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APPRAISAL OF FOREST REGENERATION IN PARTS OF THE SOUTHERN YUKON, 1972.

Northern Forest Research Centre
Environment Canada
Edmonton

APPRAISAL OF FOREST REGENERATION IN PARTS OF THE SOUTHERN YUKON, 1972

by

F. Endean
Canadian Forestry Service

INTRODUCTION

At the request of the Yukon Forest Service the writer made a rapid reconnaissance of forest regeneration in the vicinity of the main highways in the south Yukon. The appraisal was carried out with Dr. L. W. Carlson, C.F.S. (responsible for nursery liaison) in the period 10 - 14th July and covered the following areas, Alaska highway from Watson Lake to Whitehorse to Haines Junction, Highway No. 2 from Whitehorse to Pelly Crossing.

The object of the appraisal was to decide whether the lack of regeneration in the area covered was sufficient to justify the construction of a forest nursery at Whitehorse. A report showing the extent of areas requiring artificial regeneration was handed to the Yukon Forest Service on 14th July (copy attached).

Since it appears that nothing has been written about the forest regeneration problem in the Yukon it was felt that some of the observations made were worth recording.

Species distribution and growth conditions

The area covered lies mainly in the central Yukon section of the Boreal Forest Region (B26b) with the exception of the Haines Junction area which is in the Kluane section (B26d), Rowe (1959). The general distribution of species and sites has been well described by Rowe (1959). Briefly white spruce covers the lowlands and valley bottoms with black spruce on organic soils and those with high water table. On moister sites and north and east aspects white spruce covers upper slopes to timberline (3,500 - 4,500 ft asl). Lodgepole pine occurs on the coarse drier soils and on areas of intrusive rocks with shallow soil (Fig.1). Aspen is ubiquitous, "pioneering" most burned sites and acting as an overwood for spruce regeneration. Soils are poorly developed because of their recent origin and the cool dry climate. The Kluane region is colder and drier (fewer frost free days) with poorer tree growth and more open stands (Fig.2).

Two points worth emphasising are (1) the widespread layer of volcanic ash found at approximately 2 - 4 inches depth in the profile (Fig.3) which is said to have an adverse effect on root development (Rowe 1959) and (2) the marked effects of aspect on middle and upper slopes, the south and west being much drier than north and east.

In all the areas examined rooting, particularly of pine, was very shallow. This is presumably caused by cold soils and the volcanic ash layer already mentioned. (Areas of true permafrost are said to be small in the southern Yukon, Gairns 1968).

Forest growth in the southern Yukon must be considered in a very different way from that in more temperate regions. Stands merchantable for lumber are almost entirely white spruce and are confined to the lower elevations especially the alluvial flats, Holman (1943). Sixty percent

(60%) of the merchantable forest resources are in the Liard River drainage in the southeast Yukon (Gairns 1968). Merchantable value of the forest vegetation should not be a primary consideration. The forest cover is equally important in (a) maintaining soil and ecological stability pending more intensive use (if ever) (b) maintaining wild life populations and (c) for reasons of pure aesthetics in what is becoming a popular recreational area. The main threat to its stability is repeated wild fire at short intervals.

Effects of fire

Forest fire is a subject of particular interest to residents of the Yukon because of the threats it poses to townships and its marked and long lasting effects on the landscape. Revegation of burnt over areas is slow under the harsh Yukon conditions, it takes at least ten years for noticeable revegation.

Wild fire has obviously been a major and normal factor in the ecology of the woody species and most of the stages of stand development now seen are a function of the time which has elapsed since last disturbance and the nature of available tree seed sources.

Lodgepole pine stands of the type shown in Fig.4 (Watson Lake area) regenerate readily after fire even in shallow crevices in the intrusive rock outcrops (Fig.1). Many of these stands are overstocked (despite heavy damage due to browsing) in terms of site carrying capacity and can be expected to stagnate in later years. No instances of regeneration failure in lodgepole pine were seen even though the only available seed source is unburnt cones on residual trees. The great risk in this forest type is of a second wild fire before the regeneration reaches seed-producing size. This might be considered as worthy of some priority in fire protection plans.

