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RESEARCH NOTES

BRITISH COLUMBIA FOREST SERVICE
VICTORIA, BRITISH COLUMBIA, CANADA

No. 63 1974

COMPATIBILITY OF GRASS SEEDING AND CONIFEROUS REGENERATION ON CLEARCUTS IN THE SOUTH CENTRAL INTERIOR OF BRITISH COLUMBIA

by

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Introduction

In the 60's extensive acreages of logged lands (68,000 acres in the Kamloops Forest District) were sown to grasses without benefit of studies concerning the impact upon forest regeneration. Conflicting opinions arose concerning the objectives of these operations and their effects upon the regeneration of coniferous tree species. The competitive effect of grass seeding upon this regeneration had not been defined, nor had direct damage by grazing stock been assessed. A review of the literature indicated considerable differences of opinion among researchers in the U.S.A. (Denham, 1959; Sowder, 1957; Rummell and Holscher, 1955; Tackle and Roy, 1953; Roy, 1953; Baron, 1962; U.S.D.A., 1957; Schubert and Heidmann, 1970; Pickford and Jackmann, 1944; Mueggler, 1962.)

Accordingly a co-operative study was initiated involving the Research Division and the Grazing Administration of the British Columbia Forest Service, and the Canada Department of Agriculture Research Station at Kamloops. This research was aimed at studying the effect of sowing non-rhizomatous species of domestic grasses, and the effect of grazing upon the establishment, survival and growth of coniferous tree species (primarily lodgepole pine). A secondary objective was to determine the effect of grass sowing upon the re-establishment of native shrubs and forbs.

During 1971-72, nine clearcuts of various sizes were selected for study and aerially sown with grasses at the rate of four pounds per acre. Portions of each clearcut were left unseeded as controls. Because of poor distribution of grass seed and/or germination, three of the clearcuts were deleted from further study.

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During 1972-73, nine additional clearcuts were selected and sown with grass at the rate of four pounds per acre. Because of the cool, wet, spring and extended dry, hot, summer, germination was very poor. Even where germination was partially successful, the distribution of grass plants was sporadic, and useful experimental data have not been realized.

One additional seeded area, previously not grazed, was added to supplement the study. The analysis and interpretations in this preliminary report are confined to results from this supplementary area plus four of the clearcuts treated in 1971-72. Hopefully, additional meaningful data will be obtained from the additional areas in 1974.

Climatic Conditions

The year 1973 was one of the driest on record for the Kamloops Forest District. The direct effect of this was evident in the mortality of naturally regenerated tree seedlings which was general in most of the clearcuts studied. Herbage production was directly affected by the lack of moisture. Under a more normal moisture regime herbage production would have been greater and this may have produced a greater effect on conifer seedling survival. Because of the dry conditions both grass and conifer seedlings were easily uprooted by cattle. Some of these losses may not have occurred under normal moisture conditions.

TABLE 1 - Climatic Data for 1973 by Area (1972 Data in Brackets)(1) No data collected on Area 2 (Supplementary Area).

Area	Elevation	Dates of Record (2)	Temperature °F Maximum	Minimum	Precipitation (Inches)	Number of Days Under 32°F	Over 65°F
1	4400	Mid-May- October 1	84.5(83.9)	27.9(13.5)	5.92(9.03)(3)	13(20)	48(59)
3	4200	"	85.7(86.2)	24.8(14.6)	6.43(3.97)(3)	25(22)	59(55)
4	3800	"	86.6(87.5)	17.1(11.1)	5.24(6.85)(3)	23(34)	54(68)
5	4600	"	84.0(84.2)	22.1(15.2)	6.54(6.34)	23(22)	56(47)

(1) Instruments Supplied by Climatology Division, British Columbia Land Inventory.

(2) Commencement dates for 1972 data approximately 2 weeks later and termination dates 3 weeks later than the 1973 dates.

(3) Part of data missing, usually as a result of rain gauges being disturbed by animals.

It is of interest to note that, within the medium to high elevations covering the study area, frost conditions occurred even during the mid-summer period. During the spring germination period, extensive cool periods retarded germination, particularly of grass sown the previous winter.

On the average, maximum and minimum temperatures were not much different in 1973 than in 1972 but the days with frost and high temperatures during the critical periods were more frequent in 1973. Also, precipitation was lower during 1973.

