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## REDWOOD SPROUTS ON JACKSON STATE FOREST

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Very little is known about the habits and growth potential of redwood stump sprouts, even though they are often the main basis for restocking cutover redwood lands. This paper reports the findings of studies and observations of redwood stump sprouting and thinning of redwood sprouts on Jackson State Forest since 1950.

Fig. 1. Redwood stump showing sprouts one year after logging.

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## Sprouting

Redwood sprouts begin appearing soon after the parent tree is cut, and several hundred sprouts may occur around any one stump (fig. 1). Sprouts from roots have also been observed on Jackson State Forest, but no special studies on the Forest have been made on this phase of sprouting.

Most of the sprouts around a redwood stump come from the base of the stump, with some from the side, and occasionally a few from the top. Some stumps do not sprout, but generally this happens less than twenty percent of the time. R. E. Dresser, while a forester on Jackson State Forest, found that approximately 85 percent of the old growth stumps sprout, and 95 percent of the young growth stumps sprout. Studies on the Yurok Experimental Forest have shown similar results.

Not all stumps sprout immediately. A study of some 300 stumps one year after logging showed that 81 percent had sprouted. A further check, 2-1/2 years following logging, found that 91 percent of the stumps had sprouted. Some studies have suggested that very old and very large stumps do not sprout as often as younger and smaller stumps. The results of this study (fig. 2 and 3) tend to discount

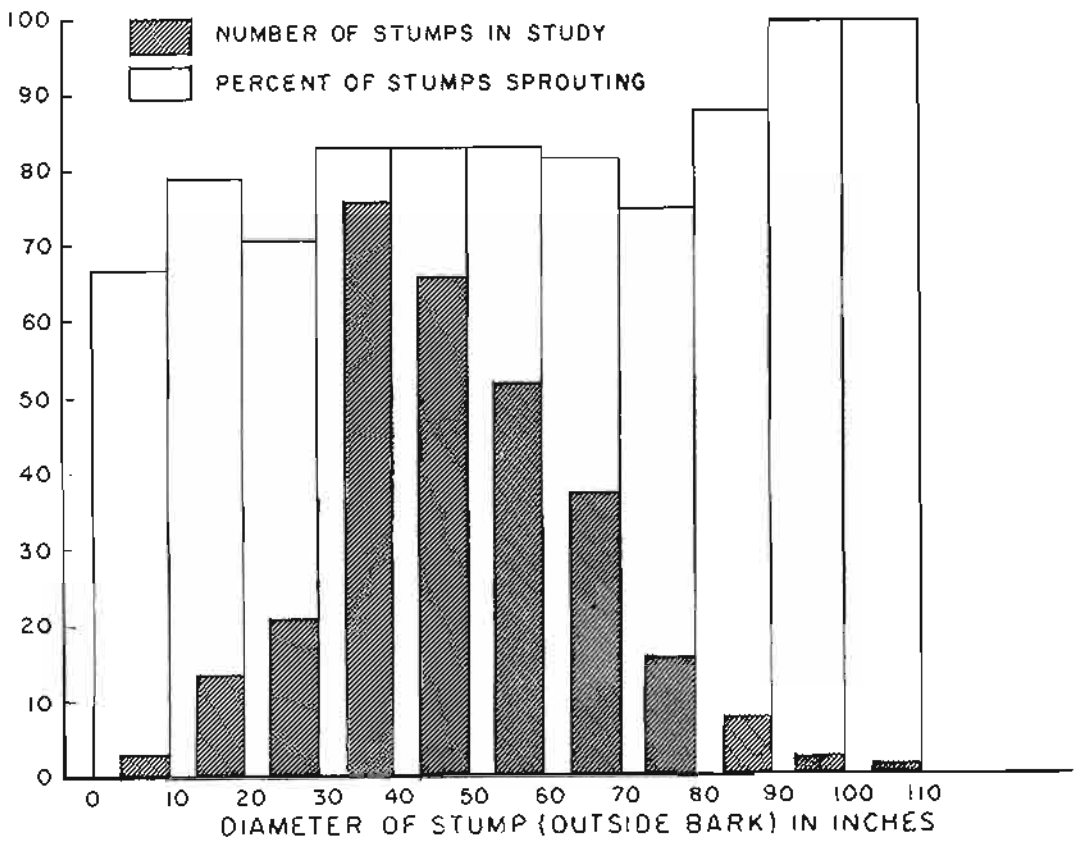


Fig. 2. Range of redwood stump diameters in the study, and percent sprouting by ten-inch diameter classes, one year following logging, 293 stumps.