The story with spruce is not so encouraging. Extensive areas of adult spruce have been burned over at different times (Fig.5). Because white spruce cones shed seed annually, there is not a large stock of seed held in the cones which can be released after fire as is the case with lodgepole pine. Where the burn has been intense the seed source is completely destroyed and the woody vegetation appears to revert to aspen and willow. Burns are rarely completely destructive over large areas however and small islands of spruce residuals are left (usually in the wetter hollows) to act as a sparse seed source for a new stand (Fig.6). Spruce regeneration from such scattered residuals is sporadic, depending upon windborne seed, some of which may travel on the snow crust. Aspen and willow appear to "pioneer" most sites after a fire but particularly the spruce sites and act as a very beneficial shelter wood for the spruce regeneration. This regeneration eventually overtops the aspen (Fig.2) to form a new stand, the density of spruce depending upon seed supply. The dangers of repeated fire in totally eliminating the struggling spruce are obvious. Fig.7 shows a very sparse regeneration of spruca under aspen following a fire which left few residuals. Gairns (1968) discusses and maps large areas which have been reduced to "scrub" aspen and willow as a result of repeated fires. On the other hand, where there is an adequate source of seed, spruce regeneration after fire does not seem to be a problem. Organic layers are generally shallow and there always seems to be an adequate exposure of mineral soil to provide a seed bed.

The benefits of wild fire should be accepted however where they occur. In certain areas e.g. Mile 957 (Fig.6) on the road between Whitehorse and Haines Junction, the destruction of an adult spruce stand by fire has produced a reasonable and pleasing grass pasture which it would be wise to encourage for wildlife or stock grazing. This could be done by controlled burning and chaining to remove the remaining standing snags and dry fallen stems.

<u>Game damage</u>

Frequent instances of extensive browsing damage, presumably rabbit, were seen in lodgepole pine regeneration and to a much lesser extent in spruce (Fig.8). This was most marked north of Whitehorse. Lodgepole pine seems to be preferred and is sought out even when it occurs only as scattered individuals amongst spruce. The magnitude of the current damage is due to populations which reached a peak in 1970-71, but it is possible that browsing could be a persistant problem in artificially established pine plantations.

<u>Possibilities for artificial regeneration</u>

Before any regeneration operations are done, a large scale appraisal of the regeneration situation should be carried out, priorities set and areas for attention demarcated.

The chances of success with artificial regeneration (planting and sowing) seem good. Natural regeneration of both spruce and pine seems to be satisfactory on most previously forested sites where there is an adequate supply of seed and mineral soil exposure. It is obvious that climatic conditions suitable for seedling establishment do occur and if a program of artificial regeneration is to be undertaken the first step would be to determine at what time of year this occurs.

(i) Soil/Climatic conditions

The main limiting factors to the establishment of regeneration would seem to be lack of adequate soil moisture and incidence of frost. Attention should be focused on these first. Once the areas requiring regeneration have been decided, it should be possible to estimate the best period for planting or sowing on the basis of one year's observations on soil moisture and published climatic data, to be followed by refinements as time allows. Local opinion favors the late summer and early autumn as the period with highest soil moisture and therefore the most suitable time for planting and seeding.

(ii) Methods of regeneration

Once the optimum period has been estimated, both planting and seeding should be tested. Seed-eating rodents may be a problem and the danger of rabbit damage to planted stock has already been mentioned. The importance of these hazards can only be judged by trials.

Because conditions are harsh and forest growth of seedlings relatively slow, planting would produce the most rapid visual returns. Planting should therefore be tested on areas where rapid reforestation is judged necessary. Both container seedlings and open-rooted stock of white spruce and lodgepole pine should be tried but in the writer's opinion large size container seedlings would be the cheapest and most efficient planting system.

Seeding can be done by hand or from the air and on the basis of Alberta experience there is little difference in the cost of the two methods of seed application. Seeding by hand gives more economical use of seed and allows the selection of favorable micro sites. In order to test the feasibility of seeding it would be better to test hand seeding first. Not less than ½ lb of seed of good viability would be required per acre and thus some system for seed collection and extraction would be necessary.