Results and Discussion

The 1973 examinations, with data on herbage yields and grazing provided by the Canada Department of Agriculture, showed the following:

AREA 1 - This area, of 300 acres, was planted with bare-root stock of lodgepole pine and spruce during the sping of 1971. The 300 acre area was fenced in 1972 and split into three more or less equal size fenced fields.

Sampling consisted of survival and damage assessments, and height measures, on 25 seedlings (natural or planted) within each of eight plots within each of the grass sown and no grass portions of each field. Clipping of forage was carried out on plots within and outside exclosures constructed during 1973 in the west and centre fields.

During 1973 the centre field was stocked at an average rate of 2.5 acres per animal unit month (A.U.M.)* for the two grazing periods of July 10 - August 16 and September 27 - October 26. The west field was stocked at a rate of 2.25 acres per A.U.M. between August 16 - September 27. Weight gains were reasonably good during the first term in the centre field but as the season progressed, gains dropped sharply.

TABLE 2 - Average Daily Animal Weight Gain (Pounds)

Animals	Avg. Starting Weight (lbs)	July 10 to August 16	August 16 to September 27	September 27 to October 26	July 10 to October 26
Cows	690	1.43	-0.13	-1.42	0.06
Calves	160	1.86	1.34	0.69	1.35

* A.U.M. is the amount of forage required to support a mature cow and her calf for one month (roughly equivalent to 660-pounds of air-dry forage).

At the time of clipping on August 22, the indicated utilization was 34 per cent in the grass sown area but only 8 per cent in the unseeded control strip. At the end of the grazing period, utilization was estimated to be about 70 to 75 per cent of herbage. This was heavier than optimum, but was designed to put pressure on the tree reproduction.

TABLE 3 - Herbage Yields in Pounds per Acre, August 22

GRASS		CENTRE FIELD	WEST FIELD
Seeded	Grazed	882	No grazing at Aug. 22
	Ungrazed	1328	2000
Control	Grazed	1220	No grazing at Aug. 22
	Ungrazed	1320	1048

At the time of data collection during mid-August, grazing had not been completed, therefore damage which may have occurred during the later part of the grazing season was not recorded in 1973.

On the average, for all three fields, there was no significant difference in seedling heights between grass - no grass areas. There was a significant difference in seedling heights between fields but this was a result of site differences and seedlings (species, and natural versus planted) rather than effects of grass or grazing. Similarly, differences between plots were due to site effects and differences in numbers of natural or planted seedlings per plot and to species within plots.

No evidence of coniferous seedling mortality caused by cattle damage was recorded in 1973. Although most of the mortality occurred in grass sown areas, competition from grass was not believed to be the cause. Mortality which did occur was due to poor nursery stock condition more than to any other factor. There was some damage to seedlings by cattle but this was insignificant. There was no difference in damage between grass - no grass areas.

TABLE 4 - Per Cent Survival and Damage

Field	Grass Cover	Per cent survival	Per cent of Seedlings Damaged (1)
West	Grass	99.5	4.0
	No Grass	100.0	2.0
Centre	Grass	100.0	2.5
	No Grass	100.0	4.0
East	Grass	97.5	-
	No Grass	99.0	-

(1) Damage includes broken branches, stem scarring, broken tops, and browsing.

AREA 2 - This was an area densely stocked with Willow (Salix sp) that was windrowed in 1971 to prepare the area as a grazing pasture. Grass was sown in late 1971. A combination of good seedbed, scattered spruce seed-trees on the lower portion of the area and a good seed-crop on the seed-trees in 1971 provided good stocking of spruce along with the grass.

Prior to commencement of grazing in 1973 a set of plots was established to determine effects of grass and grazing on the survival and growth of the spruce seedlings. Two exclosures were constructed, one in heavy grass cover and one in light grass cover, the light grass cover being an area almost missed during seeding of grass. Plots were also established outside exclosures in grass cover similar to the inside exclosures. Data on height, survival and damage were collected on 200 seedlings within each plot.

Grazing was very heavy. By the latter part of August, prior to termination of grazing, utilization of herbage was over 90 per cent. Even willow which had sprouted and reached approximately 6-feet in height was severely pruned by the cattle.

Mortality of spruce seedlings averaged 25 per cent on unprotected plots, with 95 per cent of this as a direct result of cattle damage. A further 23 per cent of seedlings received trampling and/or browsing damage. Re-examination in 1974 will be required to determine continued effects of this damage.

Mortality and damage were significantly higher in heavy grass cover than in light grass cover but this was an effect of cattle rather than of grass competition.

