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GROWTH AND SURVIVAL OF A SITKA SPRUCE

PLANTATION IN COASTAL OREGON

by

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EDITOR'S
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The growth characteristics of Sitka spruce seedlings and the influences of environment on seedling growth have been studied on the Cascade Head Experimental Forest in western Oregon since 1949. Knowledge of the growth characteristics of selected tree species and the limiting factors of the environment is essential to the planning of an effective reforestation program.

This report describes the height growth and survival of Sitka spruce (*Picea sitchensis*) during the first 8 years of the study. The information applies specifically to the fog-belt area along the coast of northern Oregon and more generally to all areas in western Oregon and western Washington where Sitka spruce is used for reforestation.

STUDY AREA

The study is being made on a low site II clearcut that was harvested in 1948. The west half of the clearcut was burned in the fall of 1948; the east half was left unburned. A ridge divides the clearcut into well-defined north and south slopes that are similar in steepness and drainage. Thus, four distinct environmental conditions are represented: north slope burned, north slope unburned, south slope burned, and south slope unburned.

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Slash burning was considered satisfactory, and an examination afterward showed little damage was done to the soil. One percent of the area was severely burned (soils baked red), 38 percent was lightly burned (surface litter charred), and 61 percent was untouched by fire. Soil reaction of the burned sites was changed from strongly acid to slightly alkaline. Within 4 years, however, the soil was again acid.^{2/}

METHOD

A plot of 100 Sitka spruce seedlings was established in each of the four environments--400 trees in all. Within the plots, the seedlings were planted in several rows parallel to the dividing ridge. In unburned areas, the seedlings were spaced about 5 feet by 5 feet. In burned areas, the seedlings were planted only on the burned sites, and spacing was more irregular. An experienced man planted the seedlings, using a hoe as the planting tool.

Planting stock was 3-0 Sitka spruce, grown at Wind River Nursery near Carson, Wash. The seed was collected in the Calawah River drainage near Forks, Wash., where climatic conditions are very similar to those at the planting site. The seedlings had 4-inch tops and 6-inch roots when they were lifted from the nursery on October 25, 1948, and placed in cold storage. On January 18, 1949, the south slope of the study area was planted. Because soil on the north slope was frozen, the stock for this area was heeled in at the experimental forest headquarters. That spring (April 1) the north slope was planted.

In the fall of 1950, 1952, 1954, and 1956, the trees were checked for survival, measured for height, and rated for competition from vegetation. Tree height was considered as the distance between the highest leader and the point where the ground and stem meet. Height was measured to the nearest inch. Rating for degree of herbaceous and brush competition was as follows:

<u>Rating</u>	<u>Description</u>
0	Free of competition
1	Overtopped on one side
2	Overtopped on two sides
3	Overtopped on three sides
4	Overtopped on all sides

^{2/} Tarrant, Robert F. Effect of slash burning on soil pH. U.S. Forest Serv. Pac. NW. Forest and Range Expt. Sta. Res. Note 102, 5 pp. (Processed.) 1954.

RESULTS

Height Growth

The trees that were alive in 1956 averaged 89.5 inches in height, with 86 percent of them exceeding 50 inches (fig. 1). The tallest tree was 197 inches; the shortest, 11 inches. The trees had grown rapidly since planting, nearly doubling their average height every 2 years, as shown in the following tabulation:

<u>Year examined</u>	<u>Average height (Inches)</u>	<u>Periodic height growth (Inches)</u>
1949	4.0	5.0
1950	9.0	7.6
1952	16.6	28.6
1954	45.2	44.3
1956	89.5	

Figure 1.--Fast-growing, 8-year-old Sitka spruce in test plantation at Cascade Head Experimental Forest.



The average height would have been greater if 67 terminal leaders had not been killed by whipping of hardwoods or by the Sitka-spruce weevil (Pissodes sitchensis). This leader damage usually resulted in crooked stems or multiple leaders. It was estimated that loss of leaders from all causes reduced average tree height by 6.5 inches. Sitka-spruce weevil was not noticed until 1956, when 14 leaders were found destroyed.

Average tree height was also reduced by competition from vegetation (fig. 2). In 1956, trees rated "4" for brush competition averaged 69.0 inches; trees rated "4" for herbaceous competition averaged only 51.0 inches. These heights compare with 89.5 inches for the average tree, and 113.0 inches for trees free of competition. Herbaceous cover was the main competition through 1954.

