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REPRODUCTION FOLLOWING SMALL GROUP CUTTINGS IN VIRGIN DOUGLAS-FIR

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Quick and adequate regeneration of Douglas-fir forests as they are harvested is a major forest management problem in the Puget Sound region. Clear-cutting by staggered settings has not always resulted in adequate regeneration even where no part of the area is more than one-fourth mile from a seed source. Single tree selection, experimented with extensively, has many times been followed by excessive windthrow, injury, decay, and shock to residual trees. Furthermore, tree selection has favored regeneration of the more tolerant species of the stand over the more valuable Douglas-fir. However, progressive cutting of small groups, starting in overmature or defective concentrations, might combine the benefits of selection and clear-cutting into a reasonable compromise.

Study

A study to compare the adequacy of regeneration following small group cuttings and large staggered clear-cuttings has been conducted by the Olympic National Forest in cooperation with the Puget Sound Research Center on a National Forest sale of the Simpson Logging Company near Camp Grisdale, Grays Harbor County, Washington. Six group cuttings 1.2 to 4.0 acres in size were made in concentrations of large, overmature Douglas-fir 400-500 years old. The stands represented site II, contained an understory of younger hemlock, and averaged 115 M board feet per acre. Timber was felled into the cutting area and skidded by tractors for loading off the logged area. These small groups were logged in March 1945, after which approximately 7 percent of the logged area was burned. An adjoining clear-cut area of 130 acres, 3000 feet wide at its widest point, was logged in 1942, using a high-lead system. The slash was burned in 1943 and reburned in 1946. Since 1946 when cone crop records were first started, there have been two medium seed years for Douglas-fir, 1949 and 1950. Seed crops in other years were reported as very light. Hemlock seed was medium to abundant in 1946 and 1949 and light the other three years.

Table 1.--Stocking for Douglas-fir and hemlock, separately and combined

Ground conditions	Douglas-fir		Hemlock		Combined 1/		No. plots	
	Small group	Large Cl.cut	Small group	Large Cl.cut	Small group	Large Cl.cut	Small group	Large Cl.cut
	Stocking percent							
All conditions	40	26	79	50	85	59	241	125
Burned surface	82	25	100	62	100	72	17	69
Unburned surface	36	25	77	32	79	45	224	56
Disturbed surface								
Compaction	6	18	8	18	10	18	34	11
Skidding	61	56	87	44	92	67	39	9
Undisturbed surface	39	24	87	53	88	63	168	105

1/ Combined stocking is not the sum of the Douglas-fir and hemlock percentages since for the combined figure a quadrat was considered stocked if it contained one or both species. Hence, a single quadrat commonly contained both Douglas-fir and hemlock, but only counted as one in the combined stocking.

Table 2.--Stocking in relation to distance from timber edge

Type of cutting	Distance from timber	Douglas-fir	Hemlock	Combined
	- Feet -	Percent		
Small group	under 500	40	79	85
Large clearcut	under 500	31	80	83
	500-1000	16	40	48
	1000-1500	14	32	45
	0-1500 1/	22	55	62

1/ This classification does not include all the plots on the large clearcut tabulated in Table 1.

Both large and small cuttings were re-examined by the cooperators in November, 1950. Reproduction counts were made by milacre quadrats--241 quadrats on the small group cutting area and 125 on the large clearcut. Counts of established Douglas-fir or hemlock seedlings (two years or older) were made and each quadrat was classified according to the condition of the seedbed. Seedbed conditions were rated as burned or unburned and disturbed or undisturbed by logging. Disturbed areas were further classified as light disturbance from skidding or heavy compaction as from tractor roads.

Results

The small group cuttings resulted in 85 percent stocking[1/] (Table 1), with either Douglas-fir or hemlock, compared with 59 percent for the large clear-cut area. The small group areas were 40 percent stocked with Douglas-fir and 79 percent with hemlock; the large clearcut was stocked 26 percent with fir and 50 percent with hemlock. Seedlings on the small group area were generally more vigorous and of better form than those on the large clearcut.

Burning increased hemlock stocking from 32 to 62 percent on the large clear-cut area, but Douglas-fir stocking was unaffected. Stocking of both hemlock and Douglas-fir was better on the burned than on the unburned plots of the small group cuttings. Burns in both cases were not severe and debris and ground cover were rather heavy on the unburned surfaces.