TABLE 5 - Heights, Survival and Damage by Treatment

Treatment	Avg. Seedling Height (cms)	Mortality (Number of Seedlings)	Mortality Due to Animals	Number of Living Seedlings Damaged	Vegetation Density in % Coverage per sq. ft.
Heavy Grass					
Fenced	3.67	2	-	-	54.8
Unfenced	3.62	55	51	43	35.6
Light Grass					
Fenced	3.73	1	-	-	26.0
Unfenced	3.63	45	44	25	16.4

TABLE 6 - Herbage Production (Pounds per Acre) and Utilization

Treatment	Yield	Per Cent Utilization
Heavy Grass		
Fenced	2146	
Unfenced	116	94
Light Grass		
Fenced	1265	
Unfenced	93	92

AREA 3 - This area, of 125 acres, was sown with grass in 1971-72 but turbulent air conditions caused drift of seed onto the control area. Since no control strip was available, comparative studies of grass - no grass could not be established. However, the area was planted with bare-root stock of spruce during the Autumn of 1972 and plots were established during 1973 to study effects of cattle grazing on the planted stock.

Survival, damage, condition and height were recorded for each seedling within four sets of 100 seedlings. Cattle grazing was almost continuous over a four month period during the summer and autumn.

Between early June and early October an average of 11.3 per cent mortality occurred as a result of cattle damage and a further 6.5 per cent mortality was attributed to other causes. In addition to the mortality attributed to cattle, approximately 4 per cent of living seedlings received trampling or browsing damage.

AREA 4 - Data collected on each milacre of 25 four-milacre plots within each fenced and unfenced plot within the grass - no grass areas showed no difference in per cent stocking with conifers between the grass and control areas. There were some interactions between grass seeding and fencing. Mortality, in number of seedlings, was significantly higher on grass sown than unsown areas and on unfenced than fenced areas. However, mortality was also higher on unseeded fenced areas than on seeded fenced areas, therefore grass did not have a significant effect on seedling survival. There was no significant difference between grass - no grass areas with respect to the percentage of mortality attributable to animal damage but the combined effect of grass and animals produced a significantly higher per cent of damage to living seedlings than where there were animals but no grass.

The mortality attributed to animal damage and the number of living seedlings damaged by animals, were high on this area compared with most of the areas examined. The main reason for this was poor cattle management, that is, salting in the wrong place and allowing cattle to remain on the area for too long a period.

The high utilization of this area by cattle was evidenced by results of herbage clipping during late August. At this time, when grazing for the year was not completed, the utilization of forage on grass sown-unfenced plots and unseeded-unfenced plots was approximately 86 and 58 per cent, respectively.

TABLE 7 - Herbage Production (Pounds per Acre) and Utilization

	Fenced (Ungrazed)	Unfenced (Grazed)	Per Cent Utilization
Grass	2573	369	86
No Grass	1355	571	58

TABLE 8 - Per Cent Stocking, Number of Seedlings, Mortality and Damage by Treatment

Treatment	Per Cent Stocking 1972	Number of Seedlings per Acre	Per Cent Stocking 1973	Number of Seedlings per Acre	Mortality 1972-73 Number of Seedlings/ Acre	Per Cent of Mortality Due to Animals	Per Cent of Living Seedlings Damaged
Grass							
Fenced	3.0	370	30.0	575	30	-	-
Unfenced	26.0	2230	64.5	2255	450	26.7	23.3
	15.5	1300	47.2	1415	240		
No Grass							
Fenced	21.5	1650	48.0	2085	125		
Unfenced	10.0	730	40.0	875	145	24.1	13.7
	15.8	1190	44.0	1480	135		

AREA 5 - Data on survival and damage were collected on each milacre of 100 four-milacre plots within each of the grass sown blocks and non-grass control blocks.

Mortality on grass sown blocks was significantly greater than on control blocks but the difference was due more to site condition than to effects of grass seeding. The mortality, in absolute number of seedlings per acre, was fairly high but probably no more than normal for lodgepole pine during the first couple of years of establishment, and in consideration of climatic conditions prevalent during 1973. The amount of mortality attributed to cattle damage was a minor portion of the overall mortality. The final effect of cattle during 1973 will depend upon the recovery of seedlings trampled and browsed. However, even complete loss of damaged seedlings will not account for a significant portion of total mortality.

On all cut blocks, the percentage of area stocked increased regardless of decreases in number of seedlings per acre through mortality.

