AN OPERATIONAL TRIAL OF SCARIFICATION AND AERIAL SEEDING ON THE QUEBEC NORTH SHORE

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FOREST RESEARCH LABORATORY
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INFORMATION REPORT Q-X-11

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ABSTRACT

In 1967, the Quebec Forest Research Laboratory, in co-operation with various agencies, carried out an operational-scale demonstration of artificial regeneration on the Quebec North Shore. The site chosen was an unproductive tract of forest land which had been logged over and burned in 1944. A 320-acre block was scarified by a bulldozer, dragging a shark-fin barrel and tractor pad scarifier. In the fall, the area was seeded to jack pine by means of a helicopter. This report covers all phases of the project's establishment and discusses factors which could affect its success.

INTRODUCTION

There are large areas on the Quebec North Shore where regeneration following destruction of the forest by fire, is non-existant. Extensive burned over areas in the vicinity of Forestville, Quebec, are typical of this. It is there that the Forest Research Laboratory of the Quebec Region has initiated research to devise methods by which these areas may be reforested.

Planting, although always a certain means of obtaining a stand, is also a very expensive one. Seeding is less expensive, therefore research was initiated in seeding on prepared seedbeds to determine if this method could be adapted to the area (MacArthur, 1960). The work which began in 1960 indicated that jack pine sown on a mineral soil seedbed provided the most satisfactory regeneration of these areas.

Research to date, however, has been of an investigatory nature and no large scale operational trials of these broadcast seeding techniques have been tested. Thus, in the fall of 1966, the Quebec Laboratory concluded an agreement with various agencies to carry out an operational-scale demonstration of artificial regeneration on typical North Shore conditions using scarification and aerial seeding techniques. This report covers all phases of the establishment of this project.

CO-OPERATING AGENCIES

Perhaps unique in the annals of Quebec forestry, is the amount of co-operation that went into this project (Hatcher, 1967). Four agencies were involved, namely;

1) Forest Research Laboratory, Quebec Region.

2) Service de la Restauration,
Ministère des Terres et Forêts du Québec.

3) Anglo Paper Products Ltd.

4) Timber Branch,
Ontario Department of Lands and Forests.

The project itself was initiated by Mr. A. Demers[1] at that time with the Forest Research Laboratory. A 350-acre block was provisionally selected for the study, 25 miles east of Forestville on Route 15 (Fig. 1). The proposed project was discussed in detail with Mr. Hervé Lizotte, Head, Restoration Services, Quebec Department of Lands and Forests. From this, the two Government agencies agreed to carry out the project on a cost-sharing basis.

Procurement of a sufficiently large quantity of jack pine seed for the aerial seeding was the next phase of the study. Anglo Paper Products Ltd., arranged for this by having a selected stand of jack pine cut and the cones collected by the Indian residents of the Bersimis Reserve. Pulpwood went to the company and the 318 bushels of cones collected were shipped to the Quebec Department of Lands and Forests' nursery at Berthierville for seed extraction and treatment[2].

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1) Superintendent, Montmorency Forest, University Laval, Ste-Foy, P.Q.

2) Arasan, endrin mixture as a repellent and fungicide.

Scarification of the demonstration area by shark-fin barrel and tractor pad scarifiers was carried out by Paul Boucher, a local contractor at Les Escoumins, P.Q.

Aerial seeding was carried out by an helicopter rented from Autair Helicopter Services Ltd., St. Jean, P.Q. The seeding itself was carried out using a Brohm Aerial seeding unit. Mr. H. Brohm, Mechanical Research Dept., Ontario Department of Lands and Forests, installed the equipment on the helicopter and supervised the entire aerial seeding operation.

SEED COLLECTION

The seed collection took place in late September and October, 1966. The area selected was 67 road miles north of Forestville (Fig. 2). It was a young jack pine stand with a Cladonia-Vaccinium site type (Lafond, 1967). A complete stand description is given in Appendix I. The Indian residents of the Bersimis Reserve did a good job of collecting a very clean crop of cones. A total of 318 bushels yielded 102 pounds of cleaned seeds. They were extracted, cleaned and stored at the Berthierville nursery of the Quebec Department of Lands and Forests. In September 1967, the seeds were treated with an arasan-endrin repellent and fungicide, the exact quantities of these chemicals used being outlined in Appendix II. Five pounds of seed were treated at a time.