Soil disturbance by skidding increased the stocking of Douglas-fir in the small group cuttings, but had no affect on hemlock regeneration. The same trend was apparent on the large clearcut, although there were so few plots that the observation is not conclusive (Table 1). This improvement of Douglas-fir stocking is due to the baring of the mineral soil, a condition known to be favorable for its establishment. Stocking on tractor-compacted roads was reduced drastically for both species on both areas. Poor regeneration on tractor roads is due to excessive soil compaction and frequent occurrence of "mud holes." Normally this condition is overcome by gradual encroachment of roadside reproduction.

Distance from uncut timber edge clearly affected stocking beyond 500 feet (Table 2). Comparison of cutting methods shows that stocking for the combined species was similar for the first

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1/ Stocking is based on the percentage of 1/1000-acre quadrats having at least one seedling classed as thrifty or medium vigor. A milacre is a circle 7.5 feet in diameter. Any extra trees on the quadrat are ignored on the theory that only one could develop adequately on such a small area. The milacre quadrat is generally used for determining stocking in young seedling stands. In seedling and sapling stands over 3 years old, a 1/250-acre quadrat is normally used. In such cases, 3 seedlings younger than 2 or 3 years are required to equal one established, older seedling.

500 feet from seed source: 85 percent for the small group cutting, and 83 percent for the large clearcutting. However, stocking on the large clearcut dropped to 48 percent for distances of 500-1000 feet and remained at approximately that level in the 1000-1500 foot zone.

Windthrow about the edges of the small group cutting area was observed to be negligible. In contrast, excesive windthrow took place along the boundaries of the large clearcut. No field data were taken, however, to provide a quantitative measure of the difference.

Discussion

Douglas-fir occupied 47 percent of the stocked quadrats in the small group cuttings (Table 2), compared to 35 percent on portions of the large clearcut within 1500 feet of uncut timber. Within the large clearcut the proportion of Douglas-fir decreased slightly as the distance from timber edge increased. Up to 500 feet, 37 percent of the stocking was Douglas-fir; from 500-1000 feet, 33 percent; and from 1000-1500 feet, 31 percent. This is easily explained since Douglas-fir seed is not so easily wind disseminated as the lighter hemlock seed. Apparently, small cuttings not only improve total stocking, but also favor Douglas-fir over hemlock in a regenerating stand.

Some measure of the adequacy of regeneration resulting from the two cutting methods may be of interest. This comparison is based on the following assumptions: (1) Douglas-fir and hemlock are satisfactory regeneration species; (2) full stocking is desired by age 30 years; (3) present stocking of 50 percent is sufficient to develop into adequate stocking at age 30 through additional seedling establishment as well as through normal development of an understocked stand; and (4) large and small clearcuts are comparable in slope, soil, site, and exposure.

Under these assumptions, all the group cuttings qualify as adequately stocked, except for a near failure on compacted roads (10 percent). Regeneration in portions of the large clearcut within 500 feet of seed source is likewise adequate except on the unburned area (45 percent) and on roads (18 percent). However, in portions of the large clearcut over 500 feet from seed source adequacy of stocking is questionable since it is 48 percent for the 500-1000 foot zone and 45 percent for the 1000-1500 foot zone.

On all cuttings the proportion of Douglas-fir should at least maintain itself during the development of the stand since it is more vigorous than hemlock. Stocking of both species may be expected to increase as new seedlings start from future seed crops.

Summary

On six small group cuttings in old-growth Douglas-fir, satisfactory reproduction was obtained on all areas within five years. On a nearby large clearcutting, however, satisfactory restocking was confined to parts of the area within 500 feet of the timber edge. From 500 to 1500 feet, restocking was slightly below the "satisfactory" level.

Burning apparently favored both Douglas-fir and hemlock reproduction. Stocking of Douglas-fir was considerably better on surfaces disturbed in skidding than on relatively undistrubed surfaces. Hemlock regeneration showed no significant difference due to skidding disturbances. For both species, however, poor stocking was obtained on main tractor roads.

Douglas-fir reproduction was more numerous and vigorous on the small areas. There is an indication that the width of cutting areas should not exceed 500 feet in the direction of prevailing winds to secure the maximum amount of Douglas-fir regeneration. At distances greater than 500 feet, regeneration decreases and the proportion of Douglas-fir to hemlock is likewise reduced.

Windfall was severe around the boundaries of the large clearcut, but negligible on the perimeter of the small cuttings.