TABLE 9 - Per Cent Stocking, Number of Seedlings and Damage by Treatment

Treatment	Cut Block	Per Cent Stocked 1972	Number of Seedlings per Acre	Per Cent Stocked 1973	Number of Seedlings per Acre	Mortality 1972-73 No. Seedlings	Per Cent Mortality Due to Cattle	Per Cent of Living Seedlings Damaged
Grass	1	13.2	975	15.5	925	395	3.2	4.9
	3	9.5	622	10.2	520	260	5.0	13.5
	6	14.0	1112	15.5	865	535	5.4	11.5
		12.2	903	13.8	710	398	4.6	9.3
No Grass	2	9.2	738	12.8	808	270	0	1.5
	5	40.0	4385	48.5	3898	1230	3.4	5.2
		24.6	2562	30.6	2353	750	2.7	4.5

Summary

The cool spring and warm, dry summer of 1973 affected germination of grass on newly sown areas and retarded grass development on areas previously sown. The effect of climatic conditions on conifer regeneration was three-fold: germination was poorer and mortality greater than probably would be the case under more average conditions; seedlings of both conifers and grass were more easily damaged by cattle due to dry soil conditions; and the retardation of grass growth possibly contributed to less competition to conifer seedlings. Utilization of forage by cattle was greater on grass - sown areas than on unsown (control) areas.

Where numbers of cattle and period of grazing were rigidly controlled, the amount of damage to conifer seedlings was negligible. This was demonstrated by Area 1.

Where numbers of cattle were regulated by permit, but period of grazing was too long, that is over - utilization of forage, the damage to conifer seedlings was extensive. This was demonstrated by Area 2.

Where the number of cattle under permit was uncontrolled within a limited area of a much larger grazing unit and forage was over-utilized, the damage to conifer seedlings was of sufficient magnitude to be unacceptable. This was demonstrated by Areas 3 and 4.

There may also be situations where forage is over-utilized and damage to conifer seedlings is of sufficient magnitude to be unacceptable, but is insignificant in relation to the mortality occurring as a consequence of natural causes. This was demonstrated in Area 5, where mortality due to cattle damage was of some concern, but was overshadowed by natural mortality.

The cases where extensive cattle damage occurred were usually where poor cattle management was evident. Examples of this include failure to place salt in proper locations or to move cattle at the proper time.

With the exception of one area, the amount of mortality attributable to animal damage was a minor portion of total coniferous seedling losses.

On the average, grass had no effect on germination or survival of conifers. In cases where inhibiting effects were apparent, the competition from native vegetation was of as much consequence as the competition from domestic grasses.

Literature References

Baron, F. J. 1962. Effects of Different Grasses on Ponderosa Pine Seedling Establishment. U.S.D.A. Forest Service. Pacific Southwest Forest and Range Experiment Station, Research Note No. 199.

Denham, A. 1959. Compatibility of Grass and Trees on East-side Oregon and Washington Forests. Paper presented to Society of American Foresters Annual Meeting, San Francisco, California.

Mueggler, W.F. 1962. Range Resources and Management Problems in Northern Idaho and Northeastern Washington. U.S.D.A. Forest Service. Intermountain Forest and Range Experiment Station, Research Paper 68.

Pickford, G. D. and Jackmann, E.R. 1944. Reseeding Eastern Oregon Summer Ranges. Agricultural Experiment Station, Oregon State College. Station Circular 159.

Roy, D. F. 1953. Effects of Ground Cover and Class of Planting on Survival of Transplants in the Eastside Pine Type of California. U.S.D.A. California Forest and Range Experiment Station, Research Note No. 87.

Rummell, R. S. and Holscher, C.E. 1955. Seeding Summer Ranges in Eastern Oregon and Washington. U.S.D.A. Farmers' Bulletin No. 2091.

Schubert, G.H. and Heidmann, L.J. 1970. Artificial Reforestation Practices for the Southwest. U.S.D.A. Forest Service. Agriculture Handbook No. 370,

Sowder, J.E. 1957. Rehabilitation of Disturbed Areas Following Logging and Fire (with reference to seeding grass on Ponderosa pine Forested Lands). Paper presented before Pacific Northwest Section, American Society of Range Management.

Tackle, D. and Roy. D.F. 1953. Site Preparation as Related to Ground Cover Density in Natural Regeneration of Ponderosa Pine. U.S.D.A. California Forest and Range Station. Tech. Paper No. 4.

U.S.D.A. Pacific Northwest Forest and Range Experiment Station. Annual Report 1957.