A REVIEW OF REDWOOD HARVESTING

ANOTHER LOOK --- 1990

1964

1990

STATE OF CALIFORNIA

THE RESOURCES AGENCY

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George Deukmejan
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Gordon K. Van Vleck
Secretary for Resources
The Resources Agency

Harold R. Walt
Director
California Department of
Forestry and Fire Protection

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Kenneth L. Delfino
Deputy Director

Brian R. Barrette
Staff Chief
Forest Management

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION
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Phillip G. Lowell
RPF No. 648

Contract # 8CA 85011

FORWARD

In 1972 The Division of Forestry conducted a study of harvesting practices in the redwood forest and the changes in forest cover. Pictorial examples of early day harvesting in the original growth forest were found and then compared to the forest found on the same site in 1972. In 1972 as today, there was controversy raging over the various silvicultural systems used in the harvest of redwood timber. This original study documented the fact that clearcutting did not result in destruction of the redwood forest and that in many cases it had significiant advantages. Before and after photographs demonstrated some of the most productive young growth forests now exist on areas that were clearcut to bare ground, at the turn of the century.

California Division of Forestry foresters Verne R. Osburn and Phillip G. Lowell did the original work. In 1990 Forester Phillip Lowell revised and updated the original work. As in 1972, the controversy between selective harvesting and clearcutting as the proper silvicultural method for managing the redwood forest continues on. This report is prepared in an attempt to provide objective information to the general public and interested organizations on the effect of clearcutting as a silvicultural method in the redwood forest. The basic findings of the 1972 report and reconfirmed in this 1990 update are that the choice of the best harvesting system depends on site specific conditions, and that the clearcutting method of harvesting is a legitimate silvicultural tool for perpetuating redwood as a crop, and as a species when it is used properly and other resources are protected.

Deep appreciation is extended to the many libraries, private organizations, public agencies and individuals who assisted and allowed us to utilize their knowledge and resources in compiling this report.

Harold R. Walt
Director
California Department of Forestry
and Fire Protection

A REVIEW OF REDWOOD HARVESTING

Coast redwood is a unique tree found along the central and northern coastal reaches of California. Its value lies not only in lumber content, which is world famous for quality and durability, but for its aesthetic, historic and scientific value. Its scientific value stems from being a relic species forced to a toe-hold on the edge of a continent by changing ecological conditions which favor other life forms.

Although confined to a narrow range, redwood is an unusually vigorous, healthy, competitive tree with many characteristics the forester and botanist find unique. Where conditions favor it, the tree forms the dominant forest cover. Its rapid growth, sprouting ability, longevity, and resistance to insect and disease give it a competitive advantage over other forest trees. However, where environmental conditions do not meet its specific biological demands, redwood is unable to maintain itself and gives way to other vegetation forms.

BASIC REDWOOD FACTS

In California today there are 1,570,000 acres of coast redwood timber type. The amount of redwood forest that exists today approximates that which existed at the time of California's admission as a state in 1850. Although difficult to determine with any precision it is estimated that between 100 to 200 thousand acres of redwood forest have been replaced by agriculture, residential, road, and water development uses. Of the 1,570,000 acres of redwood forest about 254,000 acres or 16% is permanently reserved in parks and preserves. The remaining 1,324,000 or 84% is termed commercial forest land which is available for the growing and harvest of redwood. Throughout most of the Redwood Region the original old-growth forest has been replaced with a fast growing young-growth forest. Over 137,000 acres of old-growth forest remain with 89,000 acres being held in protected status with parks and preserves. Growth of redwood is estimated to be 658 million board feet per year during the period 1984 to 1986. Harvest of redwood from Redwood Region forests averaged 719 million board feet per year during the period 1983 - 1987. While the knot free, fine grained old-growth redwood is prized in the market place, products from young-growth trees are rapidly replacing them and are finding ready acceptance among redwood users.

Cover: Gold Bluff Road near Valley Green

CALIFORNIA REDWOOD LANDS

SOURCE: FOX, 1988

TABLE ONE ---- REDWOOD REGION STATISTICS*

COUNTY	Redwood Acreage	Commercial Redwood Acreage	Reserved Park/Preserve Acreage	Estimated Growth M. Board Ft./yr	Harvest 1984-88 M. Bd. Ft./yr
DEL NORTE	128,000	103,000	25,000	61,000	115,995
HUMBOLDT	528,000	428,000	100,000	235,400	363,403
MENDOCINO	604,000	552,000	52,000	248,400	235,538
SONOMA	147,000	143,000	4,000	60,775	15,649
NAPA	2,000	2,000	0	800	0
MARIN	18,000	11,000	7,000	3,850	0
ALAMEDA	500	0	500	-	-
SANTA CLARA	10,000	8,000	2,000	2,800	
SAN MATEO	41,000	30,000	11,000	12,750	22,942
SANTA CRUZ	67,000	50,000	17,000	21,250	
MONTEREY	24,000	22,000	2,000	5,500	
CONTRA COSTA	500	0	500		0
OREGON	14,500	10,000	4,500	5,000	1,000
TOTALS	1,584,500	1,359,000	225,500	657,525	754,527

* Collected and estimated from various sources. Totals may be at variance from region wide data

SILVICULTURAL AND ECOLOGICAL IMPACTS

How to maintain an extensive, vigorous redwood forest has attracted the attention of scientists and laymen alike. Many theories have been advanced and several systems tried.