SCARIFICATION

Scarification began on July 18, 1967 and ended on September 1. A total of 390 machine hours were taken to scarify the 320 acres which had already been delineated by Anglo personnel. The equipment used was a Caterpillar D7B tractor pulling shark-fin barrels and tractor pads (Fig. 3). Initially, anchor chains were used in conjunction with the barrels but these were so easily entangled by the organic debris that they soon became a hindrance.

The extremely poor production of 0.82 acres/machine hour is due entirely to the characteristic difficulty of the site chosen. Having been burned in 1944, the average depth of ericaceous shrubs by 1967 was 3 feet (Fig. 4) and this growth had a very dense, resistive, root mat. If the tractor moved at normal speeds used to scarify a recent burn (2 acres/hour), the scarifiers simply bounced over the ericaceous root mat. In order to break through this resistive layer, the tractor had to remain in first gear, enormously reducing the production.

No data are available concerning what proportion of the total area has been effectively scarified to produce mineral soil or mineral soil in mixture with organic debris. An occular estimate would be from 40 to 50%. This information will be obtained during 1969. As the ericaceous species have not begun to reinvade the site, this data should be valid.

AERIAL SEEDING

Prior to seeding, an E-W line was run across the centre of the area. Pickets were placed at 90 ft. intervals along the total length

of the line, the distance between each picket marking the swathe of the Brohm Seeding unit (Fig. 5). As the N-S flight paths were never more than 1 mile in length, the pilot could easily see the flagman, wearing an orange helmet and jacket, as he positioned himself along the line at the 90 ft. intervals for each consecutive run. Lack of obstacles on the area always provided good line-of-sight between helicopter pilot and flagman. The system also ensured that the seeding unit was functioning successfully as any cessation of seedfall could easily be detected by the flagman (Scott, 1964).

Two test flights were carried out; one after the installation of the seeding unit and another at the Bersimis area. The latter was a demonstration for the sponsoring agencies but could not be made operational because of high wind velocities (Appendix III). Wind speeds, however, dropped below 8 m.p.h. by 5 p.m. on October 4, and the seeding was completed in 75 minutes. Seeding was carried out from an altitude of 150 ft. and at an air speed of 60 m.p.h. (Fig. 6).

The Brohm Seeding unit was calibrated to sow 32,000 jack pine seeds per acre using the formula outlined by Scott (1964). In fact, a total of 98.0 pounds were distributed over the 320 acres at a rate of 45,143 seeds per acre. With a germination capacity of 80%, the number of viable seeds sown per acre was 36,114.

COST OF OPERATION

The demonstration project was executed on a cost-sharing basis between the Forest Research Laboratory and the Quebec Department of Lands and Forests. Details are outlined in Appendix IV.

FIRST YEAR RESULTS

The first measurement of the jack pine regeneration took place on October 9, 1968. The amount of regeneration was determined by using the sequential stocked-quadrat tally procedure as outlined by Dick (1963). The main advantage of this procedure is that the reliability of the stocking estimate is predetermined and the minimum number of quadrats are required to provide this chosen reliability. A maximum number of 100 milacre quadrats giving an absolute error of 10% were chosen to serve the purpose.

From a randomly located starting point along Route 15, a traverse was run out across the demonstration area. This took the form of a triangle so that the traverse ended near the starting point.

A stocked milacre quadrat tally was taken at one chain intervals, each quadrat being recorded in sequence on the tally sheet. A total seedling count was taken every 5 chains. The complete length of the traverse was 100 chains. First year stocking to jack pine was 53% with 1,350 seedlings per acre.

DISCUSSION

The poor results are due in part to the extremely dry weather at the begining of the growing season 1968. The meteorological data from the nearest station indicate that precipitation was 2.40, 0.53 and 1.52 inches[3)] below normal for the months of May, June and July, respectively.

