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FOREST RESEARCH BRANCH

- Establishment Report, 1963 -

PLANTATIONS OF WHITE SPRUCE UNDER ASPEN ON DIFFERENT SOILS, FOOTHILLS SECTION, ALBERTA.

(Project A-83)

by

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Calgary, Alberta

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INTRODUCTION

Extensive portions of the Alberta Foothills and Mixedwood Forests are in pure aspen (Populus tremuloides Michx.). The Department of Lands and Forests regards such areas as non-productive and has initiated a planting program aimed at underplanting aspen stands with white spruce stock (Picea glauca (Moench) Voss). It is forecast that the number of acres to be planted will rise each year and that by 1965, between two and three million trees will have been planted.

This co-operative project was initiated to determine the effects of site and initial spacing on planting chance, seedling mortality, and periodic growth in plantations of white spruce under aspen. Accordingly, a nine-acre plantation was established on each of four different soils in the vicinity of Marlboro, Alberta. Each plantation consists of three treatments (9×9, 12×12, and 15×15 foot spacings) replicated three times and assigned randomly in each block.

The thirty-six acres of plantation were installed by personnel from the Federal Forest Research Branch and the Alberta Forest Management Branch. This report describes the establishment of the plantations in 1962.

EXPERIMENTAL AREA

Location

The plantations are located north of Highway 16 in the vicinity of Marlboro and Bickerdike, Alberta in the Edson "Corridor" of the Edson Forest Division. This is a strip of Crown land bounded on the south, west, and north by North Western Pulp and Power Limited limits and on the east by the yellow (agricultural) zone. Edson is situated at approximately 53°30' North latitude, 116°20' West longitude and 3,000 feet above sea level. The plantations are shown in a location map in Figure 1 and on stereo pairs of aerial photographs in Figures 2 and 3. The legal descriptions are as follows:

1. "Marlboro - 1962" Plantation. Northeast forty, Northeast quarter of Legal Subdivision 13, Twp. 53, Rge. 20, West of the 5th meridian.

2. "Sundance Creek - 1962" Plantation. Northwest and Northeast forties, Southwest quarter of L.S. 16, Twp. 53, Rge. 19, West of the 5th meridian.

3. "Swanson Road - 1962" Plantation. Northwest forty of the Southwest quarter and Southeast forty of the Northwest quarter of L.S. 16, Twp. 53, Rge. 19, West of the 5th.

4. "Bickerdike - 1962" Plantation. Northwest and Northeast forties of the Northeast quarter of L.S. 4, Twp. 53, Rge. 19, West of the 5th.

The land type is a ground moraine - outwash gravel - aeolian sand complex with a rolling topography. Outcrops of sandstone bedrock occur in the vicinity. The entire area was inundated in glacial times and a major spillway formed in the valley of Sundance Creek.

The soils are of the Grey Wooded Great Group of the Podzolic Order. The sub-group is Orthic Grey Wooded. Soil profiles from each of the plantations are discussed later.

The forest cover is 70-year-old aspen with scattered white spruce. Competition for planted trees from ground vegetation varies from light to heavy.

Climate

The climate in the Edson area is characterized by cold, dry winters and short, warm summers. Some climatological data are given in Table 1.

Table 1. Climatological data, Edson, Alberta. (Anonymous, 1947)

Mean annual temperature (°F.)	37
Mean annual precipitation (inches)	18.64
Mean annual snowfall (inches)	57.3
Average length of frost-free period (days)	66

There are marked changes in precipitation with changes in altitude. Muttit (1961) has reported that precipitation amounts in higher areas of Alberta are considerably in excess of what might be expected from normals indicated in literature available up to 1961. A comparison of rainfall for Edson and the Mayberne Forest Lookout Tower, which is about 15 miles northwest of Edson, is given in Table 2.