Preservation in the form of complete protection was one early theory put into practice. As man occupied the Redwood Region, environmental factors such as uncontrolled fires and flood began to be significantly altered. Other vegetation began to compete with redwood in protected areas. Vigor of individual trees over large protected areas declined. Research has given indication that complete protection will not maintain a vigorous, healthy redwood forest.

As a major portion of the Redwood Region is commercial forest land, much attention has centered around harvesting systems as a means of maintaining redwood as a major crop tree. Various silvicultural systems have been tried — some inadvertently, some by careful design — to maximize the growth of redwood. Four basic systems emerged as having application in the redwood timber type. They are:

1. A "selection" system in which only a portion of the trees, either individually or in small groups, are selected for cutting.
2. The "seed tree" system in which certain individual trees are reserved from cutting so they may serve as a seed source for the new forest.
3. The "clearcutting" system in which all trees are removed, with the new forest either starting from stump sprouts and seeding in from adjacent stands, artifically regenerated by man, or a combination of all of these.
4. The shelterwood system in which a portion of the crop trees are left to protect and encourage the emerging regeneration. These overstory trees are then removed in sucessive stages to allow proper growth of the new tree crop.

The California Forest Practice Act which regulates and controls harvesting on redwood forest land permits these four harvesting systems. These silvicultural systems, required by law, are basic to perpetuating the redwood forest by providing new trees to replace those harvested. Of the Timber Harvesting Plans submitted to the California Department of Forestry in the Redwood Region during the period 1985 through 1989, 7% utilized the selection system, 12% involved the seed tree system, 19% used clearcutting and 54% specified the shelterwood system. There is a general tendency, particularly in the northern portion of the Redwood Region to increasingly utilize the "clearcutting" silvicultural system. Some of the reasons for favoring this system are:

1. Less disturbance to the land. It is harvested and left alone for 50 - 80 years.
2. Permits use of logging machinery which has less environmental impact on the land.
3. Allows more effective meeting of the State Forest Practice Rules.
4. Fewer disease and mechanical damage problems to trees.
5. More certain reforestation results.
6. More orderly regulation of harvest, growth and growing stock.

The clearcutting system has as its primary disadvantage its aesthetically poor and disturbed appearance. Clearcutting has the potential disadvantage of excessive soil erosion and invasion by competing non-forest vegetation but with application of the Forest Practice Rules these remain theoretical disadvantages rather than real.

HISTORICAL PERSPECTIVE

When viewed in historical perspective, it is found that clearcutting of redwood forests is not unique to this generation. By examining, studying and comparing clearcuts of an earlier age, foresters can reasonably predict the effect of present day clearcut harvesting practices on future redwood forests.

The earliest clearcuts were from natural ecological phenomenon — devastating fire, windthrow, landslides and so forth. Even today it is possible to pick out areas of old-growth redwood forest in which all the trees are of approximately the same age and size as a result of a major natural catastrophe clearing the original forest.

The early loggers, utilizing man and animal power, clearcut the river flats and adjacent slopes. Most of the timber was cut or knocked down during logging. It was assumed that most of these logged areas would be suitable for agricultural purposes. Purposeful clearing attempts plus fires during and after logging resulted in bare ground similar to that of the present day planned clearcut harvesting. Today some of the finest young-growth redwood forests are located on these sites.

As logging technology progressed, machinery such as steam yarders, railroads and cable logging systems replaced man and animal power. The area logged annually increased. Logging shifted from river flats to the upland slopes above the major coastal rivers. Whole gulches and major drainages were logged at one time.

