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COOPERATIVE STUDY ON PRECOMMERCIAL THINNING OF "THIRD GROWTH" REDWOOD
AND ASSOCIATED CONIFERS

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Increasingly, thinning practices such as spacing and stocking levels need to be determined for maximizing the production of usable wood in young third growth redwood stands. In addition, the complication of sprout regeneration has to be integrated into the picture to understand the total dynamics of stand response in redwood.

A study designed to provide forest landowners and managers with this biological response information was initiated in the fall of 1980 between the PSW/Redwood Sciences Lab and the California Department of Forestry.

Past Studies

Only two other studies of precommercial thinning in redwood have been reported on. Boe (1966) installed twenty-seven 0.1-acre plots on Simpson Timber Company lands which were thinned to varying levels of stocking. His study indicated that there was a significant increase in diameter growth on the thinned plots.

Barrette (1966), after measuring some sprout clumps initially thinned in 1948 on Jackson State Forest, indicated that under conditions of full light and minimal competition, thinning of sprouts might be desirable. Cole (1982) (under publication), on remeasuring these same clumps thirty-one years after the initial thinning, indicates this is still the case but based on the excellent growth rates of the unthinned groups under intermediate light and competition conditions, suggests that it would be deleterious to thin sprout clumps growing under these conditions (see accompanying article).

The picture emerging from these few thinning studies indicates complex stand reactions which are to a large extent dependent on initial stand environmental conditions such as light, competition, stocking, site and age. Hopefully this study will provide more information on these relationships.

Study Area

The study site is on the Jackson Demonstration State Forest approximately seven miles southeast of Fort Bragg, Mendocino County. The area is located on ^{1/} Forester II, Jackson Demonstration State Forest, Fort Bragg, CA 95437.

a northeast-facing slope in the South Fork drainage of Caspar Creek. This site was chosen because the stand history, age and stocking levels represented a stand type not yet studied but one with important management implications and potential. Prior to a 1960 clearcut, which was part of a larger silvicultural experiment called the Caspar Cutting Trials, the site supported an 80-year-old second growth redwood/Douglas-fir stand. The present stand is primarily comprised of third growth redwood sprouts with a minor amount of redwood and fir seedlings.

Objectives

The primary objective is to determine the optimal number of trees per unit area so that the majority of trees are of a commercial size when the stand is ready for its first commercial thinning. The second objective is to determine the growth response of stems when multiple stems are retained in thinned sprout clumps. The third and final objective is to determine the extent of new sprouting under various levels of precommercial thinning and the impact of sprouting on stand development.

The range of densities tested has been extended to the point where it is a high probability that the optimum level of growing stock is included in the experiment.

Methods and Results

Prior to establishing the permanent plot system, ten 0.1-acre cruise plots were installed to determine the level and variability of stocking and consequently what limitations might be placed on the project. The cruise indicated that the study as planned could be installed. The permanent plot system as installed is a randomized block design consisting of five treatments plus a control replicated three times. Each treatment is on a 0.4-acre square plot with a 0.2-acre interior portion being measured and tagged while the exterior 0.2-acre serves as a 20-foot buffer on all sides. The six treatments were assigned at random in three blocks.

The five levels of stocking being tested are: 100, 150, 200, 250 and 300 stems per acre. Crop tree selection was based on the following species priority: 1) redwood sprouts, 2) redwood seedlings, 3) Douglas-fir, 4) grand fir, and 5) hemlock. All trees must be thrifty and have a minimum height of at least ten feet. All hardwoods have been removed although not treated with herbicide.

In order to study the inter-clump competition, special weighted spacing rules were developed for each density level thereby allowing for multi-stem clumps and yet keeping control of the desired number of stems per acre. The only restrictions were that the inter-clump trees had to be dominant or co-dominant and have at least two feet between centers. The non-clump trees were primarily chosen on the basis of appropriate spacing.

Prethinning measurements included a 100 percent inventory of all regeneration greater than 1.5" dbh. The total inventory results were almost identical with the cruise figures and showed that the site supported a very vigorous, well-stocked stand. The average number of trees per acre over 1.5", 4.5", and 10.5" dbh were 742, 316, and 46, respectively. In terms of volume, there was an average of 1639 cubic feet per acre for all trees over 4.5" dbh and an average of 2189 board feet Scribner per acre for all trees over 10.5" dbh.

Physical stem measurements were made with calipers for those trees under 3.5" dbh. Larger trees were measured with a diameter tape. Fifteen to twenty tree heights and ages per plot were also measured during this period for site index determination.

