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A TEST OF SILVICULTURAL PRACTICES DESIGNED TO SECURE SPRUCE REPRODUCTION IN PARTIALLY CUT MIXEDWOOD STANDS IN ALBERTA

by

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INTRODUCTION

A 2-cut shelterwood system with seedbed scarification between cutting was designed for trial on a range of sites in the spruce-aspen mixedwood. The stands selected for study had been partially cut in 1953 on an individual tree marking basis. Studies of regeneration and subsequent cultural operations began in 1959.

The timetable of operations was:

1953: Partial cutting of 90-year-old merchantable spruce to a 14-inch stump diameter limit.

1959: Seedbed scarification to mineral soil using a 10-foot wide, 6-toothed bulldozer blade on 9 10-acre sample plots. Three 10-acre samples were located on each of dry upland, moist transition and wet bottomland sites.

1963: In early fall, seedspots were sown on exposed mineral soil patches on each scarified spot. Scuffing with a work-boot was sufficient to re-expose mineral soil. A pinch, 10 - 20 seeds, treated with aluminium oxide repellent was sown on each patch.

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1964: Regeneration stocking assessed in 1963 had been raised from 13 to 35 per cent on a milliacre quadrat basis and was judged to be satisfactory. Flooding of scarified spots on wet sites resulted in a patchy distribution of stocked quadrats based on drier areas with thinner surface organic soil layers.

1966: Seedspots were examined and survival assessed.

1966-67: Winter logging of merchantable residual spruce stems to a 7-inch stump diameter limit on 6 10-acre plots. Three plots remained as controls for each site.

1969: Regeneration assessment comparing performance on 3 sites and between logged-over and control blocks.

This report summarizes merchantable spruce-wood production from the sample stands and regeneration status after removal cutting.

RESULTS AND DISCUSSION

Stand volumes

Mean volume production per acre in 1953 from the sample area was 1,000 cu. ft. Sample plot standing volumes and regeneration status is shown in Table 1. Regeneration status on all sites was unsatisfactory.

TABLE 1. STANDING VOLUMES AND REGENERATION STATUS 1959

SITE	STAND VOLUMES cu.ft./Ac.			REGEN. STOCKING Milliacre quadrats
	Spruce	Hardwoods	Total	
Dry Upland	1350	2870	4220	10.3
Moist Transition	2130	1710	3840	14.0
Wet bottom land	1540	2250	3790	11.4

Scarification was completed in 1959 without measurable damage to standing spruce. By 1963, regeneration status had been raised to 44% on Dry, 47% on Moist, and 38% on Wet sites with a mean seedling height of 2.7 inches.

Logging in 1966-67 was completed over a satisfactory snow cover (Figure 1). Rubber-tired skidders (Figure 2) and full tree-length logging methods (Figure 3) were used.

Plot volume production in Table 2 shows 1966-67 production added to the estimated 1953 means. These totals represent a satisfactory level of stand production and include increased growth found to follow partial cutting in these mature stands (Lees 1963, 1964).

TABLE 2. VOLUME PRODUCTION
cubic foot volume/acre

	1953 (Est.)	1966-67	Total
Dry Upland	1000	840	1840
Moist Transition	1000	1750	2750
Wet bottom land	1000	1800	2800

REGENERATION STATUS

A sample of 100 milliacre quadrats was surveyed in each 10-acre plot. Survey results are shown in Tables 3 and 4. The logged-over plots now have fewer seedlings (16%) but these show superior height growth (13 inches) and vigor. Uncut plots have maintained higher stocking levels (33%) but the seedlings are smaller (9 inches) and are less vigorous with poor colour and lighter needles.

Figure 1. Snow Cover During Logging

Figure 2. Logging with Rubber-Tired Skidder

Figure 3. Full Tree-Length Logs

TABLE 3. REGENERATION ON LOGGED-OVER AND UNCUT STANDS (WHITE SPRUCE SEEDLINGS 1959-1969)

Parameter	Site	Stand Treatment		
		Logged-over		Uncut
		Plot 1	Plot 2	Plot 3
Regeneration, Stocking	Dry	15	19	32
	Moist	21	14	43
	Wet	18	12	25
Mean Total Height, Tallest Seedling Each Quadrat	Dry	12.58	13.03	9.43
	Moist	13.39	13.39	10.46
	Wet	18.94	7.03	7.48
Mean Leader Length, Tallest Seedling	Dry	1.93	1.85	1.05
	Moist	2.22	2.15	1.51
	Wet	3.44	1.44	1.12
Ratio: Leader Length / Total Height	Dry	1.49	1.37	1.02
	Moist	1.67	1.64	1.14
	Wet	1.67	1.51	1.13

TABLE 4. VIGOR CLASSIFICATION OF SPRUCE REGENERATION (Percentage Distribution)

Basis: 100 Milliacre Quadrats per 10-acre Plot

Site	Stand Treatment								
	Logged-over						Uncut		
	Plot 1			Plot 2			Plot 3		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Dry	44.4	38.9	16.7	31.7	46.7	2.7	6.8	56.1	40.6
Moist	33.3	51.6	9.1	36.5	32.0	31.0	23.3	42.2	35.7
Wet	72.4	22.2	5.2	92.9	7.1	0.0	15.0	58.3	26.7

Since logging over snow and the use of existing skid trails and haul roads was specified and carefully carried out, some explanation other than logging damage was sought to explain low seedling numbers. An outstanding feature of the logged-over plots was re-invasion by ground vegetation especially grasses, Figure 4. Mosses, fine grasses and smaller herbs were the main constituents of vegetation cover on uncut plots.

Assessment of these competition effects leads to the conclusion that removal logging was carried out too soon and that this degree of snow cover could have protected larger seedlings.

Seedspot survival data are presented in Table 5. The moister plots have higher seedling stocking with more seedlings surviving per spot. Survival rates after three growing seasons indicate that although the original scarified seedbed is no longer receptive to natural seedfall, a fresh seedspot can quickly be created which will support seedling growth. Planting with larger seedlings or with container seedling stock could also be used at this stage in the regeneration period. The site for a seedspot or planting location should be carefully selected within the scarified spot to take advantage of microsite variation.

It is now planned to log-over the uncut plots, to assess seedling growth and survival and re-invasion of ground vegetation after cutting. Survival and growth of seedlings on the original logged-over areas will be followed for each site.

Figure 4. Vegetation Competition

TABLE 5. SPRUCE SEEDLING SURVIVAL ON FRESHLY SCARIFIED SEEDSPOTS 1963-1966

Site		Percentage Seedling Stocking (basis 450 seedspot sample)			
		Less than 10 seedlings/spot	More than 10 seedlings/spot	Total %	$\bar{x}$
Dry	Plot 1	44		44	60
	Plot 2	62		62	
	Plot 3	58	16	74	
Moist	Plot 1	56	16	72	79
	Plot 2	54	24	78	
	Plot 3	72	16	88	
Wet	Plot 1	48	6	54	65
	Plot 2	44	10	54	
	Plot 3	52	34	86	

REFERENCES

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