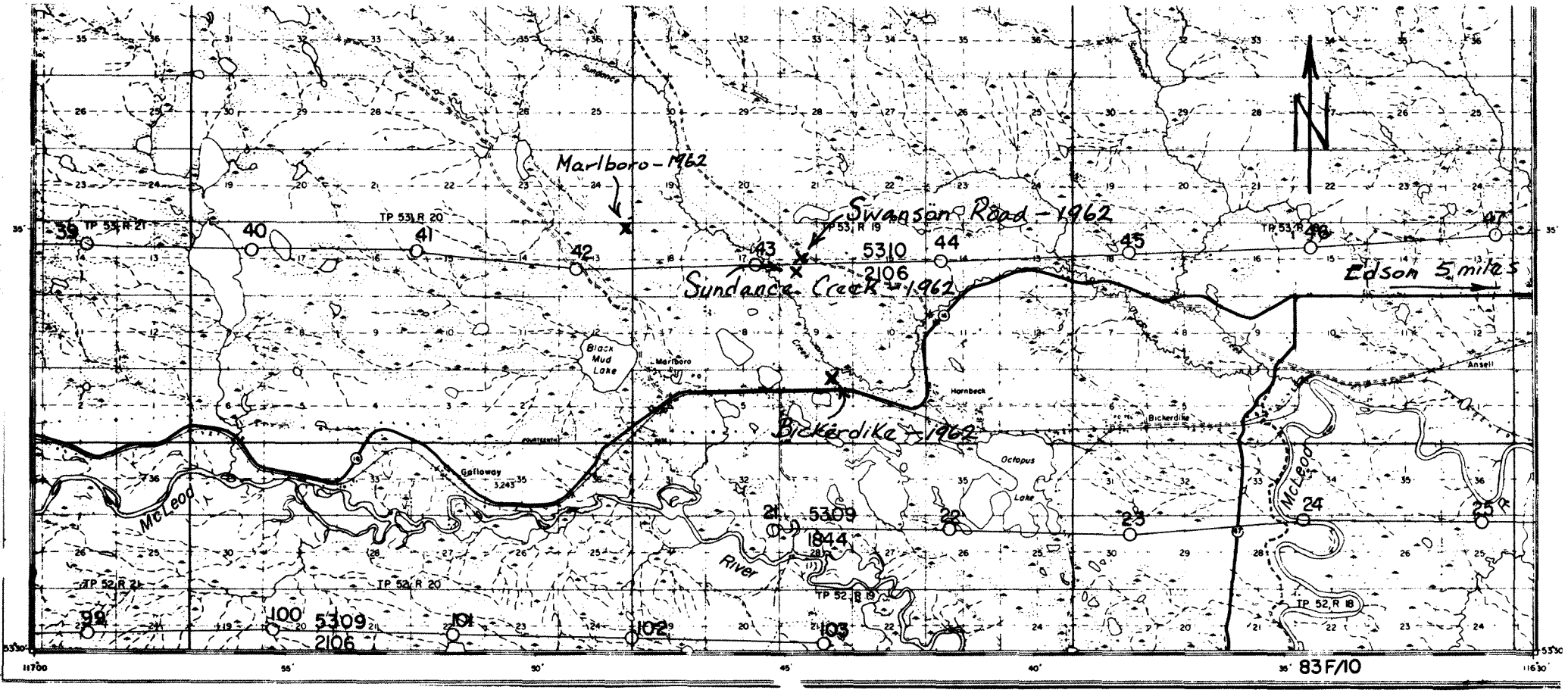


Figure 1. Location of the Edson Plantations.

