtis Lumber Company, Oregon Rafting Company, and the Western Oregon Company. These were all timber holding companies. A. B. Hammond was the largest stockholder in the A. B. Hammond Company which owned outright or indirectly the stock of the other

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[40]Melendy, p. 105, citing Department of Commerce and Labor, Bureau of Corporations, The Lumber Industry, Part II, Concentration of Timber in Important Selected Regions, p. 105.

timber companies. This Hammond company also owned stock in four other companies: the National Lumber Company, a distributor of lumber, the Oakland Sash and Door Company, The Humboldt Door and Sash Company, and the Oregon and Eureka Railroad Company.

The timber holdings of the Hammond Lumber Company of New Jersey were held with three other companies of which the Hill-Davis Company was the largest co-holder. Hill-Davis was an affiliate of the Weyerhauser Timber Company. A. B. Hammond and the Hill-Davis officials were also associated in another timber owning company not mentioned above. The picture was all the more confused when it was found that H. E. Huntington, director of the Southern Pacific Company, was also director of one of the three chief Hammond companies.[41]

The vice president of the Pacific Lumber Company was also an investor in the Rupp holdings listed in group two. One of the directors of the Standish-Hickory Company was a director in one of Union Lumber Company's firms. One of the directors of the Mendocino Lumber Company was an associate of the Union Lumber Company and also secretary of the Casper Lumber Company. Three other Union Lumber Company directors were directors of

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[41] Ibid., p. 107, citing ibid., pp. 104-105.

the Pacific Coast Redwood Company.[42] As can be seen the Union Lumber Company had gained a strong hold on the majority of the redwood in northern Mendocino county.

Group two of the Bureau's study consisted of: 1) the Hobbs, Wall and Company, the Hotchkiss Timber Company, and the Standard Lumber Company, 2) the L. E. White Lumber Company, 3) the C. A. Smith Redwood Company, 4) the Desert Redwood Company, 5) the David Ward Estate, 6) the Hill-Davis Company, 7) the Casper Lumber Company, 8) the Pacific Coast Redwood Company, and 9) J. J. Rupp et al. This group held twenty-five percent of the redwood timber.

The eight members of group three controlled almost thirteen percent of the timber. Important firms in this group were the Sage Land and Improvement Company of New York, Thomas Blair, and the Albion Lumber Company. The Albion Lumber Company was an affiliate of the Southern Pacific Company.

These first three groups had twenty-three holders which represented seventy-nine percent of the total stand. There were fifty-two owners in groups four to ten which controlled only fifteen percent of the redwood timber. All in all, seventy-five owners controlled ninety-four percent of all available redwood timber.

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[42]Ibid., p. 108, citing ibid., p. 106

TABLE 4

TIMBER CONCENTRATION IN THE REDWOOD REGION, 1913[43]

Timber Groups	Number of Holders	Timber Acreage	TIMBER SPECIES: Redwood	Douglas Fir	Other Species	Total	Percent Redwood Each Group
			In Billion Board Feet				
1	6	384,291	39.5	2.8	1.5	43.6	41.1
2	9	322,073	24.0	3.6	1.3	28.9	25.0
3	8	163,910	12.3	2.9	0.2	15.4	12.8
Total	23	870,274	75.8	9.3	3.0	87.9	78.9
4-7	9	90,962	6.2	1.6	0.1	7.9	6.5
8	10	69,169	3.4	0.5	0.3	4.2	3.5
9	21	54,444	3.7	0.3	---	4.0	3.0
10	12	20,153	1.1	0.1	0.1	1.3	1.1
Total	52	234,728	14.4	2.5	0.5	17.4	15.0
11 (Redwood Only)	7	13,720	0.2	0.3	---	0.5	0.2
11 (Total Timber)	14	450,554	5.7	4.0	1.4	11.1	5.9
Total	21	464,554	5.9	4.3	1.4	11.6	6.1
Total for Groups 1-10	75	1,105,002	90.2	11.8	3.3	105.3	93.9
Total All Holdings		1,569,276	96.1	16.1	4.7	116.9	100.0

43Ibid., p. 109, citing ibid., p. 103.

CHAPTER IX

LAND ACQUISITION LAWS

The attitude of early settlers toward the timber resources of the country was generally one of indifference. This was to be expected since most of the country had to be cleared of timber before cultivation could take place. However, the West was somewhat different because people desired ownership of land because it had standing timber rather than because it had good agricultural properties.

This somewhat unique feature posed some real problems in the disposal of land by the federal government in the redwood region. The most important laws governing land acquisition are briefly discussed here in order to show why preservationist groups felt they had to become involved.

PREEMPTION ACT, 1841

This act enabled actual settlers to gain title to land by living on it.

HOMESTEAD ACT, 1862

The Homestead Act did not require a permanent residence on the land as did the Preemption Act, consequently it was used extensively by timbermen and others to gain title to public lands.

After six months of residence and cultivation, settlers were allowed to purchase land for $1.25 per acre instead of getting it free at the end of five years of residency and cultivation. This latter part of the Homestead Act was often used fraudulently.

DESERT LAND LAW, 1877

This law allowed the removal of timber from a piece of land before title was actually gained, thus encouraging a cut and move on type of operation.[1]

Prior to 1878, no distinction had been made between timber land and other land. Consequently timber land could be acquired under the Preemption Act or the Homestead Act even though the land may not have been suitable for cultivation. Up until this time there was really no legal way of obtaining timber land.

In 1878 two acts were passed which greatly facilitated the destruction of timber land. These were the Free Timber Act and the Timber and Stone Act.

There was much demand in the western states for free timber. In many parts of the West there were seemingly inexhaustable supplies of timber, some of which were ripe or rotting, with no apparent probability that the government would soon make any use of it. Had there been a way of permitting sale of timber on

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[1]John Ise, The United States Forest Policy (New Haven: Yale University Press, 1920), p. 48.

public lands, there would have been no need of legislation at that time, but such a policy had not received serious consideration in Congress.

Considering public sentiment, it is not surprising that Congress should have provided for the sale of timber lands. It seemed strange that the law should not have been passed sooner, for the policy of sale had been recommended by almost all writers on the subject.[2]

FREE TIMBER ACT, 1878

The Free Timber Act provided that residents of the Rocky Mountain States--Colorado, Nevada, New Mexico, Utah, Arizona, Wyoming, Idaho and Montana--might cut timber on mineral lands for buildings, agricultural, mining or other domestic purposes. California and the other coastal states were not included in this act.[3]

TIMBER AND STONE ACT, 1878

The Timber and Stone Act provided for the sale of 160 acres of timber land to any person or association at a price of $2.50 per acre. The applicant was required to file with the register a "sworn statement" that the land was unfit for cultivation and valuable chiefly for its timber; that it contained no deposits of gold, silver, cinnabar, copper, or coal; that he had made no other application

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[2]Ise, p. 58. [3]Ise, p. 62.

under the act; that he did not desire to purchase the land on speculation; and that he had not made any agreement or contract for sale to anyone else. Also, the testimony of two disinterested witnesses was required to support the application. These witnesses were required to swear that they knew the facts to which they testified, from personal inspection of the land.

Since the land must be "unfit for cultivation" no settler would buy it for the purpose of cultivation, and since 160 acres was too small an area to economically practice forestry, larger tracts must somehow be obtained. This situation led to much fraud as the larger timber companies put together their ownerships.[4]

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[4]Ise, pp. 73-74.

CHAPTER X

PRESERVATIONISTS SUCCEED DESPITE BUREAUCRACIES

MOTIVATING FORCES

Devastation brought on by logging increased as mechanization increased. During the late 1870's and early eighties, band saws replaced the slow and highly wasteful circular saws in the mills. In 1881 the "steam donkey" began replacing oxen for skidding purposes. This replacement was amplified with the invention of the "bull donkey" in 1892 and the ever-growing effects of clear-cut logging were heightened by the addition of high-line techniques in 1908. Finally, about 1914 the railroad system was developed enough to add its speed and efficiency to the system.

All the efforts of the lumbermen went toward maximizing profits through efficiency and expanding markets. Insignificant items such as public relations and future sources of timber were rarely, if ever, considered by early timber barons.

CONCERN MOUNTS

Devastation produced by loggers in the 1880's set the stage and provided the incentive for an effective redwood preservation movement which really did not begin until some thirty-five years later.

In a _Harper's Weekly_ article in 1886 Charles Graham warned that "in ten years _Sequoia sempervirens_ will exist in California only as a curiosity."

Ten years later Carrie Walker wrote in the _Overland Monthly_ that "but a decade is needed for their complete extinction." In 1899 a _National Geographic_ writer stated that redwoods would be extinct at no remote period." Other writers said, there remains but "a few years supply at most" and that the redwoods would "soon be scarce" or "gone forever."[1]

Writers and editors may have had an excuse during those early years for crying doom but it also seems that other people who should have been more knowledgeable, joined in reinforcing the chant.

In 1868 the president of the California Board of Agriculture was the first doom-crying politician to go on record by saying that there was only a forty year supply of timber left and that "Europe will, in a very few years, own greater forests of our valuable redwood trees than California could ever boast of."

In 1889 the State Board of Forestry predicted that, "in less than forty years our redwood forests will exist but in theory."[2]

ATTEMPTS AT PRESERVATION

Probably the first protest against logging the redwoods occurred in the last quarter of the eighteenth century. At that time

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[1]Adams, p. 110. [2]Ibid.

two especially tall redwoods on the East Bay assisted navigators on Spanish ships as they entered the Golden Gate. Removal of these trees caused much concern in the maritime system.[3]

With a concern farther reaching than a couple of landmark redwoods, Assemblyman Henry A. Crabb of San Joaquin county introduced a joint resolution into the California Legislature in 1852. Crabb's resolution proposed that California's Senators and Representatives in Washington be instructed to seek a federal law closing the redwoods to settlement. Even though the resolution passed the lower house, it was doomed because of the lack of correct information on the part of the author. The preamble to Crabb's resolution read, "whereas the lands of California are sparsely wooded and timber for building purposes is extremely scarce and difficult to procure. . ." The bill died in the Senate for lack of a quorum.[4]

The only coast redwoods that were preserved in the nineteenth century were owned by far-sighted individuals whose land was in the general vicinity of extensive redwood logging operations. The first occurrence of this type of preservation was in 1867 when Joseph Welch, formerly of Boston, bought a grove of 350 acres in

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[3]Delong, p. 60, citing James P. Gilligan, "Man and the Redwoods" (Letters and Science Extension in cooperation with the School of Forestry, University of California, Berkeley, 1965), p. 7.

[4]Adams, p. 110.

the Santa Cruz area. Welch's neighbor, Henry Cowell, soon adopted the same philosophy and together they turned their properties into tourist attractions.[5]

Colonel James B. Armstrong of Sonoma County, one of the largest redwood operators at that time, had purchased a tract of timber in 1874 which he believed should be set aside as a public "Arboretum and Botanical Garden." On several occasions he tried to sell the plot to the state of California and eventually even tried to give it to them. However, it seemed that there was no appropriate state agency to care for the property so the Colonel's offer was rejected. Finally, in 1916 Sonoma county purchased the nearly 400 acres for $80,000 and it eventually wound up as a state park in 1934.[6]

The Bohemian Club of San Francisco began purchasing redwood acreage in 1901. This social organization has since put together an area of about 25,000 acres; what is now one of the largest acreages that has been preserved since relatively early times.[7]

Redwood Canyon was a ravine located a few miles north of San Francisco and was the objective of preservationists as early as

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[5]Delong, p. 62, citing Elizabeth R. Schlappi, "Saving the Redwoods" (Unpublished Master's Thesis, Dept. of History, Univ. of California, Berkeley, 1959), p. 21.

[6]Delong, p. 62.

[7]Delong, p. 63, citing Ernest Latimer Finley, History of Sonoma County, Calif. (Santa Rosa, Calif.: The Press Democrat Publishing Company, 1937)

1904. At that time the forestry committee of the San Francisco California Club wanted to make it a national park. In 1908 the North Coast Water Company sought to condemn the property for use as a reservoir for the town of Sausalito. Millionaire Congressman William Kent, who had purchased the six-hundred acres a few years earlier for $45,000 strenuously objected to the proposed condemnation. Kent renewed his efforts to have the federal government assume control of the canyon.

Acting under the authority of the American Antiquities Act of 1906, President Theodore Roosevelt, in 1908 accepted Kent's gift and declared the nation's first national monument known as Muir Woods National Monument.[8]

STRATEGIC ACTION BEGINS

In 1879 at least one third of every tree cut was being wasted. Realizing this, Carl Schurz, then Secretary of the Interior, recommended that Congress set aside 46,000 acres of public domain. This was the first serious proposal for a federal park in the coast redwoods.

At this time Congress started its long history of ignoring the pleas for a national park and left the job to the State of California and a few concerned citizens.[9]

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[8]Delong, p. 64. [9]Adams, p. 111.

In 1877 one of these citizens, a crusading newspaper editor, Ralph Smith in Redwood City, began a campaign which ultimately led to his death. In November, 1887 the editor guided two members of the State Board of Forestry through the Santa Cruz redwoods looking at possible park locations. Smith was dead within two weeks after the tour, the victim of an unknown assassin's bullet in the back. While alive he had stirred interest in the project but had been unable to secure essential political leadership.[10]

Phoebe Hearst, mother of the well-known publisher soon took up the campaign for the Big Basin area and the State Board of Forestry lent official support.

In 1899 Andrew P. Hill, a local photographer, received a commission for the English magazine, Wide World, to photograph the trees. As a result of this effort a public meeting was called at Stanford University, where a committee of eight citizens was formed to investigate the Big Basin proposal. Other supporters included influential professors from Stanford, The Presidents of Stanford and Santa Clara, magazine and newspaper editors, representatives of Northern Pacific Railroad. This group, called the Sempervirens Club, vowed to push the Big Basin project through.[11]

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[10] Delong, p. 65, citing Don Morton, Big Basin Redwoods, No. 38 of History of California State Parks (Berkeley: Works Progress Administration, 1937), p. 21.

[11] Delong, p. 66, and Adams, p. 111.

Father Kenna, Santa Clara President, wrote several articles for the Sacramento Evening Bee while the state legislature considered a bill to create the park.

The legislature was convinced the next year and approved the purchase of 2,500 acres of old growth timber at a price of one-hundred dollars per acre. This was the beginning of California's state park system. It is also interesting that Henry L. Middleton, President of the Big Basin Lumber Company, that was logging near the park area, donated an additional 1,300 acres to the new park.[12]

The resolution creating the "California Redwood Park" (Big Basin) passed both houses of the legislature on March 17, 1901, with only two dissenting votes. It is quite evident that the Southern Pacific played quite a role in the passage of the legislation. A study by George E. Mowry indicates that California "had only a shadow of representative government, while the real substance of power resided largely in the Southern Pacific Railroad Company."[13]

In 1903, a private group headed by William Randolph Hearst acquired historic Fort Ross and three years later gave it to the state.

Other acquisitions were made and, one way or the other, ended up as part of the state park system.

National park proposals continued to be put forth. Congress-

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[12]Adams, p. 111. [13]Delong, p. 68.

man Raker of California introduced a joint resolution in 1911 calling for an investigation on the advisability of such parks. His resolution joined the Crabb and Schurz proposals in limbo.[14]

Despite the reluctance to act on the part of the federal bureaucracy, Big Basin is now a reality and currently may exceed 10,000 visitors on a Sunday.

Additional people were exposed to the redwoods when the railroad linked San Francisco Bay with Eureka in 1914. Visitors and salesmen alike now took home an unforgettable memory and a hope that the best of the redwoods would be saved.[15]

About 1880 Secretary of the Interior, Carl Schurz, began to develop a plan for the federal government to set aside vast forest acres for the sake of future timber needs. His proposals for federal forest reserves were met with considerable opposition in Congress. These views were thought unnecessary and the House soon cut off appropriations for Schurz's timber inspectors and remained deaf to his pleas for forest preservation.