Because the cable logging systems in use during this period had little flexibility and tremendous power, most trees not cut for conversion to lumber were knocked down by the logging or when changing cable settings. The use of fire, before, during and after logging, continued as an aid to the logging process. As a result, large areas were completely clearcut and burned to bare mineral soil. The powerful machines in use also resulted in disturbed soil conditions on the

entire area. This combination created conditions ideal for forest regeneration and regrowth providing a seed source was available. Redwood sprouted prolifically from cut stumps. Some redwood, and certainly whitewood species, seeded in from adjacent uncut stands. The resulting young-growth redwood forest is typical of many thousands of acres in the Redwood Region. This type of forest is characterized by its extreme vigor, rapid growth, large volume of wood, and the great number of trees per acre. Generally, it has similar proportion of whitewood to redwood as did the virgin forest. Where burning was done for grazing development, however, a higher proportion of the young-growth forest is redwood species. Many of the young-growth stands resulting from early day logging have been recently harvested and are now growing a third crop of redwoods.

During the mid 1930's the development of logging tractors and logging trucks gave the timber operators the capability of removing only a portion of the timber stand. At the same time eminent foresters and leading forestry schools were advocating "selective logging" in which a portion of the stand was left for future growth and reseeding. Most of the major redwood lumber companies shifted to this selective harvest in which only 25% to 50% of the mature and overmature trees were removed. Selective harvesting continued, as almost an industry standard, from the mid 1930's to the late 1960's.

Both foresters and researchers began to question the concept of selective harvesting as experience and measurement began to show that in many areas selection did not deliver the expected responses. Increased growth has not materialized in many cases. Vigor of the reserved trees has actually declined. Windthrow is a significant problem in selectively logged stands. The expected reseeding and resprouting growth has been much slower than anticipated due to brush invasion and residual tree competition. Much of the regeneration that does occur is the less desirable white wood conifers such as hemlock and grand fir. Repeated entries into the forest to continually remove the selected trees have caused damage to the residual trees and unacceptable losses of regeneration. On certain soil types and under certain topographical conditions the productive potential of the timberland is not being achieved. Selective harvesting, while aesthetically pleasing and useful on some redwood timberland, is failing to maintain the redwood forest type on many other timberlands in the Redwood Region.

The clearcutting of past generations has resulted in the second -growth forests that today provide a major portion of the redwood lumber production. Both research and experience are establishing that under most conditions clearcutting these young-growth forests yield the same advantages of growth, vigor, and reforestation that it did for the original old-growth forests. Clearcutting of young- growth forests has become a common silvicultural tool in the Redwood Region where site conditions and management objectives make it the appropriate choice. Selective silvicultural systems continue be used where landowner objectives make it the most appropriate technique.

Forest researchers have been studying some third -growth stands on which the second-growth had been clearcut and the area regenerated with redwood sprouts and seedlings. One study area is located on Jackson Demonstration State Forest. This site was clearcut in 1961 and precommercially thinned to several stocking levels in 1981. The average tree diameter was 12.5 inches in 1986 after 24 years of growth. The largest tree on the study area was 24 inches in diameter and 85 feet tall at the time. The average yield of the thinned stand not including the thinned material for the period was approximately 10,000 board feet per acre. The unthinned control blocks averaged 8,000 board feet per acre. Increasing acreages of third-growth forests are appearing as mature second-growth forests are being harvested.

Serious study and thought by many forest researchers and practicing foresters on the problems of appropriate silviculture to sustain and perpetuate redwood has resulted in a return to favor of the clearcutting system. Current thinking is that it is necessary to relate the choice of a silvicultural/harvesting method to specific conditions at the forest site. No one system is better than another except as relates to conditions in the forest and the objectives of the forest owner. On selected areas clearcutting can provide a workable alternative for situations where selective logging systems are ecologically, biologically or economically unsatisfactory. The clearcut silvicultural system most nearly duplicates natural disturbance factors such as fire, windthrow or other natural ecological phenomena which assisted in sustaining the original redwood forest.

An analysis prepared on the Redwood National Park by Professors E.C.Stone, R.F. Grah, and P.J. Zinke states "Should fire be sucessfully kept out of the park and no suitable substitute interruptive factor be introduced, succession over the next one hundred years would certainly result in some change, particularly on the alluvial flats. Succession over the next five-hundred years would result in the predominance of hardwoods, Douglas-fir, Sitka spruce, lowland white fir, hemlock and western red cedar. Succession over the next two-thousand years could result in the disappearance of redwoods from the park."

Evidence available today gives every indication that redwood has not changed significantly as a forest or as a tree under past clearcutting practices. There is increasing evidence that clearcutting as a silvicultural method and an ecological mechanism is an extension of nature's method of perpetuating redwood as a forest type.

The following photographs, together with a brief explanation of each time-lapse series or individual photograph, illustrate the remarkable ability of the redwood forest to recover, even from adverse treatment. While such initial treatment is not condoned nor would it be permitted under present day forest practice rules, the graphic illustrations are worth noting.