(iii) <u>Site preparation for regeneration</u>

Mechanical site preparation should only be used where it is essential for adequate tree establishment. In most of the burned over areas seen, the organic layers were thin, 1½ inches or less and ground vegetation sparse. Because of this and the immature nature of the soils there does not seem to be a general need for the massive surface disturbance by scarification used in the southern Boreal forest. The moister alluvial areas where a dense vegetation and grass sod has developed will require scarification before planting or sowing. On the upland areas planting should be tested first with large size seedlings on undisturbed ground. The widespread layer of volcanic ash usually occurring at 2 - 4 inches depth in the soil may present some problems in seedling establishment, Rowe (1959) suggests that this ash inhibits root development.

A sample of the volcanic ash layer was collected between Whitehorse and Pelly Crossing, the chemical analysis of available elements was as follows:

pH	7.4
Conductivity	.148
	P.P.M.
Ca	1831.5
Mg	110.7
Na	26.7
K	121.9
Mn	36.70
Zn	4.36
Co	0.013
Fe	2.20
P	48.60
NO_3-N	0.00

There is nothing in this analysis to suggest that the ash layer would chemically inhibit rooting. This point should be checked more extensively. If the layer does have an inhibitory effect, it may be necessary to break through it with a shallow, single furrow plow along the line to be planted so as to allow maximum penetration of seedling roots.

Where white spruce is to be established by seeding or planting, existing aspen shelterwood should be retained except where it is too dense.

In areas which are to be seeded and since it has been suggested that hand seeding should be tried first, this can be done on hand-scarified spots 2' x 2' and 6' apart. Consideration can be given later, to broadcast seeding and the necessity for machine scarifieation, this will depend upon the proportion of mineral soil which is already exposed under natural conditions.

REFERENCES

1. Gairns, G. H. 1968. The Yukon economy its potential for growth and continuity. Vol. 8. Reference study on forest resources. Industrial Forestry Services Ltd., prepared for D. Wm. Carr and Associates Ltd. Ottawa.
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3. Rowe, J. S. 1959. Forest Regions of Canada. Can. Dept. Northern Affairs and Natmral Resources. For. Branch. Bull No. 123.

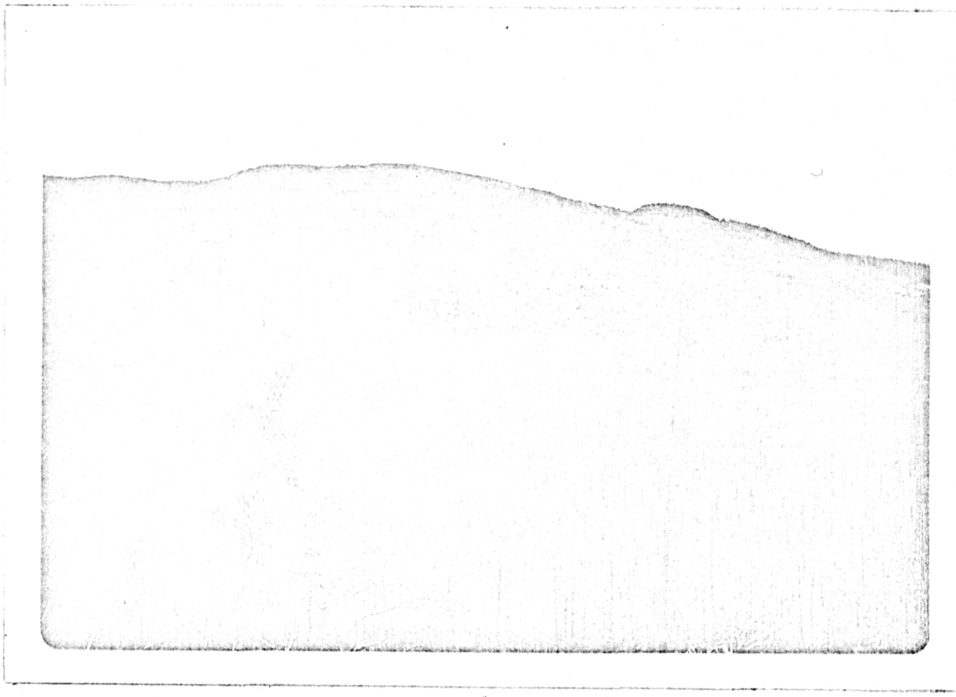

Fig.1. Lodgepole pine (background) growing on shallow soil on intrusive rocks.