In 1881 Schurz left office and a Forestry Division was established in the Department of Agriculture with Bernhard E. Fernow appointed the first chief in 1886.

In attempting to advance the ideas of his friend Schurz,

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[14]Adams, p. 112. [15]Adams, p. 113.

Fernow made his greatest contribution to American Forestry. In 1891 he convinced Interior Secretary Noble and President Harrison to support a rider on the appropriation bill. The rider enabled the President to remove public land from sale by the simple act of proclamation. This radical departure from previous land disposal practices of the government was slipped through Congress in this very devious manner. If the lawmakers had realized the impact of this rider, it is doubtful if the measure would have passed at all.[16]

As presidents began reserving millions and millions of acres of public domain forests, Congress brought increasing pressure to do away with the hastily passed bill.

Fernow's successor was Giffort Pinchot who developed a new policy for use in the forest reserves. It called for the Division of Forestry to show timberland owners on the ground how to handle their lands for a second crop. This was something entirely new in America.[17]

In 1899 Pinchot took a trip to San Francisco to discuss forestry with redwood lumbermen. He then established good working relations with private lumbermen who began to ask for management advice.[18]

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[16] Ise, pp. 117-118. [17] Delong, p. 76.

[18] Delong, p. 78.

In the same year (1910) that a national craze for efficiency started sweeping the country, Pinchot linked conservation and efficiency together. The national forests were used as a valuable tool in stabilizing the lumber industry with a goal of long-run profits.[19]

In 1917 there were only about five-thousand acres of coast redwood in any type of reserve. This was the year that a distinguished group of men took a camping trip in the redwoods and decided that the time had come for action outside of government channels. These men were Madison Grant, chairman of the New York Zoological Society; Dr. John C. Merriam of the University of California, later president of the Carnegie Institute; and Dr. Fairfield Osborn, president of the American Museum of Natural History.

With the help of some friends of equal distinction, including the chiefs of the National Park Service and the Forest Service, the Save-the-Redwoods League was formed in 1918. The first president of the league was Franklin K. Lane, former Secretary of Interior.[20]

Following the trip to the forest primeval things began to happen. Another visitor to the forest in 1919 was Newton B. Drury. At the time he was in partnership with his brother, Aubrey, in a San Francisco advertising agency. After seeing the redwoods for the first time he was a convert to the cause of their preservation.[21]

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[19]Delong, p. 89. [20]Adams, p. 113.

[21]Delong, pp. 100-101.

The Drury Advertising Company of San Francisco was hired for the vitally needed publicity work. A fund raising project was soon started and the first year four-thousand members were signed up who contributed a total of $140,000 to the league.[22] Great sums of money were needed to purchase uncut acres of forest. Although the concept appealed to the general public, significant contributions had to come in sizable gifts. Henry Osborn was not asking for just a few dollars when he asked "who will dedicate a redwood grove to the health and happiness of the American people?"[23]

In 1920 the league persuaded Congressman Clarence F. Lea to introduce a resolution asking the Secretary of Interior to look into "the suitability, location, and cost, if any, and advisability of" securing a National Redwood Park. The result of this resolution was the Redington Report, which recommended a 64,000 acre unit on the lower Klamath River, a half-mile-wide parkway along some of the Redwood Highway and 1,800 acres on the south fork of the Eel.

The slogan, "A Redwood National Park--Now or Never!" was adopted. The net result was that the House passed an enabling act, but the proposal died in Senate committee.[24]

Since government was not doing the job of protecting exceptional groves of coast redwood, the league must. Drury, who

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[22]Adams, p. 113. [23]Delong, p. 104.

[24]Adams, p. 113.

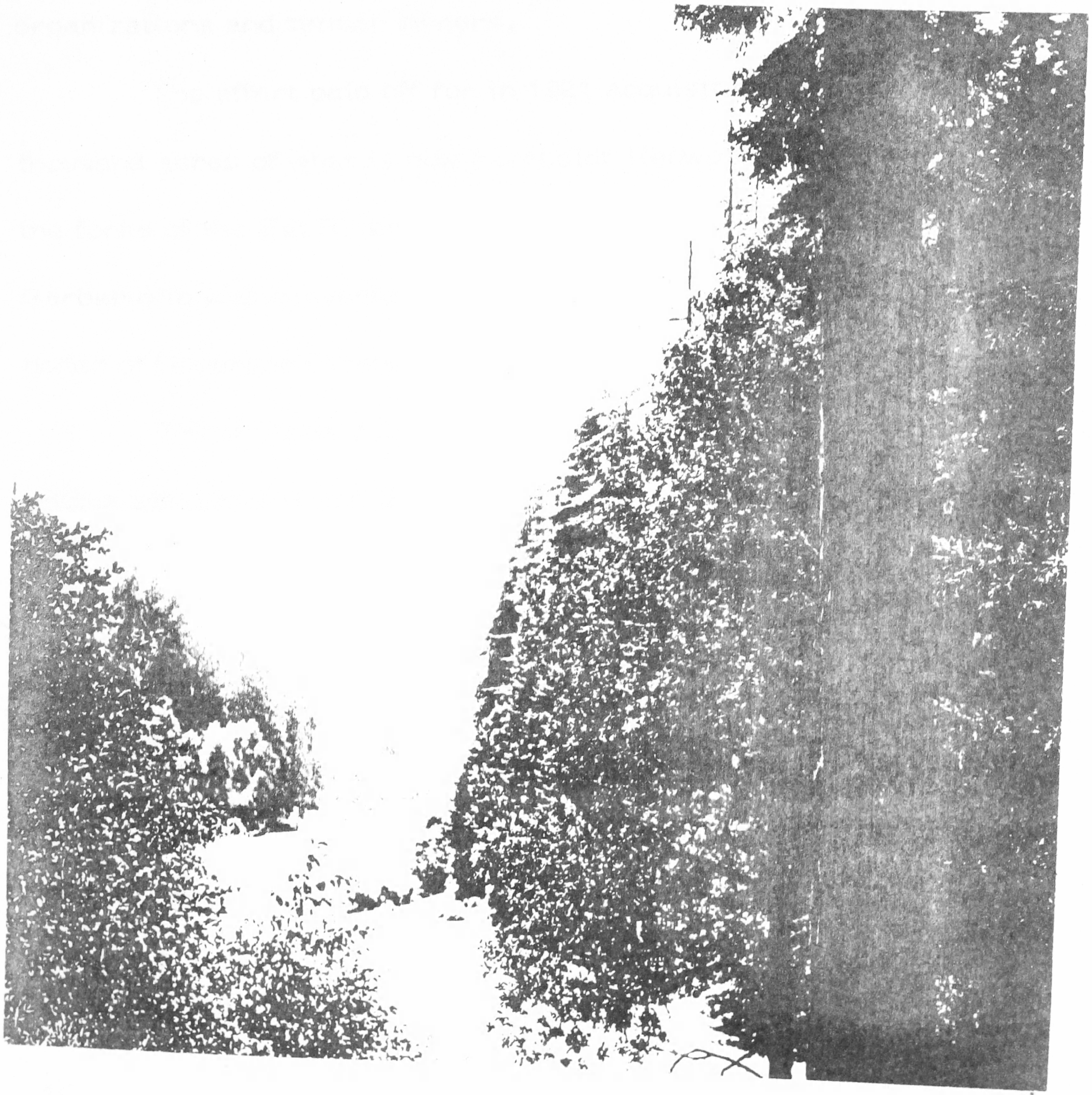

Figure 60. South fork of the Eel River. (Meiser Photo)

was now secretary of the league, and his officers became avid salesmen, taking their appeal to influential citizens, politicians, service organizations and timber owners.

The effort paid off for in 1921 acquisition was made on two-thousand acres of what is now Humboldt Redwood State Park, near the forks of the Eel River. In 1922 a five-hundred acre grove near Garberville was converted from a private resort to a state park in honor of Governor Friend W. Richardson.

The crusade's greatest achievement in the 1920's was a unique agreement from the legislature whereby the state matched, dollar for dollar, funds donated to the league.

Another fund raising gimick was "the $10,000 tour." The tour consisted of a ride in a topless touring car among the breath-taking stands. One such tour induced the late John D. Rockefeller, Jr. to donate two-million dollars for the purchase of a stand growing on the flats along Bull Creek. Rockefeller forest is now part of the 43,000 acre Humboldt Redwood State Park.[25]

Another successful campaign of the league was working with the lumber companies. Many of these companies were persuaded that their best timberlands had a higher public value than for lumber. Many companies agreed to cooperate at their own financial loss.

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[25]Adams, p. 114.

Figure 61. Standing timber on Bull Creek. (Meiser Photo)

The Pacific Lumber Company held one choice unit of 2,100 acres for forty years. Recently, in a single year land and timber tax on the unit amounted to $33,000. Simpson Timber Company held eight-hundred acres for ten years at a tax cost of $142,000. Several outstanding groves are still held in trust that would not today be available were it not for early agreements, bound only by a handshake. Additional proof that the league was effective is the fact that in only a few cases did the timber companies go to the courts to obtain a fair price for the park land.

From the beginning the purchases were on a priority basis. Both the state and the league sought to obtain the best groves first. This often meant purchasing the large trees growing in pure stands on the benches and stream sides. This was acre for acre, the most expensive land in the region.

Money came from everywhere, school children's pennies mixed with fortunes from labor unions, foundations and large corporations. Many of the gifts were large enough to be honored with the naming of a grove.[26]

MISSION ACCOMPLISHED

At its fiftieth anniversary the league recently looked back at what were pie-in-the-sky goals back in 1919. It had, however, reached its mark of preserving 100,000 acres of coast redwood. In doing so it had raised some $14,000,000--an accomplishment it could justly be proud of. Table Five shows these acres by park name and county where located.[27]

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[26]Adams, p. 115.

[27]Adams, p. 118.

TABLE 5

COAST REDWOOD STATE PARKS

NAME	COUNTY	ACRES	camp sites	picnic	swim	fish	ocean beach	trailers
Julia Pfeiffer Burns	Monterey	1,700		X				
Pfeiffer-Big Sur	Monterey	822	218	X	X	X		X
Andrew Molera (future)	Monterey	2,100						
Forest Nisene Marks	Santa Cruz	9,779						
Henry Cowell	Santa Cruz	1,737	51	X	X	X		
Big Basin	Santa Cruz	11,886	332	X		X		X
Castle Rock	Santa Cruz	513						
Butano	San Mateo	2,186	40					
Portola	San Mateo	1,740	60	X	X	X		
Mt. Tamalpais	Marin	4,888	49	X				
Samuel P. Taylor	Marin	2,576	74	X	X			X
Armstrong	Sonoma	560	45	X		X		X
Fort Ross	Sonoma	356		X		X	X	
Mailliard	Mendocino	242				X		
Indian Creek	Mendocino	15		X				
Hendy Woods	Mendocino	605	95	X	X	X		
Paul M. Dimmick	Mendocino	12	28	X		X	X	
Montgomery Woods	Mendocino	647						
Van Damme	Mendocino	1,825	82	X	X	X	X	
Adm. Wm. H. Standley	Mendocino	45		X	X	X		
Standish-Hickey	Mendocino	915	159	X	X	X		
Smithe	Mendocino	462			X	X		
Reynolds Flat	Mendocino	375	50	X	X	X		
Richardson Grove	Humboldt	831	185	X	X	X		
Benbow Lake	Humboldt	498		X	X	X		
Humboldt	Humboldt	43,718	245	X	X	X		X
Grizzly Creek	Humboldt	234	30	X	X	X		
Prairie Creek*	Humboldt	12,241	150	X		X	X	X
Del Norte Coast*	Del Norte	6,375	142	X		X	X	X
Jedediah Smith*	Del Norte	8,852	107	X	X	X		X
Loeb	Curry (Ore.)	120		X				
TOTAL		118,855	2,142					

* Managed cooperatively with Redwood National Park.

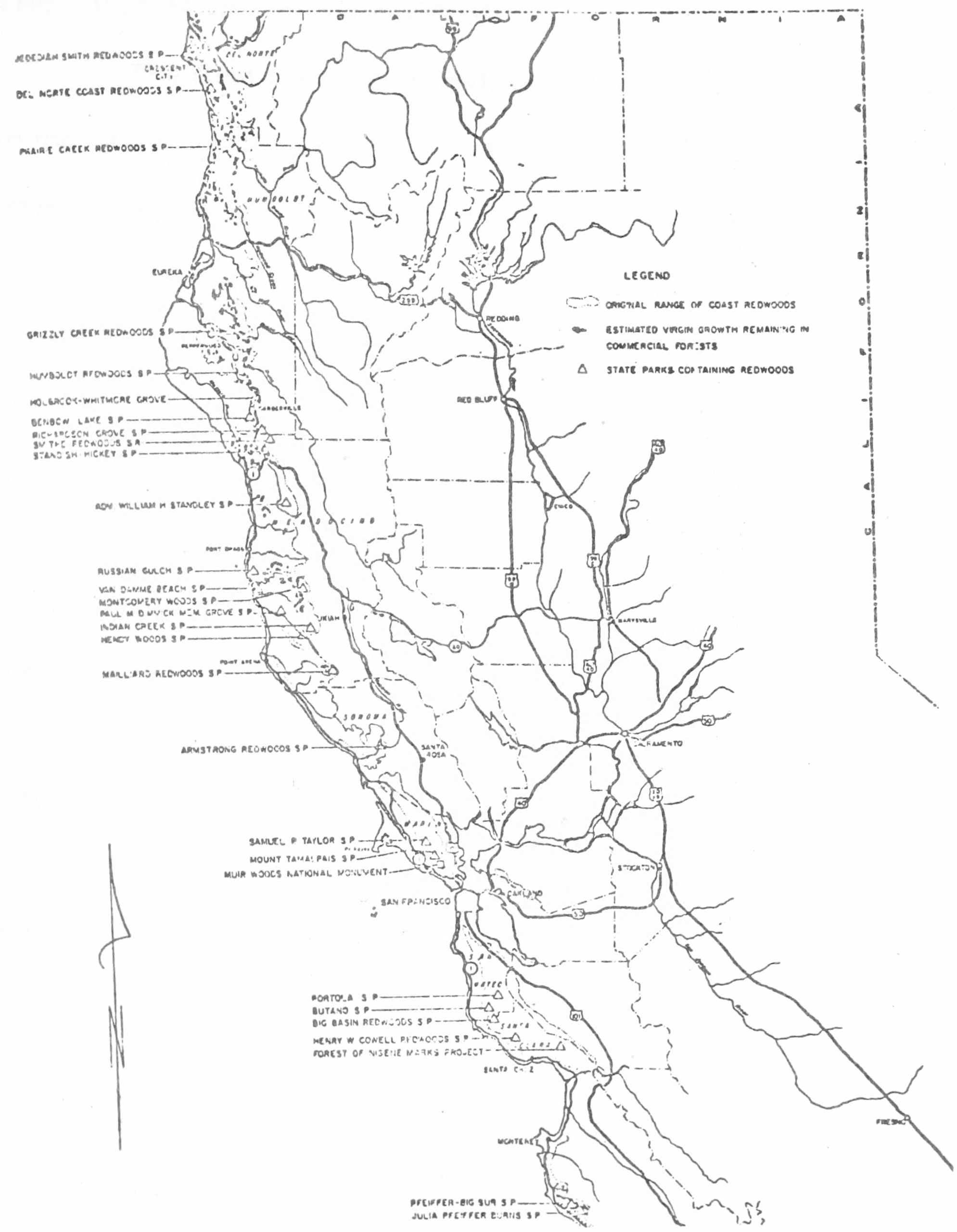

Figure 62. Original and remaining virgin forests.[28]

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[28]National Park Service, The Redwoods: A National Opportunity for Conservation and Alternatives for Action (Washington, D.C.: U.S., Dept. of Interior, 1964), p. 26.