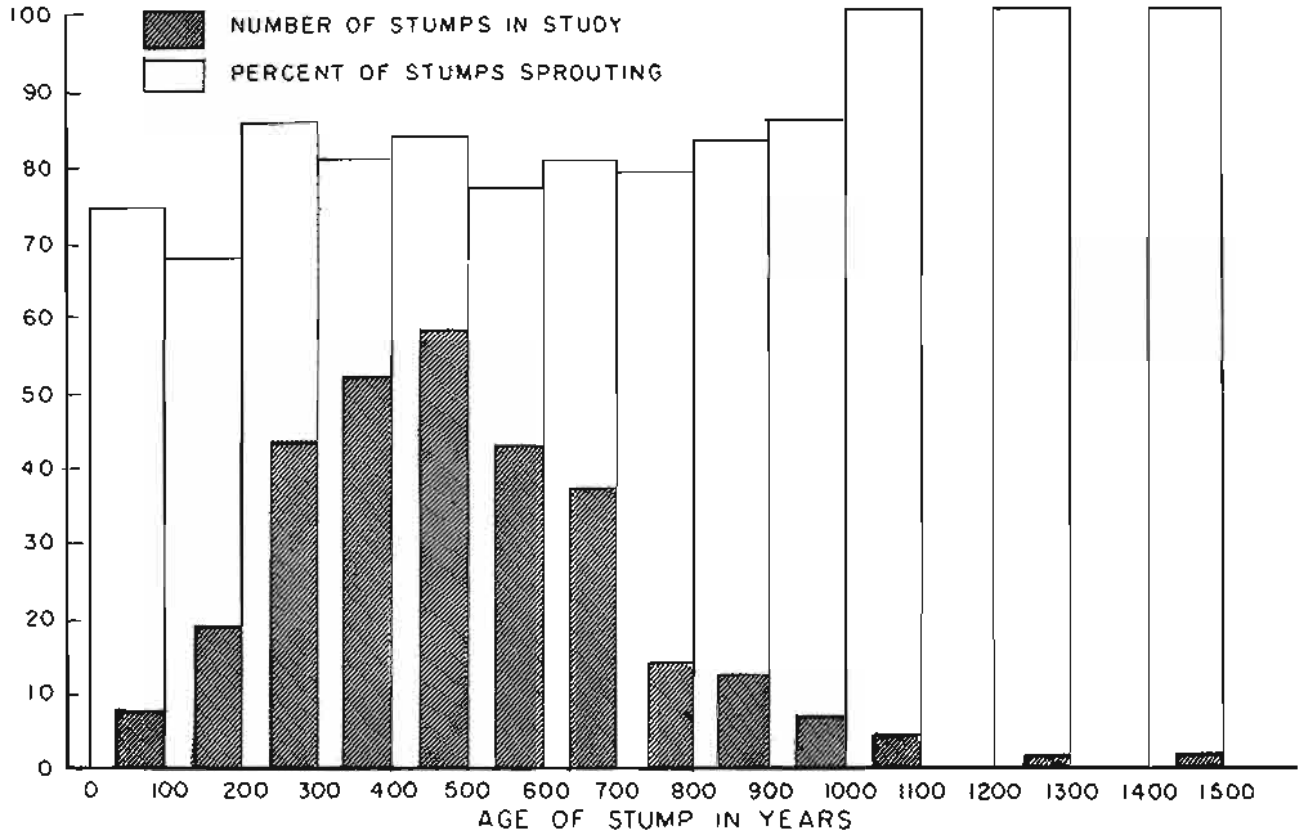


Fig. 3. Range of redwood stump ages in the study, and percent sprouting by one-hundred year age classes, one year following logging, 299 stumps.

this theory, although there was an unequal number of stumps in each diameter and age-class for better comparison. There was no apparent single or combination of factors common to the non-sprouting stumps (i.e., rot, aspect, shade, etc.). R. E. Dresser found that on Jackson State Forest, stumps covered with dirt over the root crown during the course of logging seldom sprouted.