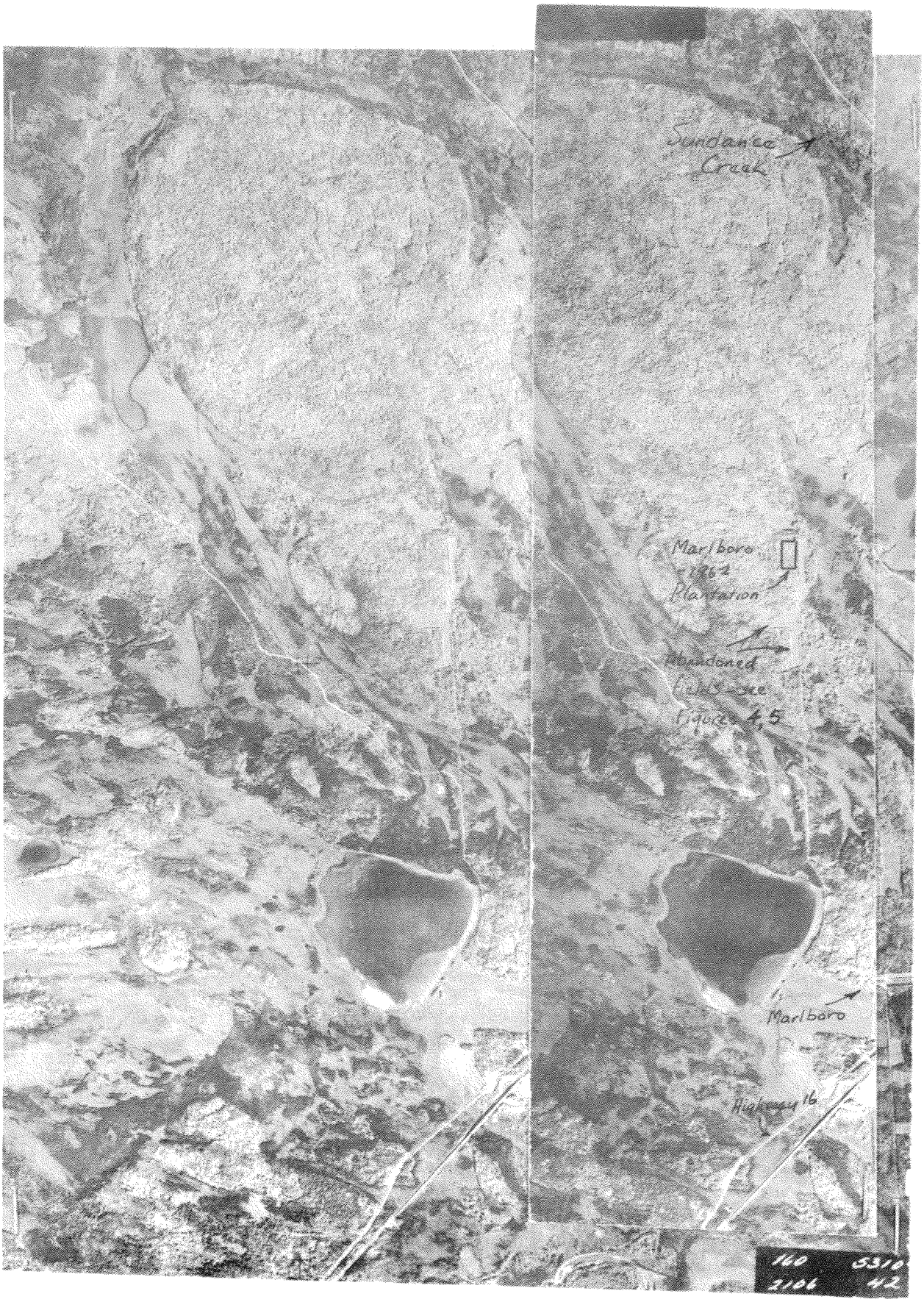


Figure 2. Stereo view of the terrain around the Marlboro Plantation. Washed till and outwash alluvium of variable texture dominate the landscape.

Figure 3. Stereo view of the Swanson Road, Sundance Creek and Bickerdike plantations. Abandoned drainage ways are apparent.

Table 2. Rainfall comparison, Edson and Mayberne, Alberta.

(Muttit, 1961).

Average precipitation (1921-1950) inches.