Figure 1. 1888
Original logging of the area using oxen

Figure 2. 1923
Same area in Bear Gulch thirtyfive years later

Figure 3 - 1990
Photograph looking into the gulch mouth

This series of three photographs illustrates the cycle from original old-growth forest to young-growth forest to a thinned, partially cut young-growth stand. The cycle will be completed at some time in the future when the remaining crop trees are completely removed to provide growing space for a new generation of seedlings and sprouts. At this point the "third-growth" forest will begin.

In Figure 1 note the virtual complete denuding of the side slopes and the relatively few cut stumps. The trees were large but few in number. The large number of snags and their condition is evidence of a considerable fire history— typical of the redwood forest type. In Figure 2 taken only 35 years after the original clearcutting notice the rapid regeneration of redwood and other conifers. This young-growth forest has completely occupied the site with a density greater than the original forest. The third figure illustrates the same stand at 90-100 years old after undergoing a partial thinning in 1969. These large trees have reached their maximum stage of growth and harvesting, both clearcutting and partial cutting is occuring in the drainage. In areas not covered by this photograph the third- growth forest is established and growing well. Because of the heavy forested growth the original photographs could not be matched precisely. The gulch mouth in Figures 1 and 2 is in the approximate center of Figure 3.

Figure 4 - 1905
Clearcut area behind the Scotia Inn cut about 1900

Figure 5 - August 1971
Same area behind the Scotia Inn

Figure 6 - February 1990
Same area behind Scotia Inn

FOREST TO GRAZING LAND AND RETURN TO FOREST

This series of photographs, with the Scotia Inn in the foreground, shows the reforestation of an area first clear cut in 1900 and then repeatedly burned in an attempt to convert the redwood forest to grassland.

Figure 4, taken about 1905, shows the Scotia Inn and the area behind Scotia Inn that was first cut about 1900. The timber was "skidded" directly into town to the local sawmill. After logging, attempts were made to kill resprouting redwood and convert the area to grazing land by repeated use of fire. After about ten years, the attempted conversion was abandoned because of rapid regrowth of the redwood sprouts.

In Figure 5, taken in 1971, the same area is shown. A dense stand of "second-growth" redwood and associated species has reclaimed the original clearcut area. About 90 percent of the conifer trees are redwood with most of the remainder being Douglas-fir which seeded in after the clearing attempts were abandoned.

In 1970 this redwood forest was partially-cut to thin the dense stand of trees. It is interesting to note that when 50% of the trees were removed for the production of lumber the growth rate of the remaining trees has accelerated beyond the already high level as measured before thinning. Figure 6 shows the forest as it exists in 1990. This forest is now managed as an even age timber stand. Another thinning will be accomplished on this stand but inevitably the remaining crop trees will be removed to establish the crop of new trees necessary for the third growth forest.

Figure 7 - 1910
Slope north of the Eel River south of Scotia — logged about 1900

Figure 8 - 1971
Same slope at a slightly different angle further upstream
where the new bridge crosses the river

Figure 9 — 1989 — Same area

REDWOOD FOREST REGENERATION
NORTH BANK EEL RIVER, THREE MILES SOUTH
OF SCOTIA, HUMBOLT COUNTY, CALIFORNIA

This three-photograph series again illustrates the remarkable ability of conifers, particularly redwood, to re-establish and occupy areas with forest soils in spite of intensive efforts to convert the area to another use.

Figure 7, taken in 1910, shows the area about 10 years after initial logging. The redwood sprouts are estimated to be about five years old. As in the previous series, attempts to convert this area from forest to grazing, primarily by the use of fire, were abandoned when it became evident that a grass cover would be extremely difficult to maintain.

Figure 8 shows a portion of the same slope as it appeared in 1971. It was taken from the U.S. 101 highway bridge slightly upstream from the original photographic point. The dense second growth stand is about 65 to 70 years old. Approximately 90% of the trees are redwood.

During the period 1961-1971 the property owner removed over 50% of the board foot volume of this stand in a commercial thinning. Special attention was given to thinning redwood sucker clumps which were particularly numerous because of past fire history.

Figure 9 taken in 1989 shows very little change from 1971. However the property owner indicates that another harvest occured throughout the area in the mid 1980's.