Even if this rather marginal regeneration survives in total without any subsequent mortality, it is unlikely that a good stand of

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3) From Monthly Records, Met. Branch, Can. Dept. Trans., Station Baie Comeau A, P.Q.

jack pine will be produced. This is due to the existence of a substantial impermeable iron pan, a few inches below the surface of the mineral soil which has not been broken by the scarification (Appendix V). The situation could be ameliorated by breaking the pan with a Parkgate plough.

Sites of such low fertility (Appendices VI, VII) make a poor regeneration chance, particularly from an economical aspect. The soil scarification equipment available was inadequate for this area which had such dense ericaceous growth as to double the normal cost of scarification. The Forest Research Laboratory chose one of the poorest sites in the area in order to determine what was involved in bringing it back into production.

FUTURE WORK

Because of the dry Summer of 1968, a small proportion of the demonstration will be re-seeded to jack pine in the Spring of 1969. Sequential stocked quadrat tally procedures will be used to determine the charges which occur in jack pine stocking over the next two years. An experimental seeding of black spruce has already begun (Fig. 1). Spring and Fall seeding using four sowing densities[4] of treated[5] and untreated seeds were set out in a split plot design. This black spruce seeding will be repeated in part during 1969.

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4) Rates used were 56,000, 112,000, 168,000 and 224,000 viable black spruce seeds per acre.

5) Arasan, Endrin repellent and fungicide.

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Dick, J. 1963. Forest Stocking determined by sequential stocked-quadrat tally. Jour. For. 61 (4): 290-294.

Hatcher, R.J., 1967. A sign of the times? Pulp and Paper Mag. Can. WR-495.

MacArthur, J.D. 1960. Trials of seed spot methods with five coniferous species in a non-reproducing burn on the Sault-au-Cochon River. Project Q-81.

Lafond, A. 1967. Notes pour l'identification des types forestiers des concessions de la Quebec North Shore Paper Company. Univ. Laval pp. 93.

Scott, J.D. 1964. Helicopter seeding trials in Ontario. Mimeo Rept., Timber Br., Ont. Dept. Lands and For. 56 pp.

APPENDIX I

Stand and site description of jack pine cone collection area

Tree Species	Jack pine
Age	47 years
Total Height	36 ft.
Ave. dbh	5.2 inches
No. trees/acre	501.2
No. cords harvested	248.0
Total area harvested	49.0 acres
No. cords/acre	5.1

Site Type	Cladonia - Vaccinium
Soil Type	Very thin humus layer covering a coarse, gravelly sand
Elevation	600 ft. above sea level
Aspect	North
Drainage	Excessive
Slope	Nil

APPENDIX II

Treatment of seeds for direct seeding

1. Preparation of repellant

- Place 45.4 g. of Endrin 50W in a clean one-gallon container
- Add 189.2 ml. of Arasan 42-S
- Stir with a paddle until the powder is so wet that no dust rises
- Beat with paddle until the mixture is smooth and free of lumps

2. Preparation of sticker

- Mix 148 ml. of undilated Dow Latex 512-R with another 189.2 ml. of Arasan 42-S in a clean one-gallon container

3. Preparation of final mixture

- Blend repellant and sticker together by pouring from can to can about 10 times.
- The final mixture totals about 444 ml. and serves for 5 pounds of seed.

4. Treatment of seeds

- Place 373 g. of seeds into a mixing can and add 88 ml. of repellant mixture.
- Close can tightly and rotate it for about 2 minutes
- Add aluminum powder at the rate of 1 or 2 teaspoons per pound of seeds and tumble the can for another 30 seconds.
- Remove coated seeds and spread it out to dry overnight in heated building.
- Sotre at 34°F in tightly closed tins.

5. Verification of the repellant coating

- Put several hundred dry seeds in a small wire basket and run a strong stream of cold water over them for 2 minutes

APPENDIX II (cont'd)

- If 2/3 of each seed remains coated, then the repellants will weather satisfactorily. If the loss is greater, the seed should be re-treated.