Some sprouts begin to grow rapidly following logging. On an area logged in the summer of 1962, and examined in December of 1962, it was found that some sprouts were already five feet tall, and 57 percent of the stumps sprouted, with an average of 14 sprouts per stump. The average height of these sprouts was one foot. The tallest sprouts in February of 1965 (2-1/2 years after logging) were 13 feet high. Checks on three other recently logged areas on Jackson State Forest showed 100, 98, and 90 percent of the stumps sprouting.

## Thinning Sprouts

Sprouts utilizing the extensive root system of the parent redwood have a head start on the natural seedlings and brush species found on redwood-growing lands, especially tanoak (Lithocarpus densiflorus) and blueblossom (Ceanothus thyrsiflorus). This vigorous start from stump sprouts helps young-growth redwood stands to achieve phenomenal growth rates at a very early age, especially on the better sites.

There are occasionally several hundred redwood sprouts on one stump, but only a few become merchantable trees (fig. 4). Can the faster growing, more developed sprouts be encouraged to a greater growth rate by thinning? A sprout thinning study was started on Jackson State Forest in 1950 by George Dudley, to answer that question.

Fig. 4. Typical unthinned sprout clump six years after logging.

The study area on Jackson State Forest is approximately seven miles east of Fort Bragg. It is on a high site III and Hugo soil[2/]. The area was logged in 1948, and a light slash fire covered most of the area the same year. In 1950, fifteen stumps or groups of stumps were selected, and all but the dominant and codominant sprouts were removed (fig. 5 and 6). On one stump it was necessary to remove 261 sprouts. Another stump had 51 sprouts left after thinning, although only the seven tallest were marked for future measurements.

The diameter of each sprout was recorded one foot above the ground, or as close to there as possible. The total height in inches

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2/ United States Forest Service, Pacific Southwest Forest & Range Experiment Station. Soil-Vegetation Maps, Glenblair Quadrangle.

Fig. 5. Sprout clump prior to thinning.

Fig. 6. Same clump thirteen years after thinning. Age of sprouts is fifteen years.

was noted for all the remaining sprouts, and on several stumps, diameter and height measurements were taken of the sprouts that were removed. The diameters of all the stumps were recorded, their condition noted (e.g., burned, rotting, etc.), and before and after pictures were taken. In 1957, the sprouts were remeasured at

the one-foot level, with diameter taken to the nearest one-tenth inch, and total height of each sprout taken to the nearest one-half foot.

While no controls were established when the stumps were originally thinned in 1950, twenty neighboring stumps were selected for comparison early in 1963. After two growing seasons, these were remeasured along with the thinned redwood sprout clumps.

The stumps were grouped into three classifications, depending upon their relative competition and available light. The "open" group had very little competition from surrounding vegetation, and received light from all sides. The "suppressed" group had heavy competition, and received little direct sunlight. The "intermediate" group was between the "open" and "suppressed" groups. While the groupings were somewhat arbitrary, the difference in growth rates between the "open" and "suppressed" groups in terms of diameter growth were significant at the 95 percent level for both the thinned and unthinned redwood clumps.

Three of the sprout clumps were thinned a second time, with all sprouts removed except those tagged for remeasurement, and in a few cases it was necessary to cut these to improve the spacing. Some resprouting has occurred on these stumps. While this resprouting may be a problem, it is thought that the larger sprouts will shade out or suppress the new sprouts.

