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NATURAL REPRODUCTION OF SHASTA RED FIR^{1/} FROM A SINGLE GOOD CONE CROP

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The initiation and rapid increase in harvesting of Shasta red fir-mountain hemlock stands in southwestern Oregon have emphasized the lack of information needed to manage these species intelligently. The most important single management practice for converting old growth to managed forests is the application of cutting methods that will assure prompt regeneration of desired species. Clearcutting in staggered settings has been used for the first sales in Shasta red fir on the Rogue River National Forest. A pioneering study to assess natural regeneration was started in 1951 from which preliminary useful information is now available.

Shasta red fir is an important component of the true fir^{2/}-mountain hemlock type, which covers approximately 1,200 square miles in the Cascade and Siskiyou Mountains of southwestern Oregon alone.^{3/} The

^{1/} Abies magnifica var. shastensis Lemm.

^{2/} The true fir of the "true fir-mountain hemlock type" of southwestern Oregon may be either Shasta red fir, noble fir (Abies procera Rehd.), or California red fir (Abies magnifica A. Murr.). Published maps and information show that the ranges of the three firs overlap. Their botanical differences are slight, the species may hybridize, and it is possible that Shasta red fir is an intermediate form between noble and California red fir. According to published identifying characteristics, the present study is concerned with Shasta red fir, which is considered locally to extend from Diamond Lake to the California line.

^{3/} Hayes, G. L. 1953. A problem analysis for the forest land of southwestern Oregon. Pacific Northwest Forest and Range Experiment Station. Typewritten manuscript; 119 pp.

type occurs principally in mature stands at elevations above 4,500 feet. In Douglas County, Oregon, where species volume data are available, there are about 124 thousand acres of Shasta red fir-mountain hemlock containing approximately 5 billion board feet of Shasta red fir and 1 billion board feet of mountain hemlock.^{4/} Shasta red fir sawtimber volume within Douglas County is exceeded only by Douglas-fir volume of about 42 billion board feet. Because of the extent and importance of the Shasta red fir-mountain hemlock association, research was initiated in 1951.

Natural reproduction resulting from the good seed crop of 1951 was studied on a 35-acre clearcutting in nearly pure Shasta red fir. The study area is located on clay-loam soil on a moderate southeast slope at an elevation of 5,200 - 5,500 feet on the south side of the Rogue River-South Umpqua divide near Union Creek, Oregon. Precipitation is about 50 inches annually. Summers are characteristically dry, although thundershowers may occur. Most of the precipitation falls during the winter, over half of it as snow. Because snow remains until late spring, seedlings germinate late and must develop in a short growing season.

The area was tractor yarded downhill to the southeast corner of the clear cut. Mineral soil was exposed on numerous skidroads located throughout the area. Close utilization left relatively small amounts of heavy debris, and the light slash was left unburned (figure 1).

Seed fall from the 1951 crop averaged at least 140,358 seeds per acre, or 3.22 seeds per square foot (measured by 9 seed traps in a single line across the tract). Almost 98 percent of the seed fall was Shasta fir; the remainder was mountain hemlock and Douglas-fir. Seed distribution varied from a high of 726,000 seeds per acre in the timber near the southeast boundary (1 seed trap) to an average of 58,080 per acre on the northwest half of the tract. Seed fall on the southeast one-third of the area averaged over four times as much as elsewhere. This may indicate that the major seed-distributing wind came from the southeast. Only 17 percent of the total 1951 seed crop fell before October 3.

4/ Broders, C. O. 1951. Economic and industrial survey of the Inland Umpqua Basin, Douglas County, Oregon, with particular emphasis upon forest resources and their utilization. Roseburg, Myrtle Creek, and Riddle Chambers of Commerce. 106 pp.