	Elevation	May	June	July	August
Edson	(3000 ft.)	1.82	3.34	3.53	2.99
Mayberne	(4800 ft.)	2.71	3.66	5.18	3.35

Local frost occurs during the growing season, particularly in large forest openings and in topographic depressions. According to Currie (1954), spring frosts have been recorded at Edson as early as May 30 and as late as July 19 (median date, June 15) and autumn frosts have been recorded as early as July 16 and as late as September 23 (median date, August 21).

History

Settlement of the Edson area began in the early 1900's and was encouraged by the construction of the Canadian National and Grand Trunk Railways. Farm abandonment began soon after World War I and today most of the farms on upland sites have been vacated. During the first half of the twentieth century lumber milling rose to importance in the area and at that time much of the mature white spruce was removed from the mixedwood forest near Edson. This may account for the paucity of white spruce in aspen stands today. In addition, widespread forest fires have served to maintain the aspen forests. Recently the locality was put on a sustained yield management plan by the Alberta Department of Lands and Forests and current operations are confined to small pulpwood cuts for sale at North Western Pulp and Power Limited at Hinton, Alberta and to sawmilling on small timber berths.

The Alberta Department of Lands and Forests has endeavoured to restock abandoned farmlands near Edson to coniferous species by scalping and seeding (Figures 4, 5). Fields were disked two ways, then seeded to white spruce.

In addition to scalping and seeding, the Alberta Department of Lands and Forests has begun to scarify large acreages of land which are under aspen and which have some source of white spruce seed. In aspen stands in which there is no spruce seed source, white spruce is being planted. The plantations which are described in this report are in pure aspen stands in which there is an insufficient white spruce seed source to bring back a heavy white spruce cover.

FIELD METHODS

In September, 1961, the writer and Mr. L.L. Kennedy of the Alberta Department of Lands and Forests visited several potential plantation sites near Edson. In May, 1962, a reconnaissance survey was made of soils and surface materials. Interpretation of aerial photographs showed the location of the main land forms and soil conditions were sampled using a truck-mounted Bull Hydraulic Soil Sampler.

Experimental Design and Layout

Since the objective of the study is to describe the optimum spacing level for each surface material under study, the experimental design was a random block with three spacing treatments replicated three times on each of the four soil types. Each block was a replication with the treatments consisting of 9×9, 12×12, and 15×15 foot spacing assigned randomly. The design is illustrated in Figure 7.

Fig. 4. Abandoned farm, one mile north of Marlboro, Alberta. Treatment: two-way disking and hand seeding to white spruce.

Fig. 5. Abandoned farmland one mile north of Marlboro, Alberta. Treatment: two-way disking and hand seeding to white spruce.

Fig. 6. Planting bar used in the 1962 Edson planting operation.

Using a staff compass and chain nine-acre blocks were laid out on each of four surface materials, namely, on an alluvium with a till (?) cap, a coarse gravelly alluvium, an alluvium with a ponded cap, and an aeolian (?) parent material. All bearings were based on true north. One-acre compartments were then delineated with strings and all block and compartment boundaries were marked with spray paint. Trees outside of the block boundary were painted blue; compartment boundaries (other than the outside boundary) were painted orange facing south and west. Aluminum stakes were placed at compartment corners.

The layout of each of the four plantations required 5 man-days and the planting operation required 50 man-hours per 9-acre plantation. Planting commenced on May 24th and was completed on May 30th. The slit method and the planting bar (Figure 6) were employed with no ground preparation. The best spacing accuracy was maintained by planting in rows across the short sides (2 chains) of the compartments.

The planting stock was 3-0 white spruce of local provenance and was reared at the Oliver nursery near Edmonton. It was transported to the Edson sites in large kraft paper bags with polyethylene liners. The roots were in moist mud. Heavy rains fell during the week prior to planting and the soil remained moist during the planting operation. Warm temperatures (up to 70°F.) and overcast skies persisted during the 7-day planting period.