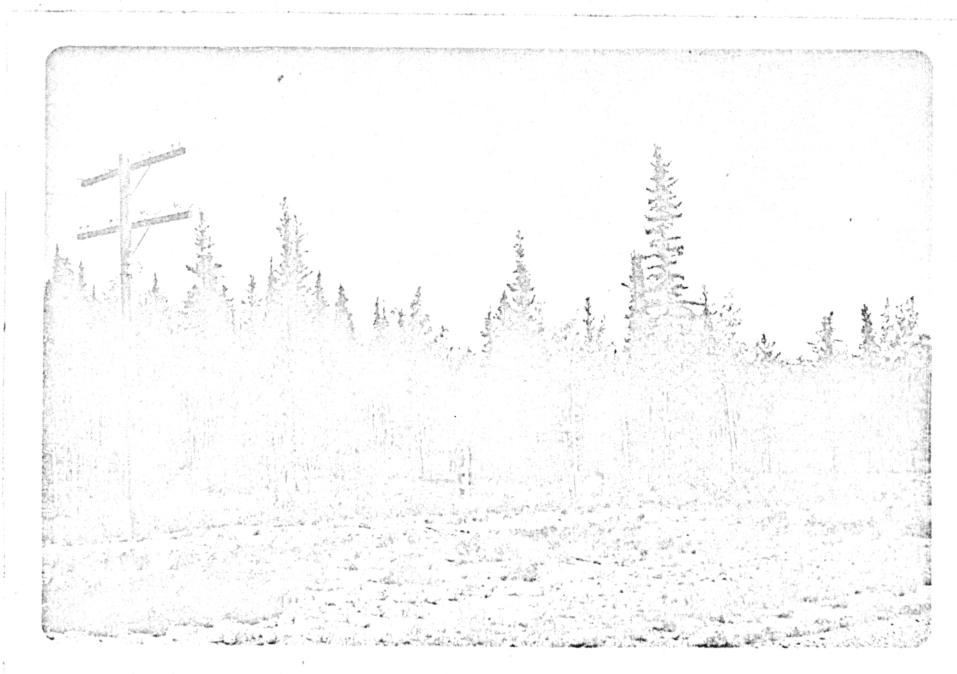

Fig.2. Open spruce, aspen stand in Kluane area.

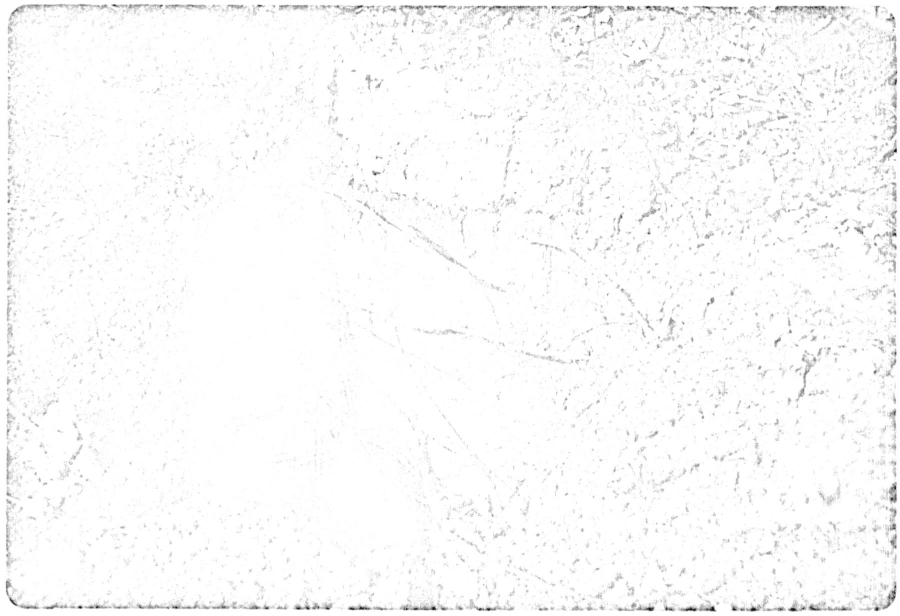

Fig.3. Soil profile near Whitehorse (proposed nursery site) showing layer of white volcanic ash.