Comparisons will be made in the future not only between the thinned and adjacent unthinned redwood sprout clumps, but between the rethinned and thinned sprout clumps, if the difference in growth rates appears significant.

Table 1 summarizes the annual diameter and height growth rates for thinned and unthinned sprouts over various periods of time. The 65 dominant and codominant sprouts around the thinned clumps over

Table 1. Annual diameter and height growth rates for thinned and unthinned redwood sprouts.

| Sprout Classification | Diameter Growth Per Year in Inches | | | Height Growth Per Year in Feet | | |
|---|---|---|---|---|---|---|
| | Thinned Sprouts | | Control | Thinned Sprouts | | Control |
| | 1950-1964 | 1963-1964 | 1963-1964 | 1950-1964 | 1963-1964 | 1963-1964 |
| Open | .56 | .40 | .41 | 2.9 | 2.5 | 2.2 |
| Intermediate | .35 | .31 | .43 | 1.8 | 1.5 | 2.8 |
| Suppressed | .20 | .19 | .18 | 1.0 | 1.1 | 2.4 |
| Average | .41 | .34 | .35 | 2.1 | 1.8 | 2.5 |

the 15-year period show an average diameter growth per year of 0.41 inches. The "open" group averaged 0.56 inches, and the "suppressed" group only 0.20 inches. It was also noted that the average diameter growth rate for the last seven years (1957-64) was only 75 percent of the first eight-year period (1950-57). Over the 15-year measurement period, the fastest growing sprout had an average diameter growth of 0.81 inches per year and the slowest 0.11 per year.

Height growth showed a similar correlation with diameter growth. Over the entire measurement period of 15 years, the average annual growth for thinned sprouts was 2.1 feet per year. The "open" sprouts averaged 2.9 feet per year, while the "suppressed" averaged only 1.0 feet per year. The fastest growing sprout had an average growth rate of 3.9 feet per year, while the slowest was 0.3 feet per year. As with diameter growth, height growth has slowed down considerably in the last seven years.

The diameter growth rate for the unthinned sprouts was greater than the thinned sprouts in all but the "suppressed" class for the past two years, and only slightly less there. In height growth, only the "open" class in the thinned sprouts had a greater growth rate than the unthinned sprouts. The "open" unthinned group averaged 0.41 inches per year in diameter growth in the two-year measurement period, while the "suppressed" group averaged 0.18 inches per year. Height growth rates were somewhat reversed, with the "open" averaging 2.2 feet per year, the "intermediate" group 2.8 feet, and the "suppressed" group 2.4 feet. The average for all the control sprouts in this period was 0.35 inches per year diameter growth, and 2.5 feet per year in height growth. Further results will be forthcoming which should have more significance.

It has been suggested that the large number of sprouts occurring around the parent stump are needed to keep the massive root system of the parent tree alive. The results of this study tend to support that hypothesis, as the unthinned control sprouts are now growing faster than the thinned ones. By thinning redwood sprouts at two years of age, the living root system may have been reduced due to fewer sprouts supplying it with nutrients.

## Conclusions

Based on 15-year observations of thinned redwood sprouts and the 2-year observations of unthinned sprouts, the following tentative conclusions have been reached:

1. The frequency of redwood stumps sprouting was variable from 57 percent a few months after logging to 100 percent, but generally over 80 percent of the stumps eventually sprouted.

2. No apparent reason for non-sprouting redwood stumps was discovered.

3. The effects of thinning (i.e., increased growth rates) on redwood sprouts are being reduced with time. Therefore, more

thinning may be desirable. Thinning sprouts in heavy shade with heavy competition appears to be unwarranted. Thinning of sprouts with plenty of light from all sides and little competition from competing brush and timber species may be desirable.

4. Further studies should be established to determine the best age to thin stump sprouts. The current study has shown that some stumps have more potential for sprouting than others. Future experiments should be restricted to the best stumps, which are those in the "open" group. Selection of such stumps with light from all sides and little competition, appear to be the best ones for further study of sprout thinning.