Each plantation was tied into a section corner or a prominent landmark, using a staff compass and steel tape. An aluminum sign and creosoted post were placed at the southeast corner of each acre compartment. The compartment number, spacing interval, and year are shown on the sign. An identical sign was nailed to a tree near the center of the acre compartment so that it faced the southeast corner post.

Figure 7.

Field layout of the Marlboro White Spruce-Under-Aspen Plantation, Edson Forest District, Alberta.

Project A-83. 1962.

Note: Each cell is one acre in size.

Parent Material I

Replication 1.	b	c	a
" 2.	b	a	c
" 3.	c	a	b

Parent Material II

Replication 1.	a	b	c
" 2.	a	c	b
" 3.	c	b	a

Parent Material III

Replication 1.	b	c	a
" 2.	a	c	b
" 3.	a	b	c

Parent Material IV

Replication 1.	c	a	b
" 2.	a	c	b
" 3.	b	a	c

Spacing levels

a.) 9×9 (6,216 trees) (518 trees/acre)

b.) 12×12 (3,624 trees) (302 trees/acre)

c.) 15×15 (2,326 trees) (194 trees/acre)

Total number of trees required 12,168

Total number of acres planted 36

RECORDS

Growth data were taken as follows:

1. Aspen dominants. Total height and d.b.h. of 10 trees at each plantation.
2. Basal area per acre, using a Spiegel relascope (10 factor). Two samples were taken in each acre compartment; the first at the one-chain mark along the center line and the second at the three-chain mark.

Soil-site data were recorded as follows:

1. A site description was prepared using form F 862 (5-58).
2. Ground vegetation species were listed under shrub, herb-grass, and moss-lichen headings. Estimates of cover were made.
3. Particle size analyses were performed on samples from the main soil profile horizons at each site.

THE PLANTATIONS

1. Marlboro - 1962 (Figures 8, 9 and 11)

The plantation is situated approximately two miles north of the Marlboro settlement on the west side of a north-south seismic line (Fig. 11). The soil is a deep stratified coarse sand and coarse gravel with a thin (24 inches) till cap of sand clay loam; the topography is gently rolling.

The forest cover is pure 70-year-old aspen with scattered white spruce (Figure 8). Scattered pockets of young aspen were included in the nine-acre block and they were planted up together with the older growth (Figure 9). The average annual height growth of dominant trees is slightly over one foot.

Fig. 8. 70-year-old aspen cover with scattered white spruce on the Marlboro plantation site. May, 1962.

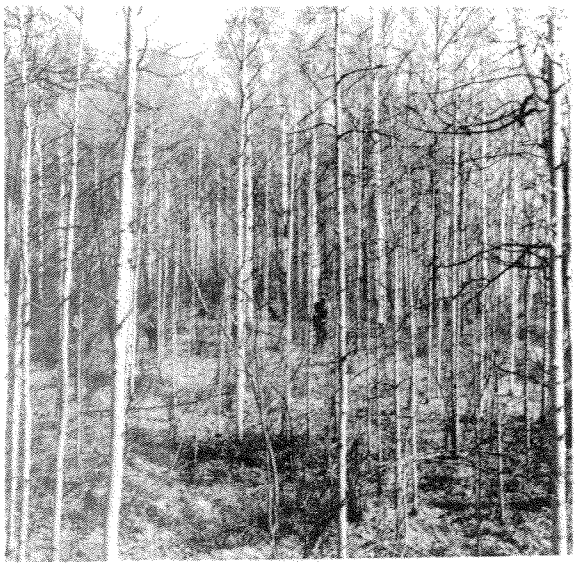


Fig. 9. Young-growth aspen included in the Marlboro plantation. May, 1962.