THE FEDS MUST HAVE A PARK

The first time that a redwood national park was proposed in the United States Congress was in 1911.[29] This was a bill introduced by California's Congressman John E. Raker.

Just before the election in 1967 the Senate passed its redwood national park bill, S.2515 authored by Senators Jackson and Kuchel. This bill was a compromise of several bills submitted and provided for a 64,000 acre park in two counties, costing one-hundred million dollars.

In 1968 the House cut the Senate's bill in half (28,000 acres) and slipped it through a floor vote under suspension of the rules.

A joint committee compromised the two versions of the bill and settled for a 58,000 acre park costing ninety-two million dollars for acquisition. After passing the bill, the 90th Congress was called the "most historic" in conservation achievements.[30]

President Johnson, having never seen the redwoods, signed the Redwood National Park Act in October, 1968.

It seems rather ironic that the federal government should wake up at this late date. Theoretically, in the early days this park could have been preserved at a cost of $145,000, the price which homesteaders paid for the land.

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[29] Delong, p. 210. [30] Adams, pp. 130-131.

This delay in action has caused hardships on the part of many people. Four timber companies were hardest hit by the creation of the park, some losing as much as seventy percent of their timber. Local officials blame the park for annual loss of $500,000 in tax revenue and some counties have raised their timberland assessments one-hundred percent and thus placed an added burden on the remaining landowners.[31]

In December, 1974 the Arcata National Corporation settled its suit against the federal government for its take-over of eleven-thousand acres of timberland as part of the national park. Previously Arcata had received $57.8 million in cash and exchange property. During this settlement Arcata received an additional $35.4 million plus simple interest at the rate of 6.6 percent a year on that amount since October 2, 1968. Thus Arcata's total compensation will be about $93.2 million, exclusive of interest. The payment of about fifteen million dollars in interest is expected sometime after April 1, 1975.[32] It doesn't take much calculating to see that settlement with this one company has cost well over the amount originally set aside for acquisition of the entire park. One wonders what the total actual cost of the park might be and whether this expenditure is justified at this point in time since the bulk of the good virgin stands

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[31]Adams, p. 132.

[32]Wall Street Journal, December 31, 1974.

of redwood have either been cut or are currently in a state park.

Probably the most logical reason for the creation of a coast redwood national park is the unique splendor of this remnant from the past. Since creation of our first national park (Yellowstone in 1872) it has been accepted policy that the nation's most superb scenic lands should become parks for all the people.

Table Six shows the current acreage by ownership in the redwood region.[33]

TABLE 6

COAST REDWOODS IN GOVERNMENT OWNERSHIP

Agency	Acreage
California Department of Parks and Recreation	119,415[a]
California Division of Forestry	52,070
National Park Service	31,374[b]
U.S. Forest Service	20,927[c]
County of San Mateo	6,443
U.S. Bureau of Land Management	2,600
Marin Municipal Water District	2,600
U.S. Bureau of Indian Affairs	2,013
City and County of San Francisco	2,000
Other public agencies	8,565
	248,007

[a] Includes coast redwoods in parks not classified as redwood type, such as Austin Creek, Russian Gulch, Kruse Rhododendron Reserve and Bothe-Napa.
[b] Includes 2,431 acres authorized but not yet acquired.
[c] Includes approximately 13,000 acres subject to exchange under provisions of Redwood National Park Act.

[33]Adams, p. 34.

CHAPTER XI

CONCLUSION

The coast redwood is a splendid, unique tree with an ancient past, a somewhat unsettled present and a very restricted future. It is not only the tallest tree in the world but one of the most coveted, both in the forest and in the lumber market. Discovered by white man scarcely two-hundred years ago, it has fallen before his axe and saw and served many of his needs for some one-hundred and fifty years.

The original ravaging of the redwoods was done by the first generation of redwood loggers who were inventive geniuses. They had to be in order to cope with the problems of redwood logging. These men were independent and adventurous, largely being the first white Americans to settle in the California wilderness which was basically unknown when statehood came in 1850.

At the beginning of the twentieth century the American conscience began to have its effect on the minds of some conservationists for the ravaging being handed out to the redwoods. Slowly but with a definite goal in mind, preservationists began to move in behalf of the redwoods.

Simultaneous with the early redwood preservation effort, was the popular national movement of "conservation," stressing efficiency and morality. Gifford Pinchot, with the support of President Theodore Roosevelt, interpreted conservation in terms of use of resources and thus provided some good leadership to the timber industry.

The current inventory of redwood in the commercial forest amounts to about twenty-nine billion board feet, half of which is old growth. Some lumber companies will have to start cutting second growth entirely in about ten years, while others can wait twenty-five years. It is expected that the redwood lumber industry will reach a point of sustained yield in 1983.[1] At that time the industry will cut timber only as fast as it grows, so consequently the supply will be determined by the quality of sites held in industry ownership and the intensity of management applied to these lands. At this point in time it seems that one could say that the redwood lumber industry has been preserved.

We are still concerned with the preservation of the redwood trees, even those already "preserved." In 1959 the California State Division of Highway's bulldozed a freeway through the heart of the Humboldt Redwood State Park, destroying hundreds of virgin trees and upsetting the ecological balance of the area.

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[1]Adams, p. 160.

Building the freeway made those contributors to the saving of the redwoods realize that powerful State agencies could still destroy redwoods where ever they pleased.[2]

Then too, it is believed that the ability of the redwoods to produce seed has been generally weakening. Good seed crops are rather infrequent and viability is low. Some studies show that the large trees' ability to produce cones is reduced when the stimulants of fire and flood are removed. The absence of fire also allows competition to build up. True, the redwood also reproduces by sprouts but this tendency also reduces with extreme age.[3]

I suppose I could assume that we have done a fairly decent job of preservation, given the constraints of bureaucracies and other complex organizations coupled with the ambitions of free enterprise, but I still wonder what the total, eventual impact of white man will be on the most noble among trees.

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[2]Delong, p. 184.

[3]Adams, p. 147.

APPENDIX A

THE IMPORTANT TIMBER-TYPE SOIL SERIES OF HUMBOLDT COUNTY

Soil Series	Pounds Nitrogen* Per Acre (4-foot depth)*	Inches of Water* Storage Capacity (4-foot depth)**	Major Forest Type
Empire	10,217	9.5	Redwood
Larabee	22,500	14.3	"
Orick	9,052	12.3	"
Sites	8,163	16.5	"
Mendocino	11,508	5.7	Mixture Redwood and Douglas fir
Masterson	10,867	6.7	"
Hely	25,685	8.3	"
Atwell	15,620	5.4	"
Hugo	7,315	8.8	Douglas fir
Melbourne	6,178	4.3	"
Usal	18,886	3.2	"
Neuns	1,291	2.7	"
Hoopa	1,451	4.4	"
Tish Tang	5,919	9.8	"
Boomer	4,477	6.0	"
Weitchpec	2,787	7.7	"
Hoover	5,634	3.1	"
Tonini	9,238	4.7	Sitka Spruce

* Information supplied by the Soil-Vegetation Survey

**Formula for calculating nitrogen & water storage capacity are taken from Zinke, Paul J. (1960) Forest Site Quality as Related to Soil Nitrogen Content Trans. 7th Intern. Congress of Soil Science, Madison, Wisc. IV 52 Vol. III pp 411-418. N content of soil = (% N fine earth) × (100 − % >2mm Rocks) × (Bulk Density) × (Soil Depth inches) × (8.9). (grams/cc)
(1/3 atm. − 15 atm.) × (100 − % >2mm Rocks) × (Bulk Density) × (Soil Depth inches) = inches waterholding capacity per unit depth.

APPENDIX B

Conifers occurring less commonly with redwood are:

Port-Orford-cedar (*Chamaecyparis lawsoniana* [A. Murr] Parl.)
Pacific yew (*Taxus brevifolia* Nutt.)
Western redcedar (*Thuja plicata* Donn)
California torreya (*Torreya californica* Torr)

Some conifers associated with redwood under atypical situations are:

Gowen cypress (*Cupressus goveniana* Gord.)
Knobcone pine (*Pinus attenuata* Lemm.)
Lodgepole pine (*P contorta* Dougl.)
Sugar pine (*P lambertiana* Dougl.)
Bishop pine (*P muricata* D. Don)

Of the hardwoods in the redwood type, the two most abundant and generally distributed are:

Tanoak (*Lithocarpus densiflorus* [Hook. and Arn.] Rehd.)
Pacific madrone (*Arbutus menziesii* Pursh).

Other hardwoods found in the redwood type are:

Vine maple (*Acer circinatum* Pursh)
Bigleaf maple (*Acer macrophyllum* Pursh)
Red alder (*Alnus rubra* Bong.)
Golden chinkapin (*Castanopsis chrysophylla* [Dougl.] A. DC.)
Oregon ash (*Fraxinus latifolia* Benth.)
Pacific waxmyrtle (*Myrica californica* Cham.)
Oregon white oak (*Quercus garryana* Dougl.)
Cascara sagrada (*Rhamnus purshiana* DC.)
Willows (*Salix L.* spp.)
California laurel (*Umbellularia californica* [Hook. & Arn.] Nutt.)

Shrubs which are redwood associates are:

Lady bloom (*Ceanothus parryi* Trel.)
Blueblossom (*Ceanothus thyrsiflorus* Eschsch.)
Creek dogwood (*Cornus* x *californica* C. A. Meyer)
California hazel (*Corylus cornuta* var. *californica* [A. D C.] Sharp)
Salal (*Gaultheria shallon* Pursh)
Pacific rhododendron (*Rhododendron macrophyllum* D. Don)
Western azalea (*Rhododendron occidentale* Gray)
Poisonoak (*Rhus diversiloba* T. & G.)
Wood rose (*Rosa gymnocarpa* Nutt.)
Thimbleberry (*Rubus parviflorus* Nutt.)
Salmonberry (*Rubus spectabilis* Pursh)
California blackberry (*Rubus vitifolius* C. & S.)
California huckleberry (*Vaccinium ovatum* Pursh)
Red bilberry (*Vaccinium parvifolium* Sm.).

APPENDIX B–Continued

A variety of herbs, many restricted to the redwood type, are found on the redwood forest floor. They include:

- Deerfoot vanillaleaf (*Achlys triphylla* [Sm.] DC.)
- Western baneberry (*Actaea spicata* L. var *arguta* Torr.)
- Glade anemone (*Anemone deltoidea* Hook.)
- Wild ginger (*Asarum caudatum* Lindl.)
- Longleaf mahonia (*Berberis nervosa* Pursh)
- Clintonia (*Clintonia andrewsiana* Torr)
- Milkmaids (*Dentaria integrifolia* var *californica* [Nutt.] Jepson)
- Bleeding heart (*Dicentra formosa* [Andr] DC)
- Fairy lantern (*Disporum smithii* [Hook.] Piper)
- California alum root (*Heuchera micrantha* Dougl.)
- Western water leaf (*Hydrophyllum tenuipes* Hel. var *viride* Jepson)
- Oregon coltsfoot (*Maianthemum bifolium* DC *kamtschaticum* [Gmel.] Jepson)
- Monkey-flower (*Mimulus dentatus* Nutt.)
- Indian lettuce (*Montia parvifolia* [Moq.] Greene)
- Redwood sorrel (*Oxalis oregana* Nutt.)
- Sweet coltsfoot (*Petasites palmata* [Ait.] Gray)
- White-veined shin-leaf (*Pirola picta* Sm.)
- Saxifrage (*Saxifraga* L. spp.)
- Slinkpod (*Scoliopus bigelovii* Torr)
- Fat solomon (*Smilacina amplexicaulis* Nutt.)
- Slim solomon (*Smilacina sessilifolia* Nutt.)
- Fringe cups (*Tellima grandiflora* [Pursh] Dougl.)
- Sugar-scoop (*Tiarella unifoliata* Hook.)
- Star flower (*Trientalis europaea* L. var. *latifolia* Torr)
- Coast trillium (*Trillium ovatum* Pursh)
- Inside-out flower (*Vancouveria parviflora* Greene)
- Pioneer's violet (*Viola glabella* Nutt.)
- Western heart's ease (*Viola ocellata* T. & G.)
- Evergreen violet (*Viola sempervirens* Greene).

Several shade-loving ferns are important components of the ground cover under redwood stands. Sword fern (*Polystichum munitum* Presl.) is by far the most common. Others are:

- California maidenhair (*Adiantum emarginatum* Hook.)
- Five-finger fern (*Adiantum pedatum* L.)
- California wood fern (*Aspidium rigidum* Swz. var. *argutum* Eat.)
- Common wood fern (*Aspidium spinulosum* [Mull.] Swz. var. *dilatatum* Hoffm.)
- Lady fern (*Athyrium filixfoemina* L. var. *californicum* Butters)
- Bladder fern (*Cystopteris fragilis* [L.] Bernh.)
- Gold fern (*Gymnogramme triangularis* Kaulf.)
- Deer fern (*Lomaria* [*Blechnum*] *spicant* Desv.)
- Licorice fern (*Polypodium volgare* L. var *occidentale* Hook.)
- Chain fern (*Woodwardia radicans* Sm.).

APPENDIX C

--Plant species, other than trees, found on cutover redwood lands in Humboldt and Mendocino Counties, California[1, 2]

TALL WOODY SHRUBS

Vegetation group and species (species above lines are listed in order of dominance)	Order of dominance within same group in virgin stands	↓
Ceanothus thyrsiflorus Eschsch.	blueblossom	7
Vaccinium ovatum Pursh	California huckleberry	2
Rhododendron macrophyllum D. Don	Pacific rhododendron	1
Salix L. spp.[3]	willows	10
Arctostaphylos columbiana Piper	hairy manzanita	14
Vaccinium parvifolium Sm.	red bilberry	3
Myrica californica Cham.[3]	Pacific bayberry or waxmyrtle	4
Corylus rostrata var. *californica* A. DC.	California hazel	5
Baccharis pilularis DC.	coyote brush	[4] E
Rhamnus purshiana DC.	cascara sagrada	8
Acer circinatum Pursh[3]	vine maple	
Ceanothus velutinus Dougl.	snowbrush	
Holodiscus discolor (Pursh) Maxim.	cream bush	
Ribes L. spp.	gooseberry and currant	
Sambucus glauca Nutt.	blue elderberry	
Sambucus callicarpa Greene	elderberry	

VINELIKE SHRUBS AND FERNS

Gaultheria shallon Pursh	salal	1
Pteris (Pteridium) aquilina L. var. *lanuginosa* (Bory) Hook.	bracken	E
Polystichum munitum Presl.	sword fern	2
Rubus vitifolius C. & S.	California blackberry	5
Rubus parviflorus Nutt.	thimbleberry	3
Berberis nervosa Pursh	longleaf mahonia	6
Rhus diversiloba T. & G.	poisonoak	4
Rubus leucodermis Dougl.	western raspberry	9
Lonicera hispidula Dougl. var. *californica* Jepson	California honeysuckle	
Rosa californica C. & S.	Califirnia wild rose	
Rubus spectabilis Pursh	salmonberry	
Woodwardia radicans Sm.	chain fern	

TALL HERBS

Erechtites prenanthoides DC.	Australian fireweed	E
Epilobium angustifolium L.	fireweed	E
Anaphalis margaritacea (L.) B. & H.	pearly everlasting	E
Erechtites arguta DC.	New Zealand fireweed	E
Iris douglasiana Herbert	mountain iris	1
Iris macrosiphon Torr.	ground iris	2
Lotus stipularis (Benth.) Greene var. *subglaber* Ottley	bird's-foot trefoil	11
Baccharis douglasii DC.	Douglas baccharis	E
Gnaphalium decurrens Ives var. *californicum* Gray	California everlasting	E
Cirsium arvense Scop.	Canada thistle	E

Footnoted at end of table.