APPENDIX III

Extracts from helicopter flight log

Date	Operation	Take off	Land	Mins.
Oct. 3, 1967	Test flight for seeding equipment	18.10	18.20	20
Oct. 4, 1967	Forestville-Bersimis	8.50	9.10	20
	Demonstration	9.40	9.50	10
	Bersimis-Forestville	10.15	10.40	25
	Forestville-Bersimis	16.15	16.35	20
	Seeding	17.05	18.35	75
	Bersimis-Forestville	18.35	18.55	20
				3 hrs. 10 m.

APPENDIX IV

Cost of Bersimis demonstration area

Operation	Agency Providing Funds	Cost
1. Seed Collection		
318 bushels at $11.00	Fed. Gov.	$3,498.00
Seed extraction, cleaning	Prov. Gov.	No charge
2. Scarification		
325 hrs. at $18.00	Prov. Gov.	5,850.00
65 hrs. at $18.00	Fed. Gov.	1,170.00
Misc. (spare parts etc.)	Fed. Gov.	211.00
3. Aerial Seeding		
Helicopter 3 hrs. 10 min. at $110.	Fed. Gov.	348.00
Brohm Seeding Unit 4 days at $50.	Fed. Gov.	200.00
Total		11,277.00
Cost per acre		35.24

The above does not include the following:

	Total Man Days
2 Anglo personnel - chaining the area;	4
2 Federal personnel - organization	10
- seed treatment	3
- seeding supervision	1
	18

APPENDIX V

Soil Profile Description[1,2]

LF	12" - 0	Undecomposed forest moss and litter
H(Ah)	0 - 1"	Very dark brown 10 YR 2/2 with semi-decomposed forest litter; granular structure; abrupt and smooth boundary; 1" - 2" thick; pH 3.55
A_2	1" - 3"	Light gray 10 YR 7/1 to light brownish gray 10 YR 6/2 sand; non-sticky, non-plastic; single grains; clear and smooth boundary; 1" - 4" thick; pH 3.70
Bh	3" - 7"	Very dark reddish brown 4 YR 3/2 sand; non-sticky, non-plastic; many fine roots, single grains to granular structure; abrupt and smooth boundary 2" - 5" thick; pH 4.20
Bfh_1x	7" - 16"	Dusky red 2.5 YR 3/2 sand with fragipan; non-sticky, non-plastic; coarse subangular and blocky structure; gradual and broken boundary; 6" - 15" thick; pH 4.70
Bfh_2x	16" - 23"	Yellowish red 5 YR 4/6 - 4/8 sand with fragipan; non-sticky, non-plastic; coarse subangular blocky structure; clear and smooth boundary; 6" - 10" thick; pH 5.05
C	23" +	Strong brown 7.5 YR 5/6 - 5/8 sand mixed with black sand; non-sticky, non-plastic; single grained to very coarse subangular blocky structure; pH 5.30

1, Taken from the road cutting in the southwest corner of the area.

2, National Soil Survey Committee Nomenclature

APPENDIX VI

Soil analyses of roadside cutting

Horizon	Organic Carbon		Total		Free	K	Mg.	Free	% H_2O	% Organic Matter	
	Loss on Ignition	Wakley-Black	N	C/N	Iron	m.e./100 g.	m.e./100 g.	Al	Hygro	Loss on Ignition	Wakley-Black
			per cent		per cent						
H	44.83	46.46	1.150	40.4	0.15	0.32	0.27	0.081	8.13	77.29	80.10
A_2	0.64	1.00	0.017	58.8	0.23	0.05	0.06	T	0.11	0.11	1.72
Bh	3.50	3.60	0.070	51.4	1.17	0.31	0.05	0.694	1.37	6.04	6.21
Bfh_1x	1.89	1/	0.030	63.0	0.15	0.04	0.04	1.412	1.01	3.25	17.85
Bfh_2x	1.09	1/	0.020	54.5	1.06	0.04	0.04	0.812	0.60	1.88	5.86
C	0.56	0.23	0.010	23.0	1.56	0.04	0.04	0.112	0.20	0.97	0.39

1/ Error in the Wakley-Black due to manganese interference; the C/N ratio was calculated from loss on ignition.