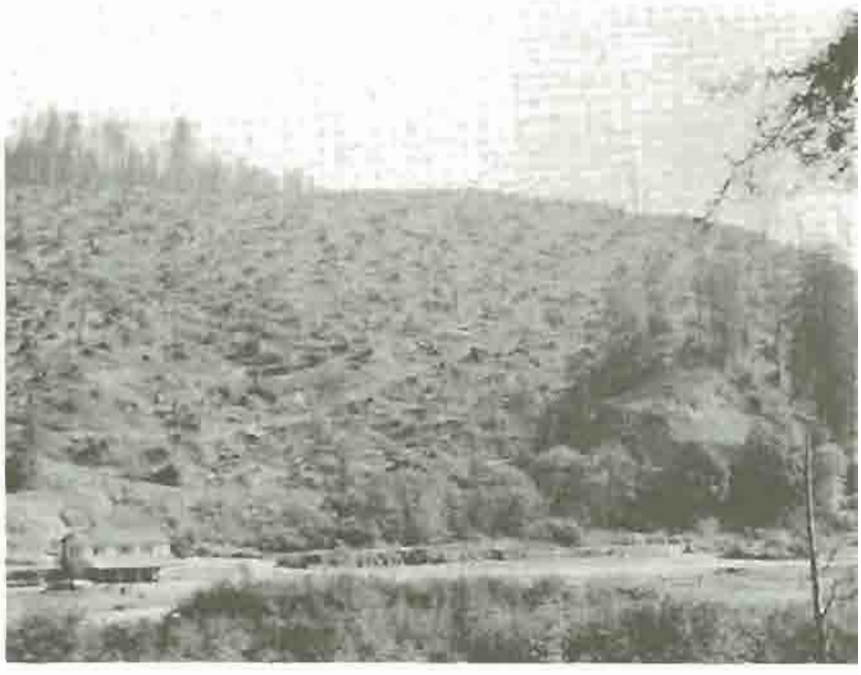

Figure 10. Clearcut old-growth redwood stand
on Geneva Hill, Humboldt County after 1963 logging.

Figure 11. The 1963 clearcut area supports a healthy
and vigorous young growth forest in 1990

REGENERATION OF A REDWOOD FOREST
GENEVA HILL, HUMBOLDT COUNTY

Geneva Hill is immediately adjacent to Highway 101 at Valley Green. In 1963 the redwood forest was cut and the area aerially reseeded with redwood, Douglas-fir and Monterey pine. Figure 10 shows the area in 1965. Notice the disturbed ground appearance already altered with redwood sprouts beginning to reoccupy the site. Figure 11 shows a vigorous young-growth forest with a predominance of redwood. The trees average 12 inches in diameter and 70 feet in height. Note that the rock outcropping visible in the lower right corner of the 1965 photo is completely hidden in the 1990 photo. Interestingly some of the Monterey pine still survive and can be seen although most have been out competed by the native redwood.

Figure 12 - 1886
Oxen logging in Caspar Creek Drainage

Figure 13 - 1971
Panoramic view of Caspar Creek Drainage

CASPAR CREEK DRAINAGE
ORIGINAL LOGGING AND REGROWTH
JACKSON STATE FOREST, MENDOCINO COUNTY, CALIFORNIA

Figure 14 - 1990 Aerial view of Caspar Creek Drainage

Figure 12 shows 1886 oxen logging in progress on Caspar Creek. Note that the area had been burned at least once prior to taking this picture. Most of the remaining trees were subsequently removed and the area reburned. Notice proportion of trees other than redwood in the down and standing timber. Presently this is part of Jackson Demonstration State Forest on which experimental cutting methods are being tried in the young-growth forest.

The young growth timber stand resulting from this early day harvesting is one of the finest in the Redwood Region. In approximately 100 years this forest has grown an overall volume of wood greater than that of the original forest. It has more trees than the original forest but they are smaller in diameter. Because of the manner in which this second growth stand developed it has a slightly higher percentage of redwood than the original stand. Each year as some of the crowded trees die their growing space is taken by the remaining trees which then can increase in size.

Casper Creek has become a world-class research area for the study of watershed management and timber harvesting. As such this young growth timber is being harvested to study the effects of timber harvesting on water quality.

Because of timber density and other factors it is not possible to precisely duplicate the 1886 photo. The 1971 photo covers the general location based on historical records. The 1990 photo is an aerial panoramic view to give a larger perspective.