APPENDIX C–Continued

TALL HERBS, continued

Vegetation group and species (species above lines are listed in order of dominance)		Order of dominance within same group in virgin stands ↓
Sonchus asper L. and *Sonchus oleraceus* L.	prickly sow-thistle and common sow-thistle	E
Cirsium edule Nutt.	Indian thistle	E
Epilobium paniculatum T. & G.	paniculate fireweed	10
Achillea millefolium L. var. *lanulosa* Piper	common yarrow	
Adenocaulon bicolor Hook.	adenocaulon	
Aquilegia truncata F. & M.	columbine	
Chrysanthemum leucanthemum L.	ox-eye daisy	
Epilobium watsonii Barb. var. *franciscanum* (Barb.) Jeps.	fireweed	
Erigeron canadensis L.	horseweed	
Gnaphalium ramosissimum Nutt.	pink everlasting	
Madia madioides (Nutt.) Greene	woodland madia	
Madia sativa Molina	Chile tarweed	
Parentucellia viscosa (L.) Caruel	parentucellia	
Sidalcea malachroides Gray	checker	
Stachys chamissonis Benth.	hedge nettle	
Tellima grandiflora (Pursh) Dougl.	fringe cups	
LOW HERBS		
Whipplea modesta Torr.	western whipplea	11
Hypochoeris radicata L.	hairy cat's ear	E
Oxalis oregana Nutt.	redwood sorrel	1
Trientalis europaea L. var. *latifolia* Torr.	star flower	15
Crepis capillaris (L.) Wallr.	smooth hawksbeard	E
Viola sarmentosa Dougl.	wood violet	7
Medicago lupulina L.	nonesuch	E
Gnaphalium purpureum L.	purple cudweed	E
Medicago hispida Gaertn.	bur clover	E
Plantago lanceolata L.	ribwort	E
Asarum caudatum Lindl.	wild ginger	
Clintonia andrewsiana Torr.	clintonia	
Dicentra formosa (Andr.) DC.	bleeding heart	
Echinocystis oregana Cogn.	hill man-root	
Erodium moschatum L'Her.	white-stem filaree	
Galium L. spp.	bedstraw	
Hypochoeris glabra L.	smooth cat's ear	
Lotus L. spp.	bird's-foot trefoil	
Montia perfoliata (Donn) Howell	miner's lettuce	
Montia sibirica (L.) Howell	Indian lettuce	
Myosotis sylvatica Hoffm.	forgetmenot	
Polygala californica Nutt.	milkwort	
Rumex acetosella L.	sheep sorrel	
Smilacina amplexicaulis Nutt.	fat Solomon	
Smilacina sessilifolia Nutt.	slim Solomon	

Footnoted at end of table.

APPENDIX C–Continued

LOW HERBS, continued

Vegetation group and species (species above lines are listed in order of dominance)	Order of dominance within same group in virgin stands ↓	
Trifolium pratense L.	red clover	
Trillium ovatum Pursh	coast trillium	
Vancouveria hexandra (Hook.) Morr. & Dec.	vancouveria	
Vancouveria parviflora Greene	inside-out flower	
ANNUAL GRASSES		
Lolium temulentum L.	darnel	E
Aira caryophyllea L.	silver hairgrass	E
Festuca megalura Nutt.	foxtail fescue	E
Bromus mollis L.	soft chess	E
Festuca rubra L.	red fescue	E
Bromus rigidus Roth.	ripgut grass	E
Polypogon monspeliensis (L.) Desf.	rabbitfoot grass	E
PERENNIAL GRASSES		
Holcus lanatus L.	velvet grass	E
Dactylis glomerata L.	orchard grass	E
Deschampsia elongata (Hook.) Benth.	slender hairgrass	E
Hierochloe occidentalis Buckl.	California sweetgrass	1
Festuca occidentalis Hook.	western fescue	E
Festuca L. spp.	fescues	E
Bromus vulgaris (Hook.) Shear	brome	E
Melica L. spp.	melicgrass	E
SEMI-AQUATICS		
	mosses	
Equisetum L. spp.	horsetails	
Juncus L. spp.	rushes	
Carex L. spp.	sedges	
Luzula DC. spp.	woodrushes	

[1] Person, Hubert L., and Hallin, William. Possibilities in the regeneration of redwood cut-over lands. 1939. (Unpublished report on file at Pacific SW. Forest & Range Exp. Sta., U.S. Forest Service, Berkeley, Calif.)

[2] Basis: 7,082 milacre quadrats surveyed in 1932.

[3] Trees listed as shrubs because their environmental effect is shrublike.

[4] Species marked E are found only on cutover areas, not in virgin stands. They are either exotics or invaders from adjacent types.

APPENDIX C-Continued

-Species important in virgin redwood stands but not common on cutover lands in Humboldt and Mendocino Counties, California[1, 2]

SHRUBS	
Cornus nuttallii Audubon	Pacific dogwood
Physocarpus capitatus (Pursh) Kuntze	ninebark
Sambucus callicarpa Greene	elderberry
Symphoricarpos albus (L.) Blake	snow berry
FERNS	
Adiantum pedatum L.	five-finger fern
Lomaria (Blechnum) spicant Desv.	deer fern
TALL HERBS	
Actaea spicata L. var. *arguta* Torr.	baneberry
Lysichiton kamtschatcense (L.) Schott	skunk cabbage
Petasites palmata (Ait.) Gray	sweet coltsfoot
Phacelia bolanderi Gray	phacelia
LOW HERBS	
Achlys triphylla (Sm.) DC.	deerfoot vanillaleaf
Disporum hookeri (Torr.) Britt.	fairy bells
Disporum smithii (Hook.) Piper	fairy lantern
Lilium L. spp.	lilies
Maianthemum bifolium DC. *kamtschaticum* (Gmel.) Jepson	Oregon coltsfoot
Mimulus dentatus Nutt.	monkey-flower
Scoliopus bigelovii Torr.	slinkpod
Streptopus amplexifolius (L.) DC.	liver-berry

[1] Person, Hubert L., and Hallin, William. Possibilities in the regeneration of redwood cut-over lands. 1939. (Unpublished report on file at Pacific SW. Forest & Range Exp. Sta., U.S. Forest Serv., Berkeley, Calif.)

[2] Basis: 7,082 milacre quadrats surveyed in 1932.

APPENDIX D

–Temperature means and extremes, by silvicultural cutting and aspect, Redwood Experimental Forest, 1960-1964

Cutting and aspect	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	Degrees F											
Clearcutting-west:[1]												
Highest	67	61	65	71	68	102	71	88	75	82	72	58
Mean maximum	56	52	52	54	57	67	62	66	59	61	54	52
Mean	49	46	45	47	50	57	54	56	51	53	48	45
Mean minimum	43	39	39	40	44	49	48	49	45	46	42	40
Lowest	32	33	33	34	36	44	45	46	42	39	36	31
Selection-west:[1]												
Highest	64	58	62	69	66	98	70	87	74	78	68	57
Mean maximum	54	51	51	53	56	66	62	63	60	59	53	49
Mean	49	46	45	47	50	56	54	55	52	52	49	45
Mean minimum	44	40	39	41	44	49	49	48	47	47	44	40
Lowest	34	33	34	33	37	43	46	43	42	39	37	35
Clearcutting-west:[2]												
Highest	62	62	60	73	74	72	72	68	83	75	57	65
Mean maximum	52	51	50	57	57	63	66	62	62	61	51	54
Mean	42	44	44	48	49	53	55	55	54	51	44	46
Mean minimum	35	39	38	41	41	44	45	49	49	45	38	40
Lowest	28	25	31	35	37	39	42	45	45	38	30	31
Clearcutting-east:[2]												
Highest	61	60	59	72	73	72	80	70	82	–	58	66
Mean maximum	51	50	51	57	58	65	69	63	62	–	51	53
Mean	40	45	44	49	51	54	56	56	55	–	45	45
Mean minimum	33	40	39	42	44	46	46	51	50	–	38	39
Lowest	29	23	30	36	40	42	44	48	45	–	30	29
Clearcutting-east:[3]												
Highest	55	71	63	62	63	65	68	82	92	86	67	59
Mean maximum	50	55	51	54	56	60	63	66	66	64	53	51
Mean	42	43	43	46	49	53	55	57	56	54	46	47
Mean minimum	36	35	35	37	43	47	49	50	48	48	41	43
Lowest	32	30	29	32	32	40	43	45	43	39	29	31
Selection-east:[3]												
Highest	51	69	63	64	62	65	68	82	96	83	68	58
Mean maximum	48	55	50	54	55	58	60	65	66	63	52	50
Mean	43	45	43	46	48	53	54	57	56	55	47	47
Mean minimum	37	37	37	39	43	47	48	51	48	49	43	42
Lowest	32	32	33	35	33	43	46	45	44	42	32	32

[1] Apr.-Dec., 1960; Jan.-Mar., 1961. [2] Feb.-Dec., 1962; Jan. 1963. [3] Jan.-Dec., 1964.

APPENDIX D–Continued

-Means and extremes in relative humidity, by silvicultural cutting and aspect, Redwood Experimental Forest, 1960-1964

Cutting and aspect	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	Percent											
Clearcutting-west:[1]												
Highest	100	100	100	100	100	100	100	100	100	100	100	100
Mean maximum	95	99	99	97	98	96	99	99	97	95	92	95
Mean	82	89	86	87	87	77	85	82	85	83	83	83
Mean minimum	58	66	61	64	67	55	62	55	62	58	66	63
Lowest	30	40	38	40	41	17	44	28	25	25	17	33
Selection-west:[1]												
Highest	100	100	100	100	100	–	100	100	100	99	99	100
Mean maximum	94	97	97	97	99	–	97	97	97	92	90	94
Mean	82	89	87	86	89	–	86	83	87	82	82	82
Mean minimum	65	70	65	64	71	–	65	61	68	65	69	65
Lowest	38	46	45	46	47	–	45	32	30	34	23	42
Clearcutting-west:[2]												
Highest	100	100	100	100	100	100	100	100	100	100	100	100
Mean maximum	94	98	98	99	99	99	98	99	99	98	98	96
Mean	80	86	87	85	84	82	78	91	91	87	91	87
Mean minimum	52	63	65	61	60	55	51	70	70	67	71	64
Lowest	30	26	40	30	50	37	43	50	24	35	55	40
Clearcutting-east:[2]												
Highest	100	100	100	100	100	100	100	100	100	–	100	100
Mean maximum	97	98	99	99	99	98	99	99	99	–	98	98
Mean	86	90	92	88	86	83	80	94	93	–	90	91
Mean minimum	55	71	73	67	64	57	51	81	77	–	71	67
Lowest	20	36	46	39	49	47	35	70	38	–	50	39
Clearcutting-east:[3]												
Highest	100	100	100	100	100	100	100	100	100	100	100	100
Mean maximum	99	97	98	97	98	98	98	98	97	97	99	98
Mean	94	80	86	79	84	85	88	83	82	86	93	94
Mean minimum	72	47	59	52	61	64	65	58	55	62	72	78
Lowest	56	23	28	20	45	40	54	33	24	17	37	49
Selection-east:[3]												
Highest	100	100	100	100	100	100	100	100	100	100	100	100
Mean maximum	99	93	98	98	99	98	99	99	96	97	99	98
Mean	93	79	90	85	91	91	92	90	86	88	92	94
Mean minimum	76	59	71	65	74	76	77	71	66	71	77	80
Lowest	66	36	43	35	57	51	65	44	37	33	44	51

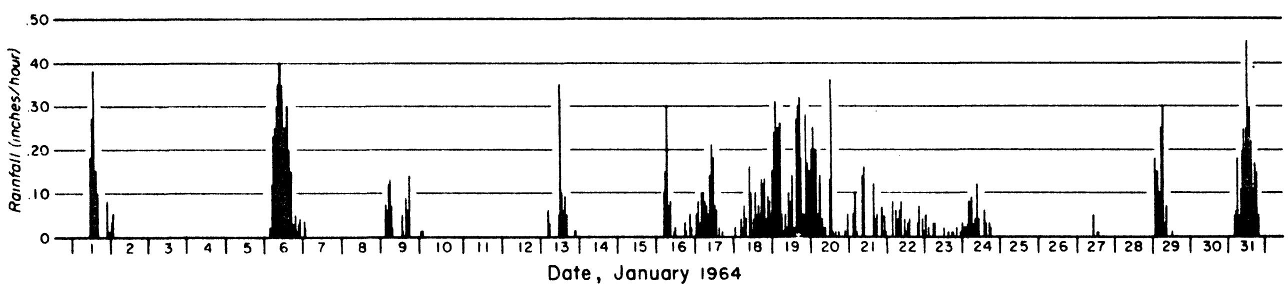
[1]Apr.-Dec., 1960; Jan.-Mar., 1961. [2]Feb.-Dec., 1962; Jan., 1963. [3]Jan.-Dec., 1964.

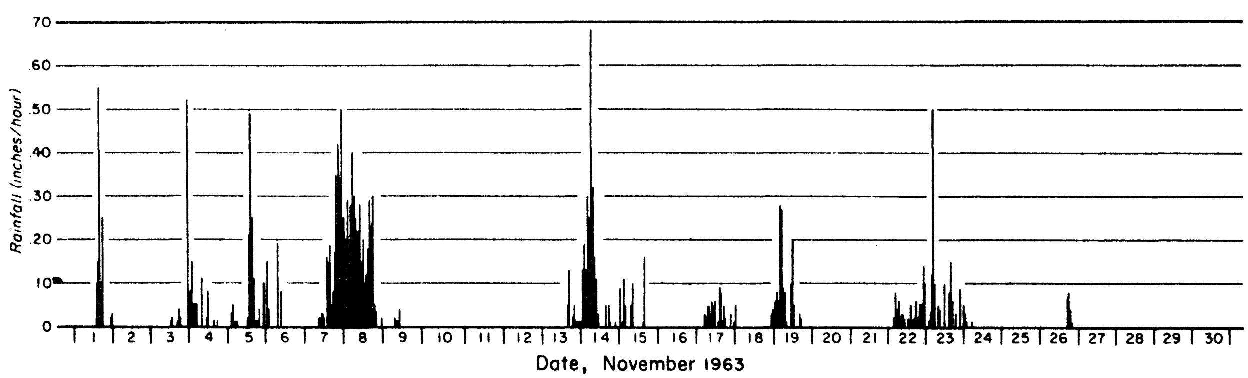
APPENDIX D–Continued

-Precipitation at the Redwood Experimental Forest, California, 1958-1965, by month

Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
	Inches												
1958 1959	0.08	0.00	1.65	3.65	11.10	8.00	17.90	14.15	8.95	1.32	1.98	0.70	69.48
1959 1960	.00	.00	4.30	4.11	1.80	6.31	9.15	11.60	19.60	6.40	12.41	.00	75.68
1960 1961	.00	.20	.30	3.82	17.97	5.92	7.87	16.53	19.79	4.85	8.54	.93	86.72
1961 1962	.00	.51	1.54	6.19	13.75	9.67	4.02	10.05	8.49	3.88	2.77	.47	61.34
1962 1963	.04	4.22	1.72	12.21	12.33	7.04	3.37	10.50	9.78	14.19	8.23	.73	84.36
1963 1964	.41	.00	1.96	8.66	19.55	5.67	22.38	2.38	9.15	1.48	1.97	2.08	75.69
1964 1965	1.98	.08	.20	1.43	20.18	28.57	13.57	3.58	1.74	9.99	1.59	.48	83.39
1965 1966	.00	1.16	.00	2.00	11.11	13.17	20.10	6.93	14.01	2.85	([1])	1.10	72.43
Average	.31	.77	1.46	5.26	13.47	10.54	12.30	9.46	11.44	5.62	4.69	.81	76.14

[1]Trace.