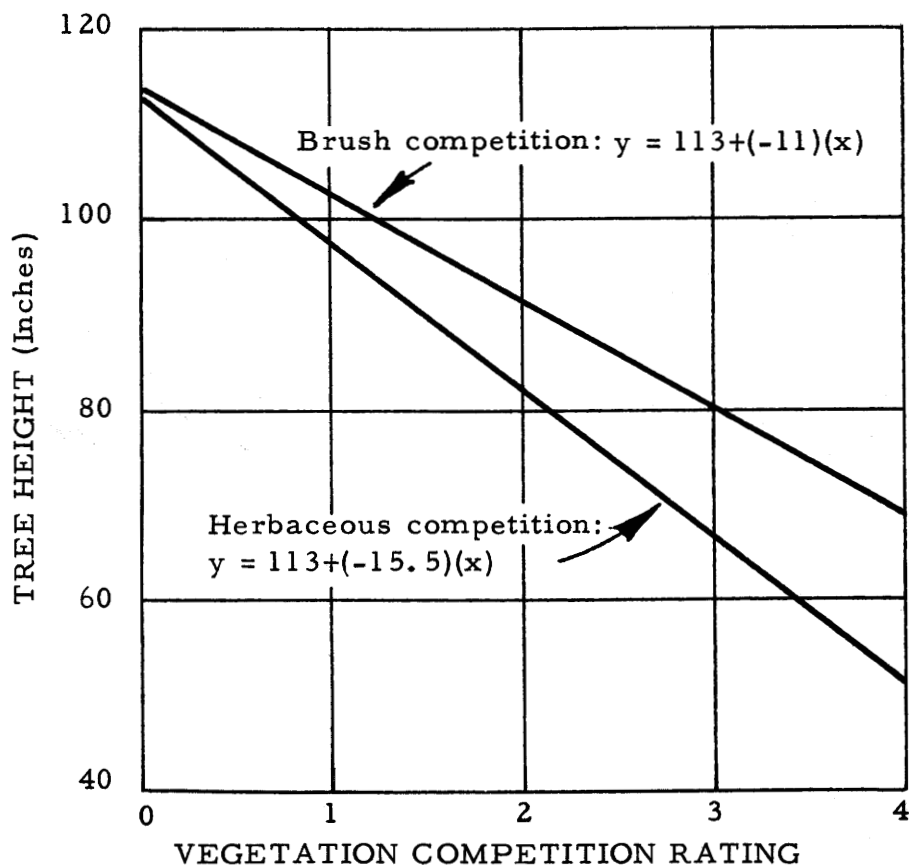


Figure 2.--Average tree height as influenced by vegetative competition. (Rated in 1956.)

The average height growth was greater on north slopes and on the burned plots, but the differences are not statistically significant:

	<u>South slope</u> (Inches)	<u>North slope</u> (Inches)
Burned	80.4	102.9
Unburned	79.6	89.4

Survival

Of the 400 trees that were planted for this test, 322 (80.5 percent) survived the first eight growing seasons. The greatest mortality occurred during the first 2 years after planting. Twenty-one of the forty-seven trees found dead in 1950 had been smothered by debris and soil that had washed onto the trees or had been cast there by mountain beaver (Aplodontia rufa pacifica). The remaining 26 trees died of unknown causes. Debris and soil movement continued to cause mortality until the soil stabilized and trees near animal dens had grown too tall for the animals to bury. The number of buried trees decreased from 21 in 1950 to 6 in 1952, and to none in 1954. Based on the 400 trees originally planted, the percentages of survival were as follows:

<u>Year examined</u>	<u>Survival</u> (Percent)
1950	88.3
1952	85.0
1954	83.3
1956	80.5

Although not expected to be a problem on the study area, competition from vegetation was the primary cause of mortality from 1953 through 1956. Western thimbleberry (Rubus parviflorus) was the main competitor in 1953 and 1954, with salmonberry (Rubus spectabilis) also causing some deaths. Most of the trees that died in 1955 and 1956 were suppressed by willow (Salix spp.) and red alder (Alnus rubra). Advanced reproduction of western hemlock (Tsuga heterophylla), released by logging, also crowded out some of the planted trees during this 2-year period.

Survival was best on the north slopes and on the burned plots, but--as with height--differences are not statistically significant:

	<u>South slope</u> (Percent)	<u>North slope</u> (Percent)
Burned	83	95
Unburned	61	84

CONCLUSION

Competition from vegetation is the major regeneration problem in coastal forests of northwestern Oregon. Special treatment to accelerate seedling growth or retard brush development is often needed to insure establishment of a new timber stand. The survival and rapid growth of planted Sitka spruce seedlings labels this species as a desirable one for brush-threatened areas.

The 4-inch seedlings planted in this study had an initial height advantage over trees starting from seed, and planting still taller trees should provide a greater advantage. For example, natural seedlings 2 years after seed fall might average 4 inches tall; 2 years after planting, the 4-inch study trees averaged 9 inches tall. In the same length of time, 15-inch planting stock might be more than 2 feet tall. Trees as large as this should be able to keep ahead of brush, and there would be little chance that they would be covered by debris from soil movement or animal activity.

Planting large seedlings, either nursery grown or wild, deserves further study.