Figure 15 - 1900
Active Glenblair Mill

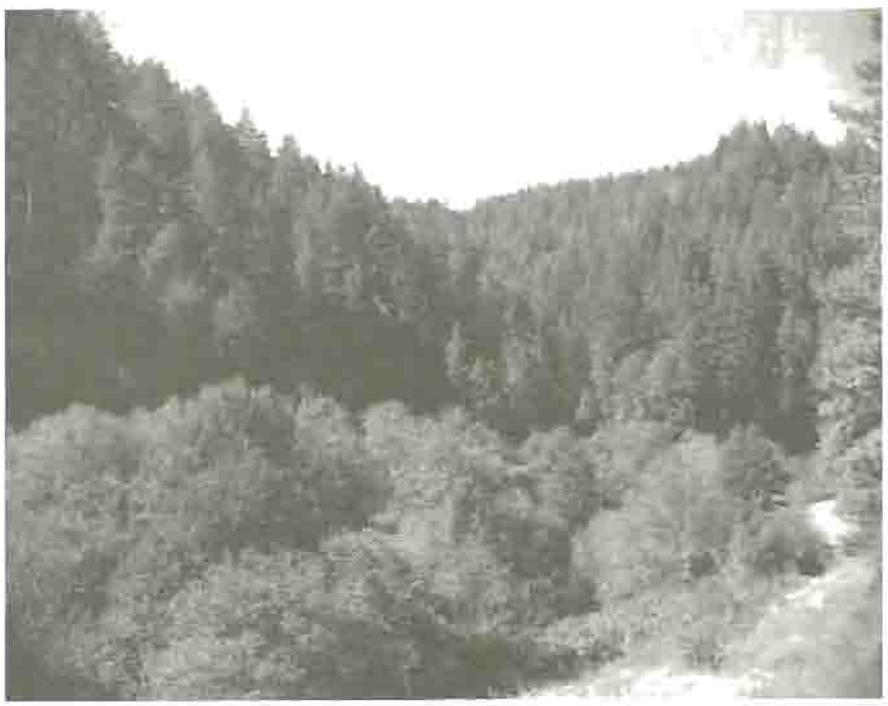

Figure 16 - 1971
Abandoned Glenblair Mill site

Figure 17- 1990 Glenblair Mill Site

This series of photographs shows the reestablishment of the redwood forest on the site and surrounding slopes of Glenblair Mill which was active until 1928.

Figure 15 shows the then active Glenblair about 1900. Note that some of the large logs had to be split in the woods to facilitate transport to the mill. Notice the open cleared slope to the left of the mill. Originally covered with a dense stand of redwood and Douglas-fir it was logged about 1890 and skidded directly to the mill pond. After clearing the area was used for grazing livestock.

Figures 16 and 17 show the same area in 1971 and 1990. A dense young redwood-fir stand has developed on the slopes surrounding the former mill site. Second-growth trees up to 30 inches in diameter are found in this forest. Quality of the young growth is high and adjacent areas are now being harvested. Vegetation on the mill site itself is younger than on the slope. The former mill pond has naturally revegetated with alder, myrtle and other broadleaf shrubs with 6 to 12 inch diameter redwoods now shading out this temporary riparian vegetation.

In the 1990 picture note the clearcut harvest on the far slope. About 2 years old, the redwood sprouts and planted Douglas-fir are developing on the area. Because of the growth of screening vegetation this picture was taken from a helicopter.

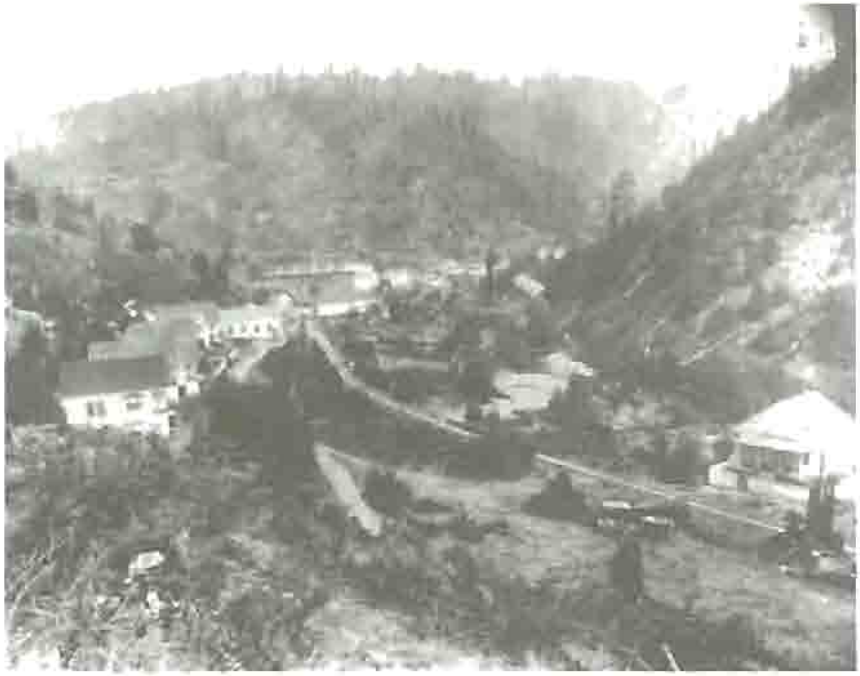

Figure 18- 1900
The logging camp town of Glenblair

Figure 19 - 1971
Site of the former town of Glenblair

Figure 20 - 1990 Glenblair Townsite

This sequence shows the reconversion of an area from a forest, to a town and back to a forest again.