Intensity of winter rains at the Redwood Experimental Forest was interpolated from rain gauge charts based on 1-hour intervals.

APPENDIX E

THE WALL STREET JOURNAL, Tuesday, Dec. 31, 1974 3

Arcata Settles Suit Against U.S. Over Timberland

Firm to Receive Additional $35.4 Million and Interest In 1968 Land Take-Over

By a WALL STREET JOURNAL *Staff Reporter*

MENLO PARK, Calif.—Arcata National Corp. settled its suit against the federal government for its 1968 take-over of 11,000 acres of Arcata timberland as part of Redwood National Park in Northern California.

Arcata said the settlement calls for it to receive an additional $35.4 million, plus simple interest at 6.6% a year on that amount from Oct. 2, 1968, until paid. Arcata already has received $57.8 million in cash and exchange property from the government for the timberland take-over. Thus, the total compensation, exclusive of interest, will be about $93.2 million.

The printing and redwood lumber company said the settlement is being submitted to the federal Court of Claims for final judgment. Payment will be received after Congress appropriates the funds.

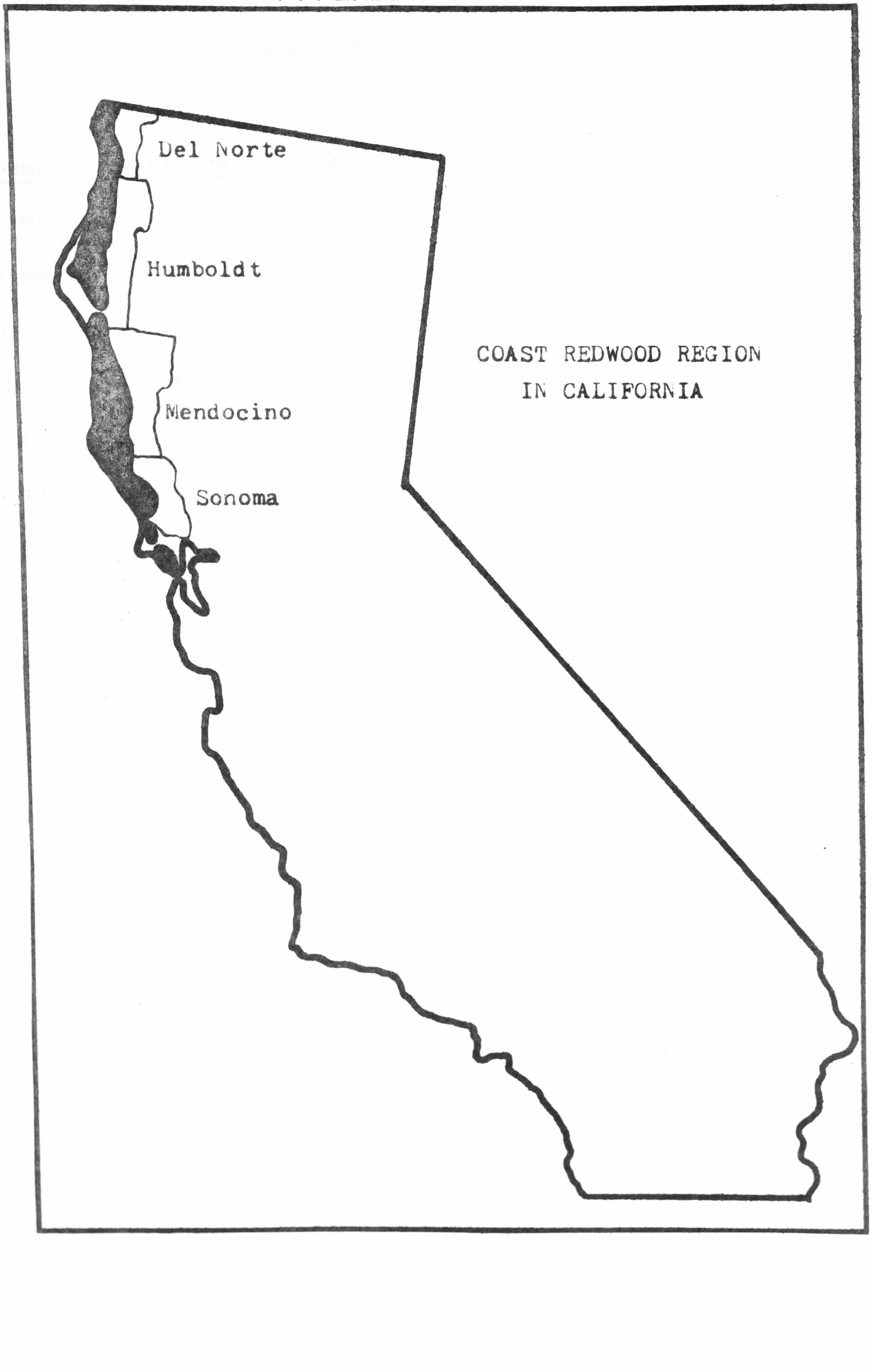
A company spokesman said Arcata expects to receive the $35.4 million principal and about $15 million interest after April 1. Initially, he said, the company will use the $50 million in proceeds to help retire its $90 million outstanding bank debt. Later, he said, the company hopes to reinvest the funds in additional timberlands and capital projects, such as acquisitions or new plants, particularly for its printing business.

He added that the $35.4 million principal amount will be added as an extraordinary gain in the fiscal 1969 financial results. In that year, the company posted earnings before an extraordinary credit of $9.9 million, or $1.37 a share. An extraordinary gain of $21.5 million brought net to $31.5 million, or $2.96 a share. The settlement will boost fiscal 1969 per-share net another $2 or so, the spokesman said.

For the fiscal year 1970 through 1974, per share net will be boosted nine cents to 10 cents a year, the spokesman said. As previously reported, the company had per-share net in fiscal 1974, ended June 30, of $1.40. For fiscal 1975, the company said earnings per share would also be increased by about 10 cents a share. Company officials haven't predicted fiscal 1975 earnings, but have said they expect them to exceed those of fiscal 1974.

In 1970, Arcata filed a $121.6 million claim against the government on the timberlands dispute. Last July, Judge Thomas J. Lydon of a federal claims court found that Arcata was entitled to another $38.9 million compensation in addition to the $57.8 million it had received. Both Arcata and the government appealed the judge's decision. With the settlement, the appeals won't be pursued, Arcata said.

APPENDIX E-Continued



APPENDIX E–Continued

REDWOOD REGION SEX RATIO
(Males/100 Females)

	County			
Date	Del Norte	Humboldt	Mendocino	Sonoma
1850			267	174
1860	354	210	224	170
1870	171	162	162	140
1880	218	135	142	129
1890	161	138	155	130
1900	126	125	145	119
1910	139	138	154	117
1920	132	129	143	111
1930	134	126	129	112
1940	125	116	131	109
1950	113	110	117	102
1960	106	108	105	98
1970	99	103	101	94

APPENDIX E–Continued

DEL NORTE COUNTY

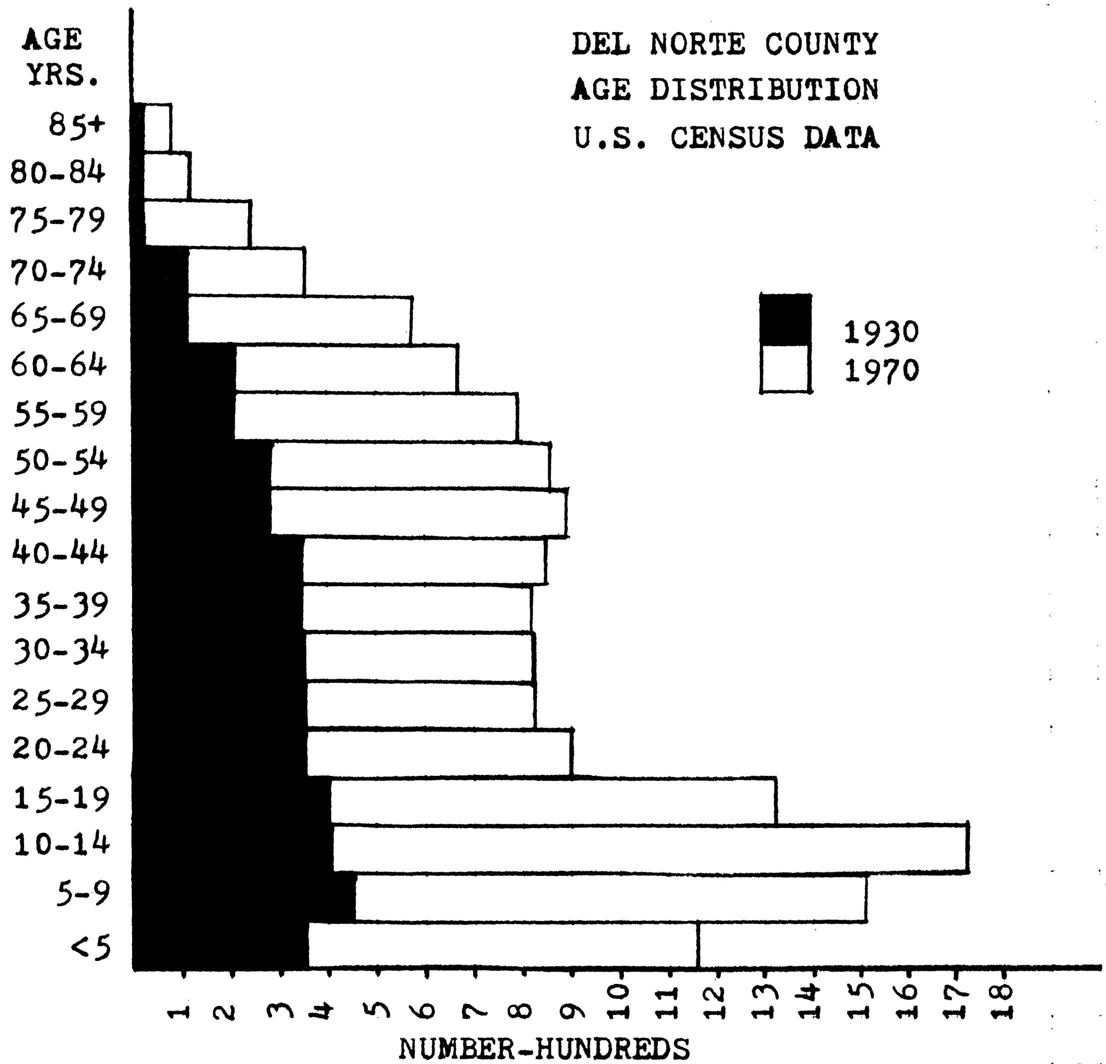
AGE DISTRIBUTION

AGE	1970	1960	1950	1940	1930
<5	1169	2390	944	320	359
5-9	1511	2093	679	375	455
10-14	1722	1821	524	373	412
15-19	1327	1280	508	404	407
20-24	900	1078	514	307	358
25-29	823	1178	628	342	357
30-34	828	1242	606	320	357
35-39	827	1225	637	350	712
40-44	854	1167	508	333	
45-49	898	1100	522	341	589
50-54	867	875	516	283	
55-59	793	723	415	280	418
60-64	672	575	369	242	
65-69	585	421	287	189	240
70-74	357	294	192	144	
75-79	246	166	183	142	71
80-84	113	92			
85+	88	51	46		
<18	5344	7153	2451		

POPULATION

YEAR	MALE	FEMALE	TOTAL
1860	1554	440	1993
1870	1276	746	2022
1880	1774	810	2584
1890	1598	994	2592
1900	1345	1063	2408
1910	1401	1016	2417
1920	1573	1186	2759
1930	2697	2042	4739
1940	2641	2104	4745
1950	4281	3797	8078
1960	9148	8623	17771
1970	7262	7318	14580

APPENDIX E-Continued



APPENDIX E-Continued

HUMBOLDT COUNTY

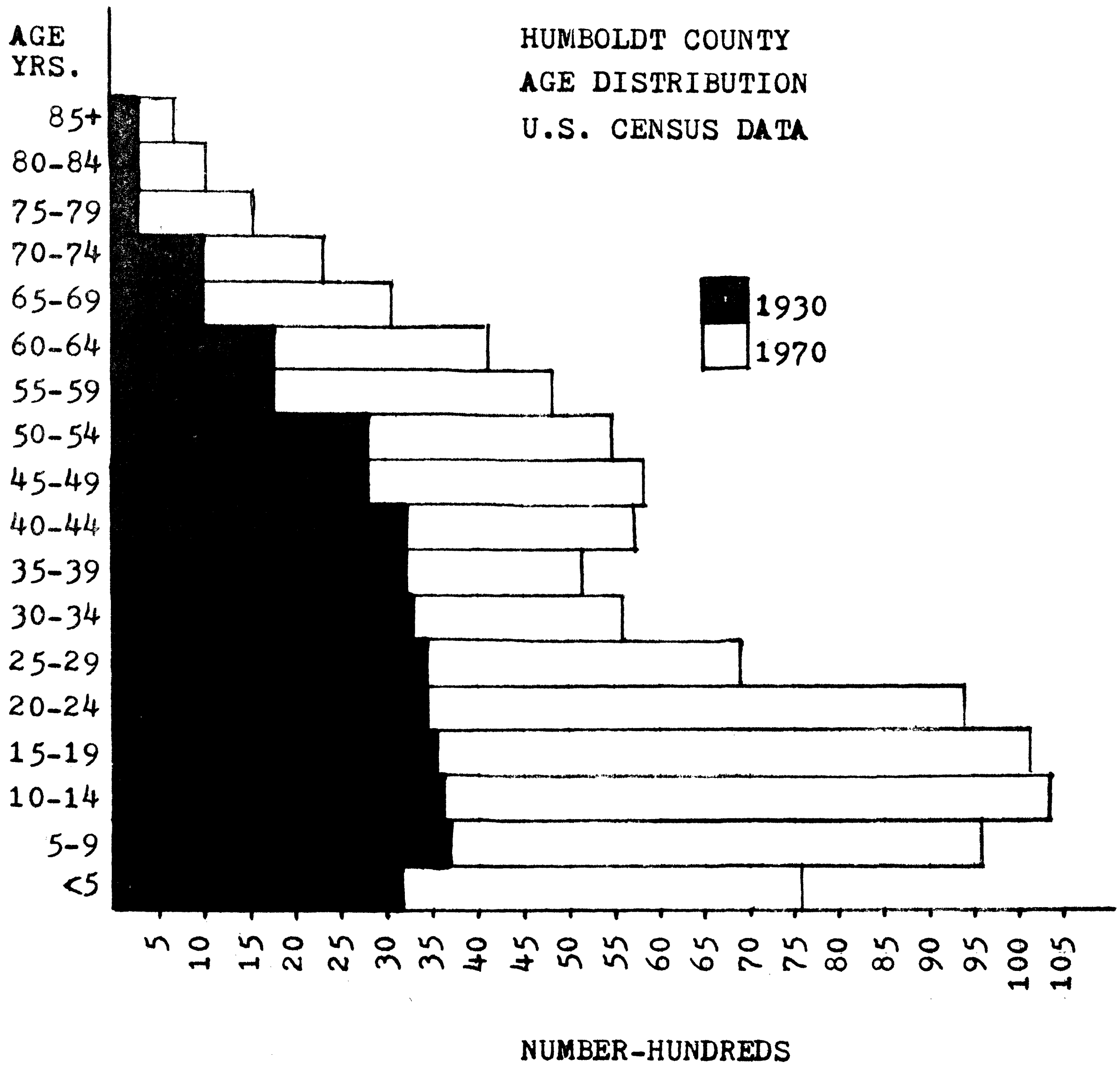
AGE DISTRIBUTION

AGE	1970	1960	1950	1940	1930
<5	7548	12891	7682	3272	3244
5-9	9602	12133	6206	3290	3753
10-14	10387	10496	5130	3502	3593
15-19	10210	7986	4551	3789	3552
20-24	9438	6722	5077	3470	3469
25-29	6867	6629	5521	3616	3406
30-34	5641	7344	5194	3504	3313
35-39	5258	7463	5350	3383	6744
40-44	5679	6752	4844	3229	
45-49	5864	6381	4261	3113	5664
50-54	5543	5216	3741	3003	
55-59	4858	4337	3294	2703	3574
60-64	4132	3322	2953	2063	
65-69	3118	2677	2373	1605	2077
70-74	2262	2156	1460	1072	
75-79	1577	1306	1361	1198	832
80-84	1012	681			
85+	696	400	243		
<18	33683	40593	21744		