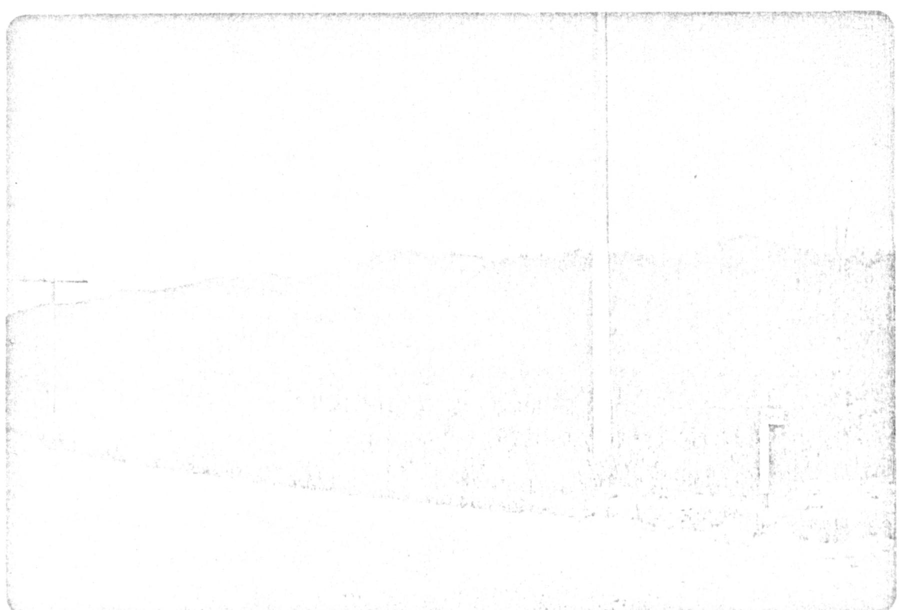

Fig.4. Abundant lodgepole pine regeneration after wild fire in a stand in the Watson Lake area.