Figure 18 shows the condition of the area about 1900. Clearcutting practices of that time are shown here. The foreground shows clearing for the townsite itself while the side hills and background indicated a thin stand of residual trees which were probably cull redwood or Douglas-fir. Redwood sprout and brush development visible on the side hills indicates that logging had probably occurred about five years previous to this picture. There is also indication of extensive use of fire in an attempt to clear portions of the area. Note the railroad track which runs through the center of the townsite.

In Figures 19 and 20 note that the railroad track shown in the 1900 photograph is now a private road and is virtually the only evidence remaining of the town. Young-growth redwood and fir have completely reclaimed the original townsite. Individual trees as large as 20 inches in diameter are on the flat portion. The Pudding Creek stream channel appears to be much the same today as it was in the 1900 photograph. Screening by young-growth timber made duplication of the original photograph impossible. Therefore, subsequent pictures were taken from the air. Only the upper one-half of the original townsite area is shown. Present timber on the slopes of the area averages about 75 to 85 years old with younger trees on the townsite itself. Stand composition is now approximately 50 percent redwood and 50 percent Douglas-fir. This composition appears to be very similar to the original stand. Note that harvesting has recently occured on the right side of the photograph. Redwood sprouting is already noticable on the clearcut areas.

Figure 21 - 1921
Typical yarder logging of the 1920's

Figure 22 - 1971
Closer view of the right side of the slope
shown in the middle of the 1921 photograph.

Figure 23. 1990 - Pudding Creek

This three picture series shows an area that was cable logged in the early 1920's. It is typical of logging operations during that period of time.

Figure 21 shows a yarder logging operation, together with an accompanying logging camp in the foreground. All trees not cut were knocked down when the cables were moved. The result was an unintentional clearcut logging operation. The use of fire on the remaining down material resulted in a mineral soil seedbed which was very receptive to natural seeding from adjacent trees such as those shown in the upper left hand corner of the photograph.

Figure 22 shows the same area covered by a dense 50-year old redwood forest which developed on the previously shown clearcut operation. Extremely good site combined with natural reforestation has resulted in an exceptionally uniform stand with individual trees ranging up to 24 inches in diameter. This stand has now reached optimum size for a harvesting operation.. Screening by the timber stand and steep terrain make duplication of the original photograph impossible. Therefore, later photographs have been taken from the air. Figure 22 shows a portion of the right side of the slope featured in the upper center of the earlier photograph.

Figure 23, taken in February 1990 shows that harvesting has again occured over most of the area. The face of the knob and right side have had a partial harvest under the shelterwood silvicultural system. The far right side of the knob, most clearly shown in the 1971 photograph, has been clearcut. Both areas will return to an even age stand structure over the next 50 years. In a few years the overstory trees in the shelterwood area will be removed to provide growing space for redwood sprouts and Douglas-fir seedlings.

Figure 24. - 1946
Area logged by cable yarding in 1946.

Figure 25. - 1971
Twenty-five years after clearcut cable logging.

Figure 26 - 1990 James Creek Mill Site
44 years after clearcutting

This series of photographs shows an area that was cable logged using techniques typical of the mid 40's.

The area shown in Figure 24 was logged prior to 1946 using cable yarding. The area itself is situated on the eastern edge of the redwood forest type near the eastern boundary of Jackson State Forest and adjacent to State Highway 20. Average slope in this area exceeds 60 percent. Following logging, the area was burned, thereby producing the mineral soil seedbed necessary for successful natural seeding from adjacent forest stands. This area is fairly typical of sites on the eastern edge of the redwood type and normally has a larger percentage of Douglas-fir than the areas shown in previous photographic series.

Figures 25 and 26 show the same area approximately 25 and 44 years since the clearcut logging. In general the area below the mill site has been revegetated adequately. Notice the relatively large amount of redwood and Douglas-fir now emerging from the soil protecting shrub cover which invaded the area almost immediately following logging. A few of the visible trees are large enough to be considered merchantable. The 1990 photograph shows the area after a 1989 shelterwood harvest in which trees over 15 inches in diameter were removed. The numbers of trees remaining are enough to utilize the growth potential of the site but vigorous hardwood growth will provide severe competition to the new redwood sprouts and Douglas-fir seedlings.