APPENDIX VII

Figure 1. LOCATION OF THE 320-ACRE DEMONSTRATION AREA

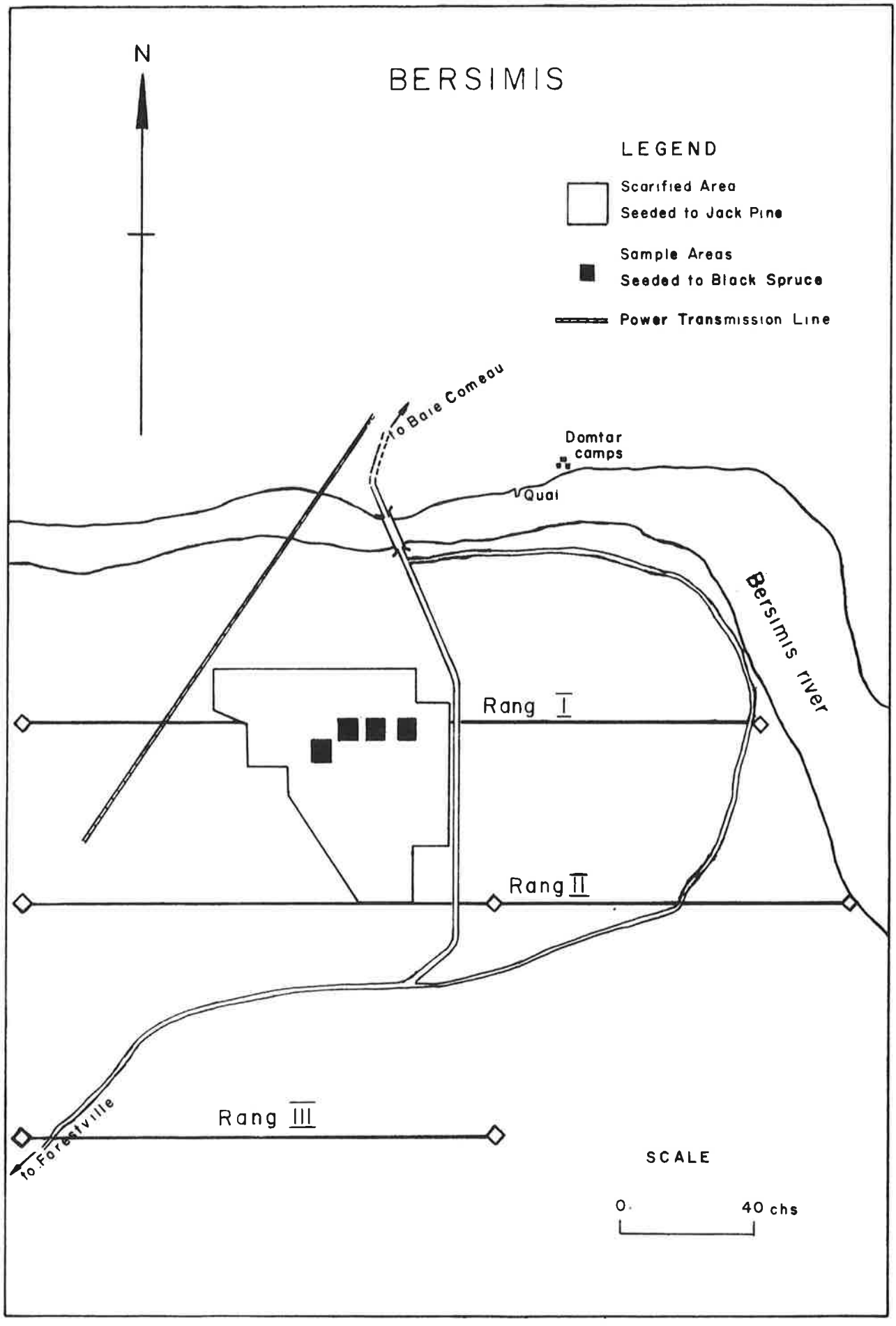

Figure 2. LOCATION OF THE CONE COLLECTION AREA