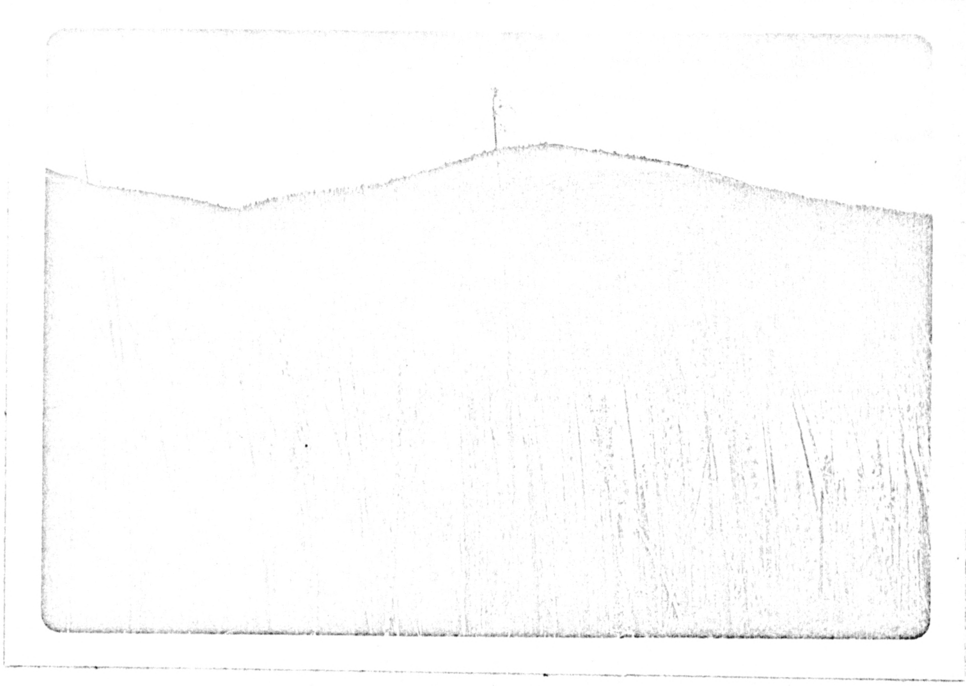

Fig.5. Extensive burn in upland white spruce.

Fig.6. Spruce residual left after fire (extreme right of picture), scrub in centre is aspen. There was virtually no regeneration in this area between Whitehorse and Haines Junction at Mile 957.

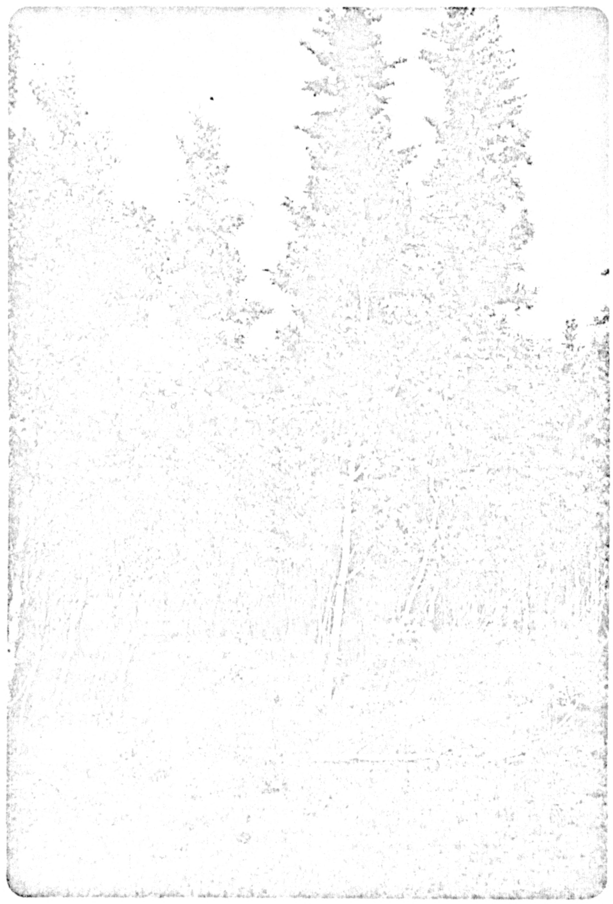

Fig.7. Old spruce residual in scrub aspen with sparse and heavily browsed regeneration between Whitehorse and Haines Junction approx. Mile 946.

Fig.8. Browsing damage on established spruce at site of Fig.7.

(APPENDIX)

Appraisal of Forest Regeneration in Major Burned Over Areas in Parts of Southern Yukon

Introduction

This appraisal was carried out by the Canadian Forestry Service at the request of the Regional Manager of Water, Lands and Forests Branch and the Superintendent, Yukon Forest Service, of the Department of Northern Development and Indian Affairs.

The object of the appraisal was to provide general information on the status of forest regeneration in certain parts of the Yukon in order to decide whether a Forest Nursery programme was necessary or not. The areas in question were those adjoining the Alaska Highway between Watson Lake through Whitehorse to Kluane Lake and Highway No. 2 from Whitehorse to Pelly River. Large parts of these areas have been burned in the last twenty years, have not regenerated to coniferous species and are the object of increasing public concern.

Methods

At this stage the intention was to obtain only a broad estimate of burned coniferous areas near highways which have failed to regenerate to coniferous species. A detailed regeneration survey was not requested. The appraisal was made on the basis of road traverses recording the position and extent of burns, the degree of recolonization of vegetation, particularly coniferous species.

Results

The main interest was in the coniferous species and visual assessments were made as to adequacy of stocking. The results of the road traverses are presented in Tables 1, 2 and 3.