POPULATION

YEAR	MALE	FEMALE	TOTAL
1860	1826	868	2694
1870	3797	2343	6140
1880	8880	6632	15512
1890	13618	9851	23469
1900	15050	12054	27104
1910	19654	14203	33857
1920	21154	16259	37413
1930	24163	19070	43233
1940	24628	21182	45812
1950	36343	32898	69241
1960	54102	50790	104892
1970	50535	49157	99692

APPENDIX E–Continued



APPENDIX E-Continued

MENDOCINO COUNTY

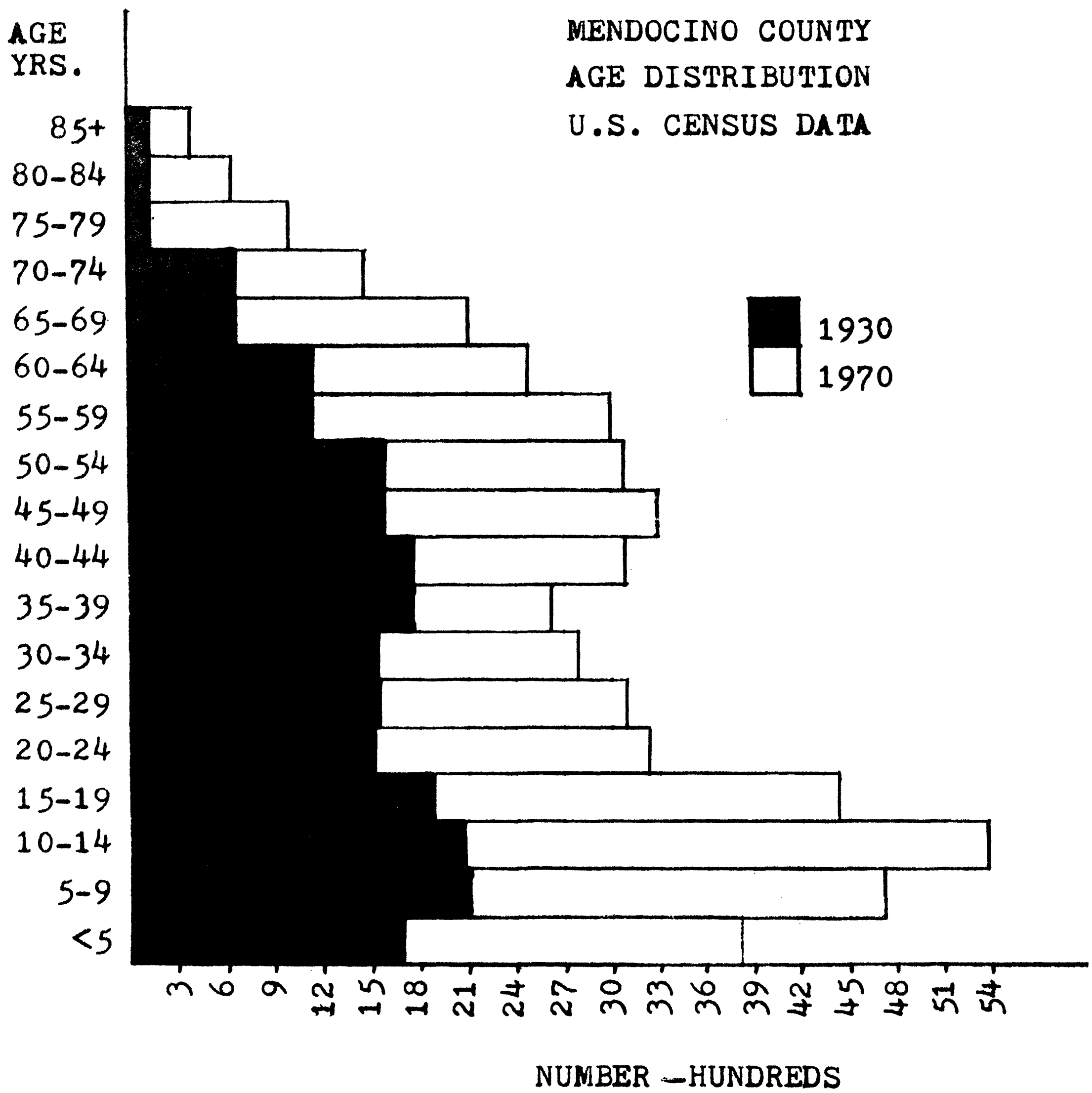
AGE DISTRIBUTION

AGE	1970	1960	1950	1940	1930
<5	3813	5294	4303	1815	1690
5-9	4724	5525	3512	1669	2107
10-14	5384	5257	2958	1996	2076
15-19	4455	3538	2337	2137	1910
20-24	3219	2492	2585	1936	1511
25-29	3173	2640	2994	2067	1523
30-34	2844	3266	3048	2001	1540
35-39	2664	3573	3123	1961	3580
40-44	3163	3431	2853	1943	
45-49	3295	3407	2644	2016	3241
50-54	3096	2960	2358	2168	
55-59	3036	2516	2164	1805	2324
60-64	2566	2070	2060	1588	
65-69	2099	1878	1617	1151	1394
70-74	1482	1463	1098	837	
75-79	1043	981	1016	774	551
80-84	627	507			
85+	418	261	184		
<18	17054	18592	12235		

POPULATION

YEAR	MALE	FEMALE	TOTAL
1850	40	15	55
1860	2738	1229	3967
1870	4663	2883	7545
1880	7526	5274	12800
1890	10714	6898	17612
1900	12102	8363	20465
1910	14540	9389	23929
1920	14204	9912	24116
1930	13247	10258	23505
1940	15804	12060	27864
1950	22033	18821	40854
1960	26187	24872	51059
1970	25722	25379	51101

APPENDIX E-Continued



APPENDIX E-Continued

SONOMA COUNTY

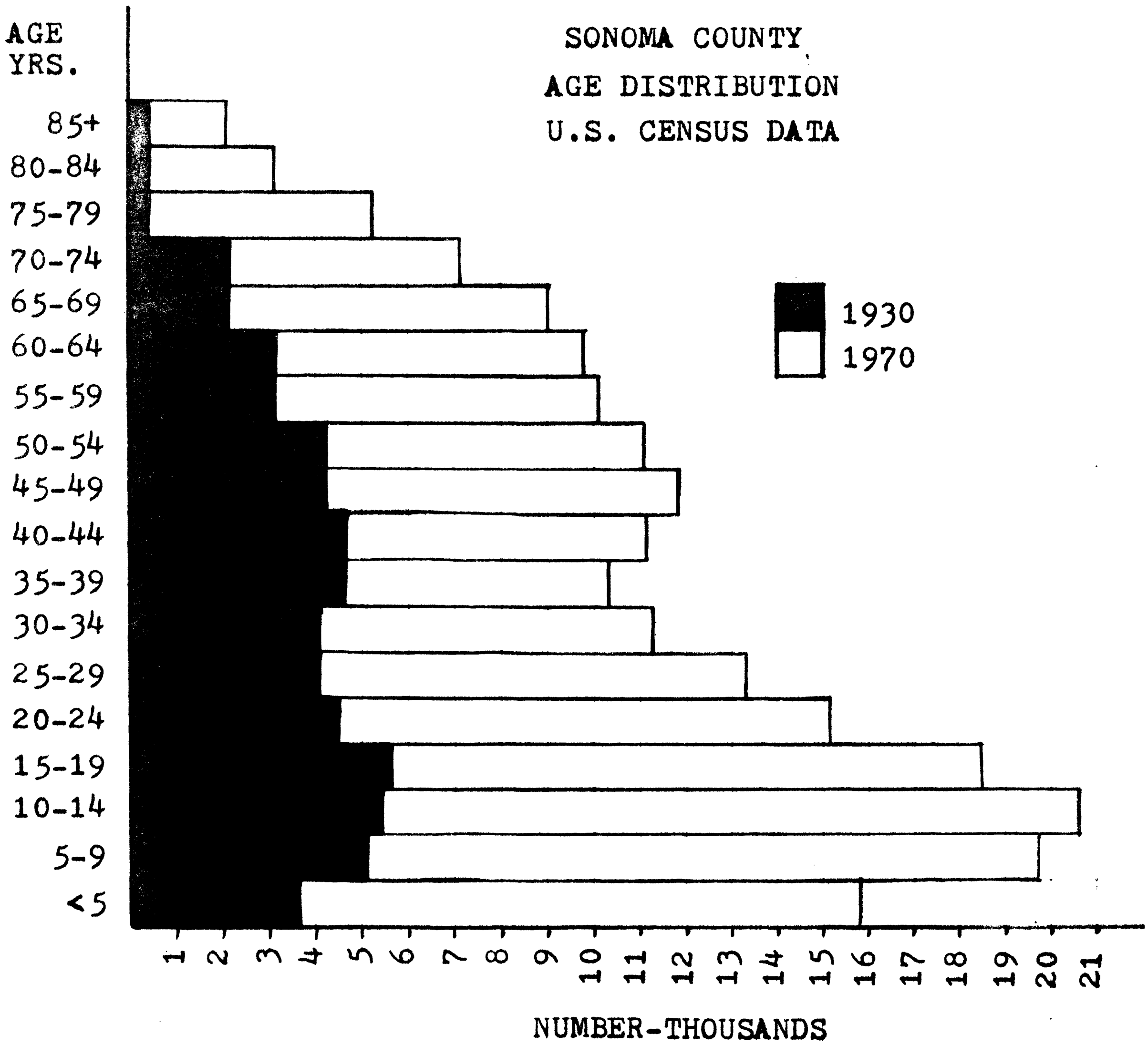
AGE DISTRIBUTION

AGE	1970	1960	1950	1940	1930
<5	15941	14681	9976	4016	3684
5-9	19849	14692	8453	4070	5063
10-14	20476	14573	7411	5010	5429
15-19	18437	10701	6741	6349	5594
20-24	15124	7523	6126	5061	4518
25-29	13226	7275	7319	4918	4068
30-34	11246	8364	7364	4649	4119
35-39	10311	10036	7477	4804	9300
40-44	11055	9321	7157	4759	
45-49	11890	8977	6497	5008	8395
50-54	11034	8065	6077	4856	
55-59	10136	7713	6011	4258	6204
60-64	9815	6701	5392	3724	
65-69	9005	6913	4541	2994	4174
70-74	7072	5452	3261	2208	
75-79	5193	3583	3046	2368	1640
80-84	3057	1766			
85+	2018	1039	555		
<18	67941	51206	30058		

POPULATION

YEAR	MALE	FEMALE	TOTAL
1850	356	204	560
1860	7488	4389	11867
1870	11574	8245	19819
1880	14610	11316	25926
1890	18514	14207	32721
1900	20900	17580	38480
1910	26113	22281	48394
1920	27428	24662	52090
1930	32821	29401	62222
1940	36077	32975	69052
1950	52313	51092	103405
1960	72989	74386	147375
1970	99362	105523	204885

APPENDIX E-Continued



APPENDIX F

WALLACE E. MARTIN
2003 N STREET
EUREKA, CALIFORNIA 95501

June 28, 1974

Cary Hull Photography
7708 McKnight N. E.
Albuquerque, New Mexico 87110

Dear Mr. Hull:

Your letter of October 8, 1973 addressed to the Humboldt County Historical Society was recently referred to me for reply. (I don't know where it has been all the time!)

I am editor of the Society's publication, The Humboldt Historian.

Mr. J. A. Meister was a prominent commercial photographer here in Eureka and my records indicate he sold his studio in 1909 "to work on his patents." Newspaper references prior to this date noted that he was making "excellent color prints" so that it is possible that he had patented the process.

I've never had occasion to go any deeper into this subject because it would entail considerable research.

In my postcard collection of local scenes, events, etc., I have numerous photos by Mr. Meister.

If you should ever want any of your photos identified, I would be willing to do so gratis if you weren't in a rush. I was born and reared in Eureka and local history has been my hobby for many years.

I'm glad to hear that you have the negatives and plates of this old-time photographer and hope you hold on to them and take good care.

Sincerely,

Wallace E. Martin

Wallace E. Martin

WEM:m

APPENDIX F-Continued

645 Evans
Missoula, Montana 59801
January 28, 1975

Wallace E. Martin
2003 N. Street
Eureka, California 95501

Dear Mr. Martin,

As you will recall I corresponded with you last June and July from Albuquerque, N.M. concerning the identification of some old pictures taken by Mr. J.A. Meiser around the turn of the century. Since our correspondence I have returned to school at the University of Montana and am now working on a professional paper on the Early Redwood History.

Enclosed you will find six xerox copies of some of the old pictures I intend to use in my paper. I would appreciate very much any information you could supply regarding people, locations etc.

Later on when the rat race of school settles down I would like to send you additional pictures for your identification if your time permits.

Thanks much for your assistance.

Cordially,

Cary W. Hull

APPENDIX F–Continued

Simpson

CALIFORNIA OPERATIONS Post Office Drawer V
Arcata, California 95521 • 707-822-0371

October 8, 1974

Mr. Cary Hull
645 Evans
Missoula, Montana 59801

Dear Cary:

Your letter requesting information on "The Redwoods - Past and Present" arrived last week. I am forwarding it to the California Redwood Association.

Unless you are from the Redwood Region, or have spent a great deal of time here, I expect that you should have a difficult time developing an accurate account of "The Redwoods - Past and Present".

I've lived and worked here for a good number of years and would hesitate to undertake such a task. I hope you can do justice to the subject from Missoula.

Any study of the nature you plan should certainly cover the history of logging and particularly the current level of forestry practice which includes tree improvement, containerized nurseries, pre-commercial thinning, and other intensively applied cultural practices. Natural regeneration and growth should also be given close attention.

Accurate comparisons should be made between the park lands and those more appropriately devoted to commercial and other recreational uses. It should be pointed out that most of the industrial lands, even before logging, did not compare with those set aside as parks and actually were of little value for that purpose.

Mr. Cary Hull -2- October 8, 1974

As you suggest in your letter, a comparison of antique logging methods with those of today is important. And, if you can, some account of prehistoric times would be of interest.

Good luck!

Sincerely,

SIMPSON TIMBER COMPANY

J. A. Rydelius
Reforestation Supervisor
California Resources

JAR:am

CC: Keith Lanning, CRA
H. K. Trobitz

APPENDIX F–Continued

Georgia-Pacific Corporation

Fort Bragg Division
90 West Redwood Avenue
Fort Bragg, California 95437 707/964-5651

October 14, 1974

Cary Hull
645 Evans St.
Missoula, MT 59801

Dear Cary:

Jere Melo, our chief forester here in Fort Bragg, forwarded your letter of October 1 to me for action.

I am sending under separate cover some literature and two books which may be helpful to you.

The old Union Lumber Company, which owned the Fort Bragg operations from 1872 until 1969, developed quite an extensive collection of negatives and b/w photos. We have recently updated and rearranged this collection to make it more readily available to persons such as yourself. The collection contains many photos of virtually every aspect of early logging and related activities here on the Mendocino Coast from about 1890 to present. Copies (b/w, 8 x 10) made from these negatives are available for $2 each. If you wish to visit this area, you can make copies of the photos with your own equipment here in Fort Bragg for no charge.