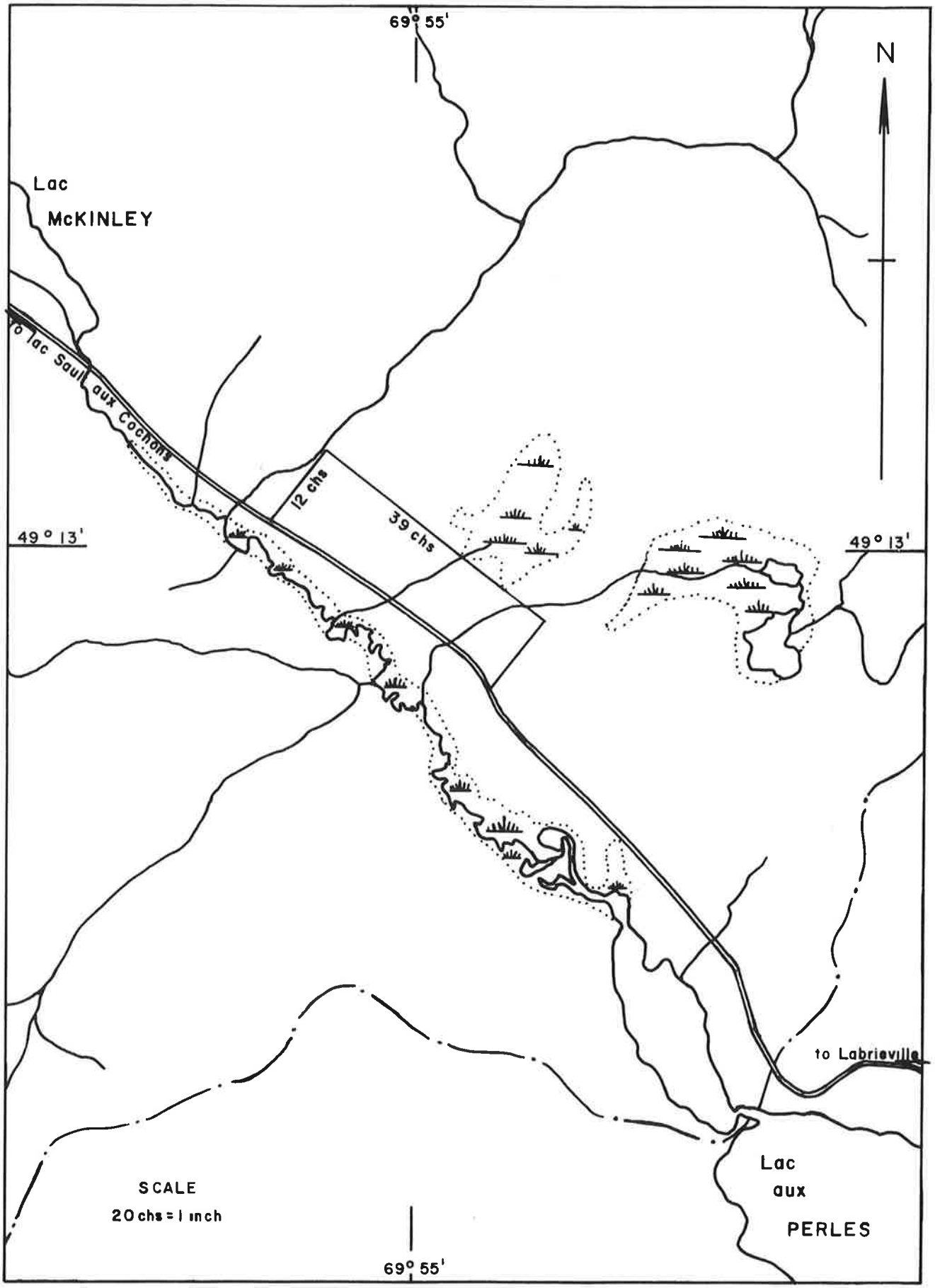

Figure 3. Shark-fin barrel and tractor pad scarifier showing combination (above) and closeup of the barrel (below).