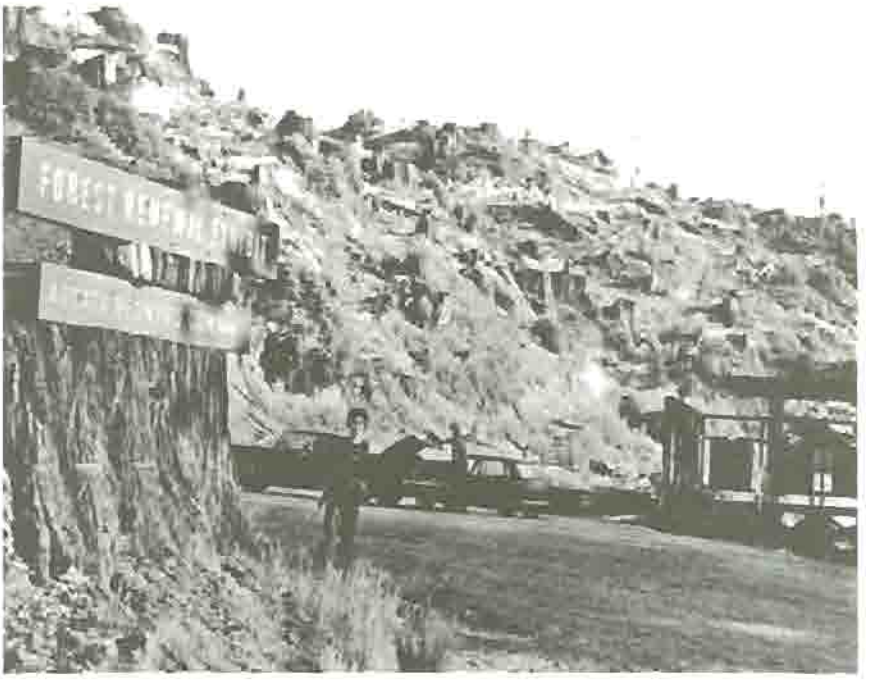

Figure 27 - 1960
Mae Creek Demonstration Area along U.S Highway 101

Figure 28 - 1971
Same area, eleven years after logging
and ten years after artificial regeneration.

PLANNED CLEAN HARVESTING WITH ARTIFICIAL REGENERATION
MAE CREEK, HUMBOLDT COUNTY, CALIFORNIA

Figure 29. - Mae Creek Demonstration area
30 years after harvest

This three photograph series depicts the result of an early planned clearcut harvesting operation which was followed by prompt artificial regeneration.

The area shown in Figure 27 is situated approximately two miles north of Berry Glen, near Mae Creek, Humboldt County, adjacent to U.S. Highway 101. This area was harvested in 1960 as a planned clearcut to be reforested with the best technology available. While the appearance of the area is devastatingly poor, in fact,it is in very favorable condition for regeneration. Conifers were seeded by helicopter in 1961. The expected regeneration did occur with unusual success.

Douglas-fir and redwood seedlings combined with the natural redwood sprouts resulted in greater numbers of trees occuring than would occur naturally. At the time of this picture the area was part of a demonstration area established on privately owned property.

Figure 28 shows the same area approximately 11 years after the initial harvesting and 10 growing seasons after the area was artifically seeded. The site is no longer in private ownership and is now part of the Redwood National Park. Larger Douglas-fir from the seeding range from 15 to 20 ft. in height. Note that the large redwood stump in the foreground which showed no visible sprouting in 1960, now has sprouts exceeding 15 ft. in height.

Figure 29, taken in March 1990 shows major changes in the area. Construction of the Redwood Bypass Freeway has removed all of the Demonstration Area. The person in this photograph is standing on the location of the marker stump in the previous pictures. The hill foreground has been cut away for fill material. However the upper slopes show almost merchantable Douglas-fir and redwood trees from both the artificial seeding of 1961 and natural sprouting. This forest is at its most rapid stage of growth and is developing very nicely.

CONCLUSION

This review and study with a brief pictorial history illustrates the point that early clearcutting and burning did not prevent a new redwood forest from developing. In most cases the silvicultural treatment, while severe by todays standards, tends to throw the ecological balance toward the maintenance of redwood as the dominant forest tree. Increasingly, as research on redwood advances, it is apparent that complete protection or only limited disturbance in redwood moves the ecological balance toward the shade tolerant species. Over time species like hemlock, grand-fir and Sitka spruce may well replace redwood as the major forest component in many undisturbed redwood forests. In many ways the early logging methods replicated those natural conditions which favor redwood.

Even though some of the most vigorous and healthy young redwood stands have developed on the early-day clearcut areas, there is no hard evidence that would support clearcutting as a single system of management throughout the Redwood Region. There are advantages and disadvantages to all of the silvicultural systems used in the Redwood Region. Specific forest conditions and landowner objectives dictate the appropriate system to be used in harvesting activities. It should be noted that many of the stands followed in the pictorial series have recently had a series of thinnings which really are a form of selective harvest. Ultimately, to meet the biological needs of redwood seedlings and sprouts for disturbed, sunlit growing space, these areas will be clearcut. Thus rather than viewing clearcutting as forest devastation it should be viewed as a biologic tool used to maintain redwood as a dominant forest tree.