I hope this information is helpful to you. If we can be of more assistance, please feel free to let me know.

Sincerely,

Jim Mitchell

J. H. Mitchell
Public Relations Manager

JHM:dr

APPENDIX F-Continued

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. Box 1019, Davis, CA 95616

January 29, 1975

Mr. Cary Hull
645 Evans
Missoula, Montana 59801

Dear Cary:

This letter will serve to bring you up-to-date on your request for our help in securing some black and white photos.

Gene Anderson, our field forester in Northern California, and Francis Morrell, soil conservationist at Eureka, have been able to positively identify the locations where the historical photos you have were taken. We are now working with Ralph Bishop, area conservationist for the North Coast, in hopes of getting photos taken of the points. The severe restriction in the travel budget is hampering our efforts but we are hopeful of obtaining the pictures.

Hope the other aspects of your educational program are progressing satisfactorily.

Sincerely,

Frank

FRANK T. HOLT
State Woodland Conservationist

cc: W. J. Sauerwein, SCS, Portland, Oregon
Ralph E. Bishop, SCS, Santa Rosa, California
Eugene S. Anderson, SCS, Red Bluff, California
Francis E. Morrell, SCS, Eureka, California

APPENDIX G

Field Office
Technical Guide
Section V - Woodland
MLRA: 4

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
March 1974

REDWOOD(INT1/4) SITE INDEX = 120.

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 40. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

			BEFORE HARVEST		PERIODIC HARVEST	
AGE	DBH	UNIT PRICE	VOLUME	GR. VALUE	VOLUME	GR. RETURN
20.	9.	40.00	600. BF	24.00	0. BF	0.0
30.	11.	44.80	3100. BF	138.88	0. BF	0.0
40.	13.	48.60	8800. BF	427.68	0. BF	0.0
50.	15.	51.80	16500. BF	854.70	0. BF	0.0
60.	16.	55.00	27400. BF	1507.00	0. BF	0.0
70.	18.	57.80	40400. BF	2335.12	0. BF	0.0
80.	19.	60.40	53700. BF	3243.48	0. BF	0.0
90.	20.	63.00	67400. BF	4246.19	0. BF	0.0
100.	21.	65.60	81300. BF	5333.27	81300. BF	5333.27

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 50. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

			BEFORE HARVEST		PERIODIC HARVEST	
AGE	DBH	UNIT PRICE	VOLUME	GR. VALUE	VOLUME	GR. RETURN
20.	9.	50.00	600. BF	30.00	0. BF	0.0
30.	11.	56.00	3100. BF	173.60	0. BF	0.0
40.	13.	60.75	8800. BF	534.60	0. BF	0.0
50.	15.	64.75	16500. BF	1068.37	0. BF	0.0
60.	16.	68.75	27400. BF	1883.75	0. BF	0.0
70.	18.	72.25	40400. BF	2918.90	0. BF	0.0
80.	19.	75.50	53700. BF	4054.35	0. BF	0.0
90.	20.	78.75	67400. BF	5307.75	0. BF	0.0
100.	21.	82.00	81300. BF	6666.59	81300. BF	6666.59

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 60. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

			BEFORE HARVEST		PERIODIC HARVEST	
AGE	DBH	UNIT PRICE	VOLUME	GR. VALUE	VOLUME	GR. RETURN
20.	9.	60.00	600. BF	36.00	0. BF	0.0
30.	11.	67.20	3100. BF	208.32	0. BF	0.0
40.	13.	72.90	8800. BF	641.52	0. BF	0.0
50.	15.	77.70	16500. BF	1282.05	0. BF	0.0
60.	16.	82.50	27400. BF	2260.50	0. BF	0.0
70.	18.	86.70	40400. BF	3502.68	0. BF	0.0
80.	19.	90.60	53700. BF	4865.21	0. BF	0.0
90.	20.	94.50	67400. BF	6369.30	0. BF	0.0
100.	21.	98.40	81300. BF	7999.91	81300. BF	7999.91

APPENDIX G–Continued

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
March 1974

Field Office
Technical Guide
Section V - Woodland
MLRA: 4

REDWOOD(INT1/4) SITE INDEX - 120.

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 40./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST GROSS INCOME	6. PERCENT INTEREST MARKING TALLY.	6. PERCENT INTEREST ESTAB. IMPRV.	7. PERCENT INTEREST GROSS INCOME	7. PERCENT INTEREST MARKING TALLY.	7. PERCENT INTEREST ESTAB. IMPRV.	8. PERCENT INTEREST GROSS INCOME	8. PERCENT INTEREST MARKING TALLY.	8. PERCENT INTEREST ESTAB. IMPRV.
20.	9.	0.65	0.0	0.87	0.59	0.0	0.94	0.52	0.0	1.02
30.	11.	1.76	0.0	0.73	1.47	0.0	0.81	1.23	0.0	0.89
40.	13.	2.76	0.0	0.66	2.14	0.0	0.75	1.65	0.0	0.84
50.	15.	2.94	0.0	0.63	2.10	0.0	0.72	1.49	0.0	0.82
60.	16.	2.83	0.0	0.62	1.85	0.0	0.71	1.20	0.0	0.81
70.	18.	2.41	0.0	0.61	1.45	0.0	0.71	0.86	0.0	0.80
80.	19.	1.86	0.0	0.61	1.02	0.0	0.70	0.55	0.0	0.80
90.	20.	1.35	0.0	0.60	0.68	0.0	0.70	0.33	0.0	0.80
100.	21.	0.95	0.0	0.60	0.43	0.0	0.70	0.19	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 50./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST GROSS INCOME	6. PERCENT INTEREST MARKING TALLY.	6. PERCENT INTEREST ESTAB. IMPRV.	7. PERCENT INTEREST GROSS INCOME	7. PERCENT INTEREST MARKING TALLY.	7. PERCENT INTEREST ESTAB. IMPRV.	8. PERCENT INTEREST GROSS INCOME	8. PERCENT INTEREST MARKING TALLY.	8. PERCENT INTEREST ESTAB. IMPRV.
20.	9.	0.82	0.0	0.87	0.73	0.0	0.94	0.66	0.0	1.02
30.	11.	2.20	0.0	0.73	1.84	0.0	0.81	1.53	0.0	0.89
40.	13.	3.45	0.0	0.66	2.68	0.0	0.75	2.06	0.0	0.84
50.	15.	3.68	0.0	0.63	2.63	0.0	0.72	1.86	0.0	0.82
60.	16.	3.53	0.0	0.62	2.32	0.0	0.71	1.50	0.0	0.81
70.	18.	3.02	0.0	0.61	1.81	0.0	0.71	1.07	0.0	0.80
80.	19.	2.32	0.0	0.61	1.27	0.0	0.70	0.69	0.0	0.80
90.	20.	1.69	0.0	0.60	0.84	0.0	0.70	0.42	0.0	0.80
100.	21.	1.18	0.0	0.60	0.54	0.0	0.70	0.24	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 60./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST GROSS INCOME	6. PERCENT INTEREST MARKING TALLY.	6. PERCENT INTEREST ESTAB. IMPRV.	7. PERCENT INTEREST GROSS INCOME	7. PERCENT INTEREST MARKING TALLY.	7. PERCENT INTEREST ESTAB. IMPRV.	8. PERCENT INTEREST GROSS INCOME	8. PERCENT INTEREST MARKING TALLY.	8. PERCENT INTEREST ESTAB. IMPRV.
20.	9.	0.98	0.0	0.87	0.88	0.0	0.94	0.79	0.0	1.02
30.	11.	2.64	0.0	0.73	2.21	0.0	0.81	1.84	0.0	0.89
40.	13.	4.15	0.0	0.66	3.21	0.0	0.75	2.48	0.0	0.84
50.	15.	4.42	0.0	0.63	3.15	0.0	0.72	2.23	0.0	0.82
60.	16.	4.24	0.0	0.62	2.78	0.0	0.71	1.80	0.0	0.81
70.	18.	3.62	0.0	0.61	2.17	0.0	0.71	1.29	0.0	0.80
80.	19.	2.79	0.0	0.61	1.53	0.0	0.70	0.83	0.0	0.80
90.	20.	2.03	0.0	0.60	1.01	0.0	0.70	0.50	0.0	0.80
100.	21.	1.42	0.0	0.60	0.65	0.0	0.70	0.29	0.0	0.80

NOTE - ESTABLISHMENT AND IMPROVEMENT BASED ON $10/ACRE

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WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 40. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	9.	40.00	2300. BF	92.00	0. BF	0.0
30.	12.	46.20	9500. BF	438.90	0. BF	0.0
40.	15.	50.60	20400. BF	1032.24	0. BF	0.0
50.	16.	54.20	33700. BF	1826.54	0. BF	0.0
60.	18.	57.40	48900. BF	2806.86	0. BF	0.0
70.	19.	60.20	65000. BF	3913.00	0. BF	0.0
80.	21.	63.00	81500. BF	5134.50	0. BF	0.0
90.	22.	65.80	98300. BF	6468.14	0. BF	0.0
100.	23.	68.00	114600. BF	7792.79	114600. BF	7792.79

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 50. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	9.	50.00	2300. BF	115.00	0. BF	0.0
30.	12.	57.75	9500. BF	548.62	0. BF	0.0
40.	15.	63.25	20400. BF	1290.30	0. BF	0.0
50.	16.	67.75	33700. BF	2283.17	0. BF	0.0
60.	18.	71.75	48900. BF	3508.57	0. BF	0.0
70.	19.	75.25	65000. BF	4891.25	0. BF	0.0
80.	21.	78.75	81500. BF	6418.12	0. BF	0.0
90.	22.	82.25	98300. BF	8085.16	0. BF	0.0
100.	23.	85.00	114600. BF	9740.99	114600. BF	9740.99

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 60. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	9.	60.00	2300. BF	138.00	0. BF	0.0
30.	12.	69.30	9500. BF	658.35	0. BF	0.0
40.	15.	75.90	20400. BF	1548.36	0. BF	0.0
50.	16.	81.30	33700. BF	2739.81	0. BF	0.0
60.	18.	86.10	48900. BF	4210.28	0. BF	0.0
70.	19.	90.30	65000. BF	5869.50	0. BF	0.0
80.	21.	94.50	81500. BF	7701.74	0. BF	0.0
90.	22.	98.70	98300. BF	9702.20	0. BF	0.0
100.	23.	102.00	114600. BF	11689.18	114600. BF	11689.18

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COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 40./MBF
MARKING AND TALLYING COST – $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	7. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	8. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
20.	9.	2.50	0.0	0.87	2.24	0.0	0.94	2.01	0.0	1.02
30.	12.	5.55	0.0	0.73	4.65	0.0	0.81	3.87	0.0	0.89
40.	15.	6.67	0.0	0.66	5.17	0.0	0.75	3.98	0.0	0.84
50.	16.	6.29	0.0	0.63	4.49	0.0	0.72	3.18	0.0	0.82
60.	18.	5.27	0.0	0.62	3.45	0.0	0.71	2.24	0.0	0.81
70.	19.	4.04	0.0	0.61	2.42	0.0	0.71	1.44	0.0	0.80
80.	21.	2.94	0.0	0.61	1.61	0.0	0.70	0.87	0.0	0.80
90.	22.	2.06	0.0	0.60	1.03	0.0	0.70	0.51	0.0	0.80
100.	23.	1.38	0.0	0.60	0.63	0.0	0.70	0.28	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 50./MBF
MARKING AND TALLYING COST – $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	7. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	8. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
20.	9.	3.13	0.0	0.87	2.81	0.0	0.94	2.51	0.0	1.02
30.	12.	6.94	0.0	0.73	5.81	0.0	0.81	4.84	0.0	0.89
40.	15.	8.34	0.0	0.66	6.46	0.0	0.75	4.98	0.0	0.84
50.	16.	7.86	0.0	0.63	5.62	0.0	0.72	3.98	0.0	0.82
60.	18.	6.58	0.0	0.62	4.31	0.0	0.71	2.80	0.0	0.81
70.	19.	5.05	0.0	0.61	3.03	0.0	0.71	1.80	0.0	0.80
80.	21.	3.67	0.0	0.61	2.01	0.0	0.70	1.09	0.0	0.80
90.	22.	2.57	0.0	0.60	1.29	0.0	0.70	0.64	0.0	0.80
100.	23.	1.73	0.0	0.60	0.79	0.0	0.70	0.35	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 60./MBF
MARKING AND TALLYING COST – $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	7. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	8. PERCENT INTEREST GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
20.	9.	3.75	0.0	0.87	3.37	0.0	0.94	3.02	0.0	1.02
30.	12.	8.33	0.0	0.73	6.97	0.0	0.81	5.81	0.0	0.89
40.	15.	10.01	0.0	0.66	7.76	0.0	0.75	5.98	0.0	0.84
50.	16.	9.44	0.0	0.63	6.74	0.0	0.72	4.78	0.0	0.82
60.	18.	7.90	0.0	0.62	5.18	0.0	0.71	3.36	0.0	0.81
70.	19.	6.06	0.0	0.61	3.64	0.0	0.71	2.16	0.0	0.80
80.	21.	4.41	0.0	0.61	2.42	0.0	0.70	1.31	0.0	0.80
90.	22.	3.09	0.0	0.60	1.54	0.0	0.70	0.76	0.0	0.80
100.	23.	2.07	0.0	0.60	0.94	0.0	0.70	0.43	0.0	0.80

NOTE – ESTABLISHMENT AND IMPROVEMENT BASED ON $10/ACRE

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WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 40. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	10.	40.00	7000. BF	280.00	0. BF	0.0
30.	14.	47.20	19600. BF	925.12	0. BF	0.0
40.	16.	52.20	36900. BF	1926.18	0. BF	0.0
50.	18.	56.20	55300. BF	3107.86	0. BF	0.0
60.	20.	59.60	74500. BF	4440.19	0. BF	0.0
70.	21.	62.60	94500. BF	5915.69	0. BF	0.0
80.	23.	65.40	114300. BF	7475.21	0. BF	0.0
90.	24.	68.00	133800. BF	9098.39	0. BF	0.0
100.	25.	70.20	152300. BF	10691.45	152300. BF	10691.45

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 50. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	10.	50.00	7000. BF	350.00	0. BF	0.0
30.	14.	59.00	19600. BF	1156.40	0. BF	0.0
40.	16.	65.25	36900. BF	2407.72	0. BF	0.0
50.	18.	70.25	55300. BF	3884.82	0. BF	0.0
60.	20.	74.50	74500. BF	5550.25	0. BF	0.0
70.	21.	78.25	94500. BF	7394.61	0. BF	0.0
80.	23.	81.75	114300. BF	9344.01	0. BF	0.0
90.	24.	85.00	133800. BF	11372.98	0. BF	0.0
100.	25.	87.75	152300. BF	13364.31	152300. BF	13364.31

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 60. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	10.	60.00	7000. BF	420.00	0. BF	0.0
30.	14.	70.80	19600. BF	1387.68	0. BF	0.0
40.	16.	78.30	36900. BF	2889.27	0. BF	0.0
50.	18.	84.30	55300. BF	4661.78	0. BF	0.0
60.	20.	89.40	74500. BF	6660.29	0. BF	0.0
70.	21.	93.90	94500. BF	8873.54	0. BF	0.0
80.	23.	98.10	114300. BF	11212.81	0. BF	0.0
90.	24.	102.00	133800. BF	13647.58	0. BF	0.0
100.	25.	105.30	152300. BF	16037.18	152300. BF	16037.18