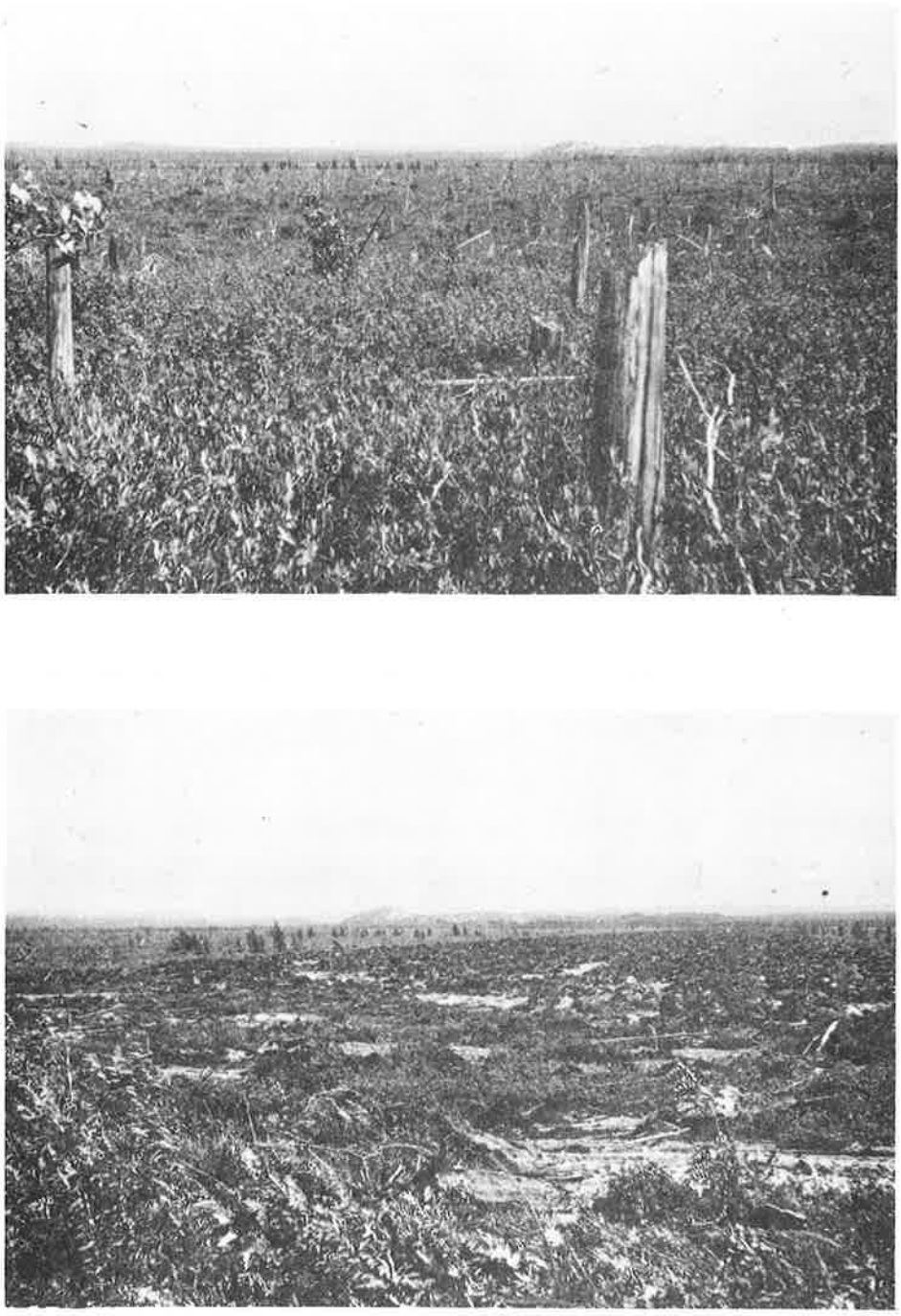

Figure 4. Typical ground conditions of the area before (above) and after (below) scarification.