The thinning operation was carried out by a contract thinning crew under a U. S. F. S. contract as the research station agreed to pay for the project. The thinning took the five-man crew approximately one month or a total of 800 man hours to complete. A total of six acres was treated which equates to an average of 133 man hours per acre. This treatment included two-stage felling with 8- or 16-foot maximum bucking lengths plus felling and lopping to a maximum height of two feet of all hardwoods and other brush species.

Measurements taken during the operation included collecting data on 150 trees for stem analysis, recording crew times for production estimates and locating sample points for contract compliance on lopping.

Measurements after thinning included a complete tally of all crop trees to the nearest 0.1 inch dbh and the nearest foot in height. Each tree had a numbered tag attached at the dbh point.

Other measurements which are still being worked on are upper stem diameters and crown measurements of five randomly selected trees per plot and the mapping of all tree locations. This last set of data will provide information on stem density, stem size and taper relationships as well as the potential sprout distribution and stem response to inter/intra-clump relationships.

Future measurements will be taken at five-year intervals. Future ingrowth will be recorded as it exceeds 1.5" dbh.

Analysis and Reporting

The effects of the varying levels of stocking will be examined on: 1) tree size, 2) merchantable volume production, 3) material quality, 4) growth rates, and 5) mortality.

Statistically significant differences will be determined by appropriate statistical tests. Present planning calls for a cooperative publication after the first remeasurement period. Each cooperating agency may also publish independently with review by the other cooperator as deemed appropriate.

Literature Cited

- BARRETTE, B. R. 1966. Redwood sprouts on Jackson State Forest. Calif. Div. of Forestry. State Forest Note 29. 8 p.
- BOE, K. N. 1974. Thinning promotes growth of sprouts on old-growth redwood stumps. USDA Forest Serv. Res. Note PSW-290.
- COLE, D. W. 1982. Redwood sprout growth three decades after thinning. (Under publication.)

REDWOOD SPROUT STUDY

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Back in 1950, George Dudley had an idea. Now retired, he was then a seasonal forestry aide at the newly-created Jackson State Forest. He decided it would be interesting to thin several redwood sprout clumps a couple years after logging to see what effect such a thinning would have on future growth of the survivors. He painstakingly measured and photographed the sprouts, tagged hundreds for future measurement, and established control points for later photographs.

But as with many silvicultural studies, meaningful results did not come overnight. It wasn't until fifteen years later that Forester I Brian Barrette (now CDF Assistant Chief for Forest Management, Sacramento) decided to remeasure Dudley's sprouts and report his findings. This resulted in California State Forest Note No. 29, "Redwood Sprouts on Jackson State Forest" (1966), available by writing Jackson Demonstration State Forest.

Now, another fifteen years have passed and some of the sprouts are approaching 100 feet in height and 30 inches dbh. Once again, the dust has been blown off the old dried and faded data sheets of this, the longest-running redwood sprout study. This time, however, the author has tools at his disposal that Dudley could only have dreamed about thirty-two years ago, such as a Spiegel relaskop, a hand-held calculator and an Apple II microcomputer.

The current study, which is in the process of being published, is entitled "Redwood Sprout Growth Three Decades After Thinning". The author hopes the study will provide useful guidelines to forest landowners and managers in the redwood region. The significant findings presented in the study can be summarized as follows:

1. Thinning of sprout clumps at two years of age accelerated growth only on those sprouts receiving full sunlight at the time of thinning.
2. Sprouts receiving moderate levels of sunlight at the time of thinning grew better when unthinned than when thinned.
3. Thinning of suppressed sprouts (i.e., those receiving little sunlight and a great deal of competition) resulted in death to most of the residual sprouts, while unthinned clumps have stagnated.
4. A second sprout thinning at fifteen years of age had little effect on sprout growth on several clumps receiving full sunlight.

The author proposes that sprout growth and mortality are related to light levels at the time of thinning and soil moisture availability during the first several growing seasons. A hypothesis is presented in an attempt to explain the physiological processes responsible for the observed results.

Finally, some silvicultural implications of sprout thinning are discussed. Since 1977, redwood has been California's leading commercial timber species, accounting for a third of the state's total timber harvest value. It is significant that in this same period redwood harvest has been increasingly composed of young growth, much (if not most) of which is of sprout origin from logging in the late nineteenth and early twentieth centuries. The trend in redwood management is toward increasing reliance on sprout regeneration and manipulation, and it is hoped that this ongoing study will prove a useful tool toward that end.

The next issue of the JDSF Newsletter will provide information on obtaining copies of the study.