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COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 40./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	7. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	8. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
20.	10.	7.61	0.0	0.87	6.83	0.0	0.94	6.12	0.0	1.02
30.	14.	11.70	0.0	0.73	9.79	0.0	0.81	8.17	0.0	0.89
40.	16.	12.45	0.0	0.66	9.65	0.0	0.75	7.44	0.0	0.84
50.	18.	10.70	0.0	0.63	7.64	0.0	0.72	5.42	0.0	0.82
60.	20.	8.33	0.0	0.62	5.46	0.0	0.71	3.54	0.0	0.81
70.	21.	6.11	0.0	0.61	3.66	0.0	0.71	2.17	0.0	0.80
80.	23.	4.28	0.0	0.61	2.34	0.0	0.70	1.27	0.0	0.80
90.	24.	2.90	0.0	0.60	1.45	0.0	0.70	0.72	0.0	0.80
100.	25.	1.90	0.0	0.60	0.86	0.0	0.70	0.39	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 50./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	7. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	8. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
20.	10.	9.51	0.0	0.87	8.54	0.0	0.94	7.65	0.0	1.02
30.	14.	14.63	0.0	0.73	12.24	0.0	0.81	10.21	0.0	0.89
40.	16.	15.56	0.0	0.66	12.06	0.0	0.75	9.29	0.0	0.84
50.	18.	13.38	0.0	0.63	9.56	0.0	0.72	6.77	0.0	0.82
60.	20.	10.41	0.0	0.62	6.82	0.0	0.71	4.43	0.0	0.81
70.	21.	7.64	0.0	0.61	4.58	0.0	0.71	2.72	0.0	0.80
80.	23.	5.35	0.0	0.61	2.93	0.0	0.70	1.59	0.0	0.80
90.	24.	3.62	0.0	0.60	1.81	0.0	0.70	0.89	0.0	0.80
100.	25.	2.37	0.0	0.60	1.08	0.0	0.70	0.49	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 60./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	6. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	7. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	8. PERCENT INTEREST: GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
20.	10.	11.42	0.0	0.87	10.25	0.0	0.94	9.18	0.0	1.02
30.	14.	17.55	0.0	0.73	14.69	0.0	0.81	12.25	0.0	0.89
40.	16.	18.67	0.0	0.66	14.47	0.0	0.75	11.15	0.0	0.84
50.	18.	16.06	0.0	0.63	11.47	0.0	0.72	8.12	0.0	0.82
60.	20.	12.49	0.0	0.62	8.19	0.0	0.71	5.31	0.0	0.81
70.	21.	9.17	0.0	0.61	5.50	0.0	0.71	3.26	0.0	0.80
80.	23.	6.42	0.0	0.61	3.52	0.0	0.70	1.90	0.0	0.80
90.	24.	4.35	0.0	0.60	2.17	0.0	0.70	1.07	0.0	0.80
100.	25.	2.84	0.0	0.60	1.30	0.0	0.70	0.58	0.0	0.80

NOTE - ESTABLISHMENT AND IMPROVEMENT BASED ON $10/ACRE

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WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 40. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	11.	40.00	14500. BF	580.00	0. BF	0.0
30.	15.	48.00	34500. BF	1656.00	0. BF	0.0
40.	18.	53.60	57900. BF	3103.44	0. BF	0.0
50.	20.	57.80	82000. BF	4739.60	0. BF	0.0
60.	22.	61.60	106100. BF	6535.75	0. BF	0.0
70.	23.	64.60	130400. BF	8423.83	0. BF	0.0
80.	24.	67.40	153500. BF	10345.89	0. BF	0.0
90.	26.	70.00	176400. BF	12347.98	0. BF	0.0
100.	27.	72.40	198000. BF	14335.19	198000. BF	14335.19

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 50. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	11.	50.00	14500. BF	725.00	0. BF	0.0
30.	15.	60.00	34500. BF	2070.00	0. BF	0.0
40.	18.	67.00	57900. BF	3879.30	0. BF	0.0
50.	20.	72.25	82000. BF	5924.49	0. BF	0.0
60.	22.	77.00	106100. BF	8169.69	0. BF	0.0
70.	23.	80.75	130400. BF	10529.79	0. BF	0.0
80.	24.	84.25	153500. BF	12932.36	0. BF	0.0
90.	26.	87.50	176400. BF	15434.98	0. BF	0.0
100.	27.	90.50	198000. BF	17918.99	198000. BF	17918.99

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 60. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

AGE	DBH	UNIT PRICE	BEFORE HARVEST VOLUME	BEFORE HARVEST GR. VALUE	PERIODIC HARVEST VOLUME	PERIODIC HARVEST GR. RETURN
20.	11.	60.00	14500. BF	870.00	0. BF	0.0
30.	15.	72.00	34500. BF	2484.00	0. BF	0.0
40.	18.	80.40	57900. BF	4655.16	0. BF	0.0
50.	20.	86.70	82000. BF	7109.39	0. BF	0.0
60.	22.	92.40	106100. BF	9803.63	0. BF	0.0
70.	23.	96.90	130400. BF	12635.75	0. BF	0.0
80.	24.	101.10	153500. BF	15518.83	0. BF	0.0
90.	26.	105.00	176400. BF	18521.98	0. BF	0.0
100.	27.	108.60	198000. BF	21502.79	198000. BF	21502.79

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COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 40./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	GROSS INCOME (6. PERCENT INTEREST)	MARKING TALLY. (6. PERCENT INTEREST)	ESTAB. IMPRV. (6. PERCENT INTEREST)	GROSS INCOME (7. PERCENT INTEREST)	MARKING TALLY. (7. PERCENT INTEREST)	ESTAB. IMPRV. (7. PERCENT INTEREST)	GROSS INCOME (8. PERCENT INTEREST)	MARKING TALLY. (8. PERCENT INTEREST)	ESTAB. IMPRV. (8. PERCENT INTEREST)
20.	11.	15.77	0.0	0.87	14.15	0.0	0.94	12.67	0.0	1.02
30.	15.	20.95	0.0	0.73	17.53	0.0	0.81	14.62	0.0	0.89
40.	18.	20.05	0.0	0.66	15.55	0.0	0.75	11.98	0.0	0.84
50.	20.	16.32	0.0	0.63	11.66	0.0	0.72	8.26	0.0	0.82
60.	22.	12.26	0.0	0.62	8.03	0.0	0.71	5.22	0.0	0.81
70.	23.	6.70	0.0	0.61	5.22	0.0	0.71	3.10	0.0	0.80
80.	24.	5.92	0.0	0.61	3.24	0.0	0.70	1.76	0.0	0.80
90.	26.	3.93	0.0	0.60	1.96	0.0	0.70	0.97	0.0	0.80
100.	27.	2.54	0.0	0.60	1.16	0.0	0.70	0.52	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 50./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	GROSS INCOME (6. PERCENT INTEREST)	MARKING TALLY. (6. PERCENT INTEREST)	ESTAB. IMPRV. (6. PERCENT INTEREST)	GROSS INCOME (7. PERCENT INTEREST)	MARKING TALLY. (7. PERCENT INTEREST)	ESTAB. IMPRV. (7. PERCENT INTEREST)	GROSS INCOME (8. PERCENT INTEREST)	MARKING TALLY. (8. PERCENT INTEREST)	ESTAB. IMPRV. (8. PERCENT INTEREST)
20.	11.	19.71	0.0	0.87	17.68	0.0	0.94	15.84	0.0	1.02
30.	15.	26.18	0.0	0.73	21.91	0.0	0.81	18.27	0.0	0.89
40.	18.	25.07	0.0	0.66	19.43	0.0	0.75	14.97	0.0	0.64
50.	20.	20.41	0.0	0.63	14.57	0.0	0.72	10.33	0.0	0.82
60.	22.	15.32	0.0	0.62	10.04	0.0	0.71	6.52	0.0	0.81
70.	23.	10.88	0.0	0.61	6.52	0.0	0.71	3.87	0.0	0.80
80.	24.	7.40	0.0	0.61	4.06	0.0	0.70	2.20	0.0	0.80
90.	26.	4.91	0.0	0.60	2.46	0.0	0.70	1.21	0.0	0.80
100.	27.	3.18	0.0	0.60	1.45	0.0	0.70	0.65	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 60./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	GROSS INCOME (6. PERCENT INTEREST)	MARKING TALLY. (6. PERCENT INTEREST)	ESTAB. IMPRV. (6. PERCENT INTEREST)	GROSS INCOME (7. PERCENT INTEREST)	MARKING TALLY. (7. PERCENT INTEREST)	ESTAB. IMPRV. (7. PERCENT INTEREST)	GROSS INCOME (8. PERCENT INTEREST)	MARKING TALLY. (8. PERCENT INTEREST)	ESTAB. IMPRV. (8. PERCENT INTEREST)
20.	11.	23.65	0.0	0.87	21.22	0.0	0.94	19.01	0.0	1.02
30.	15.	31.42	0.0	0.73	26.30	0.0	0.81	21.93	0.0	0.89
40.	18.	30.08	0.0	0.66	23.32	0.0	0.75	17.97	0.0	0.84
50.	20.	24.49	0.0	0.63	17.49	0.0	0.72	12.39	0.0	0.82
60.	22.	18.39	0.0	0.62	12.05	0.0	0.71	7.82	0.0	0.81
70.	23.	13.05	0.0	0.61	7.83	0.0	0.71	4.65	0.0	0.80
80.	24.	8.89	0.0	0.61	4.87	0.0	0.70	2.64	0.0	0.80
90.	26.	5.90	0.0	0.60	2.95	0.0	0.70	1.46	0.0	0.80
100.	27.	3.81	0.0	0.60	1.74	0.0	0.70	0.78	0.0	0.80

NOTE - ESTABLISHMENT AND IMPROVEMENT BASED ON $10/ACRE

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WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 40. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

			BEFORE HARVEST		PERIODIC HARVEST	
AGE	DBH	UNIT PRICE	VOLUME	GR. VALUE	VOLUME	GR. RETURN
20.	11.	40.00	23900. BF	956.00	0. BF	0.0
30.	16.	48.60	52300. BF	2541.78	0. BF	0.0
40.	19.	54.60	82100. BF	4482.66	0. BF	0.0
50.	21.	59.00	112700. BF	6649.29	0. BF	0.0
60.	23.	63.00	142100. BF	8952.29	0. BF	0.0
70.	24.	66.00	170900. BF	11279.38	0. BF	0.0
80.	26.	69.00	198200. BF	13675.79	0. BF	0.0
90.	27.	71.60	224100. BF	16045.54	0. BF	0.0
100.	28.	73.80	248500. BF	18339.28	248500. BF	18339.28

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 50. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

			BEFORE HARVEST		PERIODIC HARVEST	
AGE	DBH	UNIT PRICE	VOLUME	GR. VALUE	VOLUME	GR. RETURN
20.	11.	50.00	23900. BF	1195.00	0. BF	0.0
30.	16.	60.75	52300. BF	3177.22	0. BF	0.0
40.	19.	68.25	82100. BF	5603.32	0. BF	0.0
50.	21.	73.75	112700. BF	8311.62	0. BF	0.0
60.	23.	78.75	142100. BF	11190.36	0. BF	0.0
70.	24.	82.50	170900. BF	14099.23	0. BF	0.0
80.	26.	86.25	198200. BF	17094.74	0. BF	0.0
90.	27.	89.50	224100. BF	20056.93	0. BF	0.0
100.	28.	92.25	248500. BF	22924.11	248500. BF	22924.11

WOODLAND PRODUCTION POTENTIALS AND VALUES PER ACRE

++++++BASED ON $ 0.0 PER CORD, $ 60. PER MBF++++++

(WITH A 10. PERCENT INCREASE IN BASE PRICE PER 2.IN. INCREASE IN DBH)

			BEFORE HARVEST		PERIODIC HARVEST	
AGE	DBH	UNIT PRICE	VOLUME	GR. VALUE	VOLUME	GR. RETURN
20.	11.	60.00	23900. BF	1434.00	0. BF	0.0
30.	16.	72.90	52300. BF	3812.67	0. BF	0.0
40.	19.	81.90	82100. BF	6723.98	0. BF	0.0
50.	21.	88.50	112700. BF	9973.94	0. BF	0.0
60.	23.	94.50	142100. BF	13428.44	0. BF	0.0
70.	24.	99.00	170900. BF	16919.08	0. BF	0.0
80.	26.	103.50	198200. BF	20513.69	0. BF	0.0
90.	27.	107.40	224100. BF	24068.32	0. BF	0.0
100.	28.	110.70	248500. BF	27508.93	248500. BF	27508.93

APPENDIX G-Continued

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COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 40./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
		6. PERCENT INTEREST			7. PERCENT INTEREST			8. PERCENT INTEREST		
20.	11.	25.99	0.0	0.87	23.32	0.0	0.94	20.89	0.0	1.02
30.	16.	32.15	0.0	0.73	26.91	0.0	0.81	22.44	0.0	0.89
40.	19.	28.97	0.0	0.66	22.45	0.0	0.75	17.30	0.0	0.84
50.	21.	22.90	0.0	0.63	16.36	0.0	0.72	11.59	0.0	0.82
60.	23.	16.79	0.0	0.62	11.00	0.0	0.71	7.14	0.0	0.81
70.	24.	11.65	0.0	0.61	6.99	0.0	0.71	4.15	0.0	0.80
80.	26.	7.83	0.0	0.61	4.29	0.0	0.70	2.32	0.0	0.80
90.	27.	5.11	0.0	0.60	2.55	0.0	0.70	1.26	0.0	0.80
100.	28.	3.25	0.0	0.60	1.48	0.0	0.70	0.67	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 50./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
		6. PERCENT INTEREST			7. PERCENT INTEREST			8. PERCENT INTEREST		
20.	11.	32.49	0.0	0.87	29.15	0.0	0.94	26.11	0.0	1.02
30.	16.	40.19	0.0	0.73	33.64	0.0	0.81	28.05	0.0	0.89
40.	19.	36.21	0.0	0.66	28.07	0.0	0.75	21.63	0.0	0.84
50.	21.	28.63	0.0	0.63	20.45	0.0	0.72	14.49	0.0	0.82
60.	23.	20.99	0.0	0.62	13.76	0.0	0.71	8.93	0.0	0.81
70.	24.	14.57	0.0	0.61	8.74	0.0	0.71	5.18	0.0	0.80
80.	26.	9.79	0.0	0.61	5.36	0.0	0.70	2.90	0.0	0.80
90.	27.	6.39	0.0	0.60	3.19	0.0	0.70	1.58	0.0	0.80
100.	28.	4.07	0.0	0.60	1.85	0.0	0.70	0.83	0.0	0.80

COST-RETURN ESTIMATES PER ACRE AT $ 0.0 /CORD, $ 60./MBF
MARKING AND TALLYING COST - $0.0 /CORD, $0.0 /MBF
AVERAGE ANNUAL EQUIVALENTS AT SPECIFIED ROTATION AGES

AGE	DBH	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.	GROSS INCOME	MARKING TALLY.	ESTAB. IMPRV.
		6. PERCENT INTEREST			7. PERCENT INTEREST			8. PERCENT INTEREST		
20.	11.	38.98	0.0	0.87	34.98	0.0	0.94	31.34	0.0	1.02
30.	16.	48.23	0.0	0.73	40.36	0.0	0.81	33.66	0.0	0.89
40.	19.	43.45	0.0	0.66	33.68	0.0	0.75	25.96	0.0	0.84
50.	21.	34.35	0.0	0.63	24.53	0.0	0.72	17.38	0.0	0.82
60.	23.	25.19	0.0	0.62	16.51	0.0	0.71	10.72	0.0	0.81
70.	24.	17.48	0.0	0.61	10.48	0.0	0.71	6.22	0.0	0.80
80.	26.	11.75	0.0	0.61	6.43	0.0	0.70	3.48	0.0	0.80
90.	27.	7.66	0.0	0.60	3.83	0.0	0.70	1.89	0.0	0.80
100.	28.	4.88	0.0	0.60	2.22	0.0	0.70	1.00	0.0	0.80

NOTE - ESTABLISHMENT AND IMPROVEMENT BASED ON $10/ACRE

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