Seedling germination, measured on 106 systematically spaced milacre plots, averaged 3,019 Shasta red fir per acre (table 1). Seedlings of mountain hemlock, western white pine, and incense-cedar together averaged 95 per acre. Germination was delayed in starting by the previous winter's record snowfall and was not complete until the end of July. Fifty-four percent of the seedlings germinated on mineral soil, which was exposed on 42 percent of the total area. Forty-one percent of the seedlings germinated on fine litter mixed with soil, which covered 40 percent of the tract; and 5 percent of the seedlings were found on duff, which covered 8 percent of the tract. One-tenth of the surface was rock or solid wood on which seedling establishment was not possible.

Table 1. --Number of seedlings per acre germinating in 1952, and survival at the end of the first and second growing seasons

Item	Species				
	Shasta red fir	Western white pine	Mountain hemlock	Incense- cedar	Total
<u>Number</u>					
Germinated, 1952	3,019	38	38	19	3,114
Survived, 1952	2,198	28	38	19	2,283
Survived, 1953	1,708	9	28	19	1,764
<u>Percent</u>					
Survival, first year	73	75	100	100	73
Survival, second year	57	25	75	100	57

Survival of Shasta red fir seedlings was very good. Of the total number germinated, 73 percent were alive at the end of the first growing season, and 57 percent were alive at the end of the second season (table 1). Most surviving seedlings were healthy and vigorous. Although early survival was good on all kinds of seedbed, it was slightly better for mineral soil than for the others. Seedling losses were caused principally by insect clipping, drouth, and gopher activity. A 43-percent seedling loss in the first two years is remarkably low. If this is typical of Shasta red fir cuttings, one year's seedling germination could easily produce an adequate new stand.

One good seed crop has produced a stand of high medium stocking. Milacre stocking of Shasta red fir at germination time was 65 percent (table 2). Stocking was reduced to 55 percent by the fall of 1952, and second-year losses further reduced stocking to 44 percent. Forty-four percent stocking^{5/} of milacre quadrats is considered medium stocking.^{6/} By number of trees, medium stocking requires fewer than 1,460 established trees per acre, a value exceeded on this tract by 17 percent. Only a few more seedlings, well distributed, are needed for the area to rate well stocked.

Table 2. --Percent of milacre plots stocked at germination and at the end of the first and second growing seasons

Date	Shasta red fir seedlings only	Shasta red fir and seedlings of other species	All seedlings and advance reproduction
	<u>Percent</u>		
July 1952	65	65	71
September 1952	55	56	63
September 1953	44	45	53

If advance reproduction and a few seedlings of other species are included, milacre stocking was 71 percent in July of 1952 after seedlings had germinated, and 53 percent at the end of the second growing season. The advance reproduction, mostly Shasta red fir, averaged 292 trees per acre in July of 1952 and 255 trees per acre in September 1953. However, the advance growth is poor and of questionable importance; only a few stems appear likely to become useful components of the future stand.

^{5/} Forty-four percent stocking of milacres is about equal to 65 percent stocking by 1/250-acre quadrats.

^{6/} Western Forestry and Conservation Association, Seeding and Planting Committee. 1953. Reports of the Pacific Northwest Seeding and Planting Committee on various recommended reforestation practices and techniques. 69 pp. (See p. 65.)

Two years after logging, ground cover had not become dense enough to seriously hinder additional regeneration. By ocular estimate on the milacre plots, 13 percent of the clear-cut area was covered with herbaceous growth in 1952, one year after logging. Total vegetation had increased to 20 percent by fall of 1953. Huckleberry and Ribes constituted almost 50 percent of the total ground cover; bracken fern, sedge, beargrass, and numerous others made up the other half. Ground-cover composition showed little change in one year except that sedge increased more than threefold (3 to 11 percent).

Shasta red fir regenerated naturally and abundantly on the clear cut studied. The uncut stand surrounding the 35-acre clearcutting provided abundant seed, and logging exposed considerable mineral soil. Seedlings germinated and survived best on mineral soil but also did well on other surfaces. Seedbeds suitable for additional stocking should be available for a number of years if ground cover continues to increase at the present low rate. Under these conditions, good Shasta fir natural reproduction has been obtained on one area from a single good seed crop.



Figure 1. --The surface of the study area was extensively disturbed by logging, and only a small amount of slash remained.