Figure 5. Brohm Aerial Seeding Unit attached to helicopter.

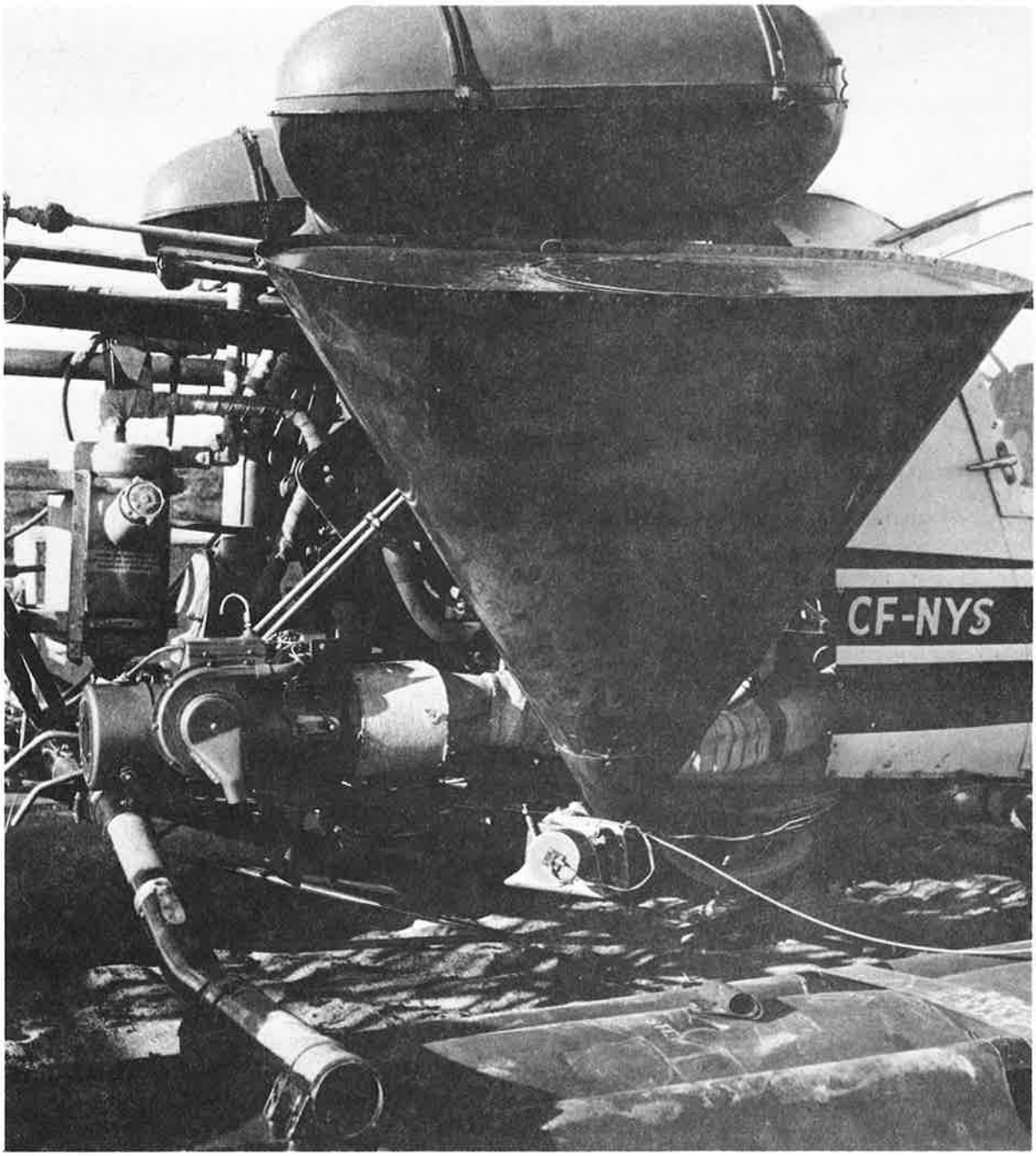
CF-NYS

Figure 6. Aerial seeding in progress.