In the immediate vicinity of the highways traversed there is a total of seventy-three and one half (73.5) miles which is unsatisfactorily stocked to coniferous species and which will not achieve this level without intervention by artificial means. In addition in many of the stretches examined, this condition extends over large areas away from the road but visible from it. We estimate such areas to be two hundred thousand (200,000) acres minimum.

If the Yukon Forest Service intends to rehabilitate these areas and even if only a two hundred foot (200') wide strip either side of the road is treated, this would require the regeneration of three thousand eight hundred (3,800) acres. Since growth is slow, planted stock would provide the quickest improvement. Assuming high mortality, because of climatic conditions and wildlife damage, this would require six hundred (600) seedlings per acre, giving a total requirement of 2.28M plants. If treatment of larger areas is considered, plant requirements would have to be considered proportionately. It is suggested, however, that parts of the burned areas away from the road should be regenerated by direct seeding.

It is obvious that if the Yukon Forest is to fulfill its obligations, a forest nursery is required in the Yukon. The production of stock in more southerly nurseries (Alberta or B.C.) is neither practicable nor biologically acceptable. We suggest a nursery unit with a potential annual production of two hundred thousand (200,000) container seedlings and one hundred thousand (100,000) seedlings. This unit should be equipped with the appropriate seed extraction facilities.

Detailed suggestions and estimates for a forest nursery at Whitehorse are given in Carlson's Memorandum to Superintendent of Yukon Forest Service, dated June 26, 1972.

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TABLE 1

Regeneration Status of Burn Areas Between Watson Lake and Whitehorse

Mileage	Burn Character	Regenerating Species	Comments
636-688	No burn		
688-694	Recent	lpp	S - 4'-6' tall
694-703	Recent	W, A, Sw	U
703-716	Recent	lpp	S (in crevices of bare rock)
716-721	Recent	lpp	S
721-753	Recent	lpp, Sw	S - fragmented burn
753-754	Recent	Sw, W	S
754-763	No burn		
763-767	Recent	lpp, Sw	S (large area burned across valley)
767-847	No burn		
847-848	Recent	lpp	S
848-914	No burn		

No burn - 207 miles
Burn + S for conifers - 62 miles
Burn + U for conifers - 9 miles

Legend to Tables

Regenerating Species

A = Aspen
lpp = Lodgepole Pine
Sw = White Spruce
W = Willow

Comments

S = Satisfactory regeneration
U = Unsatisfactory regeneration

TABLE 2

Regeneration Status of Burn Areas Between
Whitehorse and Kluane

Mileage	Burn Character	Regenerating Species	Comments
924-926	No burn		Township sites
926-934	Recent	lpp	S
934-935	Recent	A	U - no conifers
935-938	Recent	lpp	S - in crevices of bare rock
938-944	Recent	A	U - rare conifers
944-948	Recent	A, S, lpp	S - poor growth
948-950	Recent	A, Sw, lpp	U - patches of conif
950-956	Recent	A, W	U - formerly a spruc sites
956-960	Old	A, Sw	U - few Sw
960-966	No burn		
966-998	Old	A, Sw	S - scattered residu Sw
998-1054	No burn		

No burn - 64 miles
Burn + S for conifers - 47 miles
Burn + U for conifers - 19 miles

TABLE 3

Regeneration Status of Burn Areas Between Whitehorse and Pelly Crossing

Mileage	Burn Character	Regenerating Species	Comments
0-6			Township sites
6-27	Recent	lpp	U-S (50-50) - patchy severe rabbit damage
27-50	Old	Sw	S
50-65	Recent	A, W	U - old spruce site
65-78	Recent	A, Sw, lpp	S for lpp (10%) severe rabbit damag
78-114	No burn		
114-116	Old	lpp	S & U - destroyed by rabbit damage
116-122	No burn		
122-124	Old	lpp, Sw	S
124-162	No burn		
162-168	Recent	None	U

No burn - 80 miles

Burn + S for conifers - 36.5 miles

Burn + U for conifers - 45.5 miles