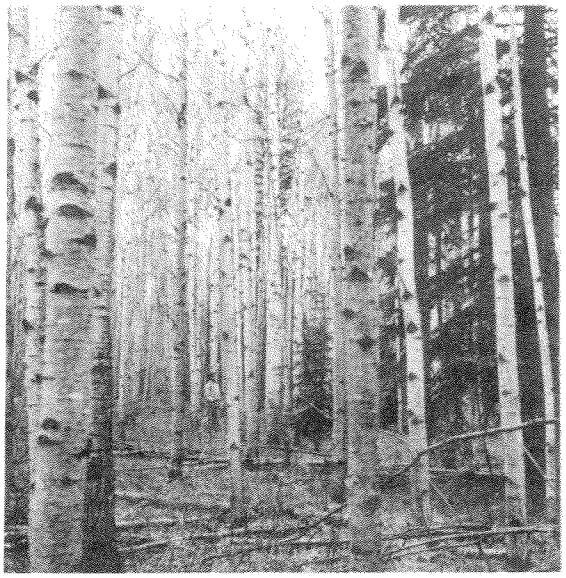


Fig. 10. 70-year-old aspen with scattered spruce. Sundance Creek plantation. May, 1962.

Basal area levels in separate compartments range from 125 to 300 square feet per acre. The average for the plantation is 192 square feet. A summary of growth data for the aspen stand is given in Table 3.

Table 3. Growth Data by Plantation Site.

Plantation	Aspen			White Spruce	
	Av. Age	Av. ht.	Av. b.a.	Av. Age	Av. ht.
	(yrs.)	(ft.)	(sq.ft.)	(yrs.)	(ft.)
Marlboro	64	66	192		
Sundance Creek	68	64	171	51	66
Swanson Road	73	75	230		
Bickerdike	59	69	109		

In post glacial times a strong flow of melt water passed through the Marlboro locality. The plantation site is at the southern end of a large elongated alluvial plain which is bounded by glacial drainage ways (Figures 2 and 3), one of which contains the misfit stream, Sundance Creek.

The parent material is a stratified sand and gravel alluvium with a till cap (?). Internal drainage is rapid and soil moisture is low, and for these reasons, summer drought periods are probably frequent.

The ground vegetation is made up mainly of Salix sp., Sheperdia canadensis and Rosa acicularis in the shrub layer and grass species in the herb layer. Competition for tree seedlings is moderate and is rated as a 3 on a scale of 1 to 5.

Department of Northern Affairs and National Resources — F 862 (5-58)

FORESTRY BRANCH

15

Fig. 11 SITE DESCRIPTION Marlboro

Site Features					
L.C.	M.R.	P.			
4	2	2			

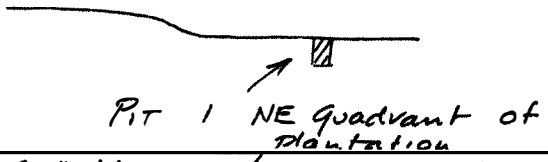
Plot No. 1 | Location Marlboro - 1962. Twp. 53, Rge. 20, W 5th

PHYSIOGRAPHY

Physiographic Site: Till/alluvium

Regional Description: Section 13, NE ¼, NE 40

Relief Sketch



PIT 1 NE Quadrant of Plantation

Local Relief

Slope 2 - 3 %

Aspect Northeast

Elevation & Topog. Pos. 3280

Material - Fobric Parent material: 24" till smear/coarse sand to fine gravel alluvium. Tree roots to 72". C_{Ca} shows white with $CaCO_3$

- Petrography

Bedrock - Depth

- Mineralogy

- Relief

Soil Moisture Quality

Water Table Location

VEGETATION

Cover Type: B3A.

Minor Vegetation Type: Salix - Shepardia; Rosa - Grass

SOIL PROFILE

Sketch	Hor.	L.L.	pH	CO_3	Colour	Texture	Stones	Structure	Horizon * Modifications
0	L				mull humus cover				
2"	F				black semi-decomposed, - matted				
	H				"	matted			well rooted
0-4"	A_E				reddish-brown	Si. l. - l.	-	platy	well rooted
6									
4-10"	Bp				buff brown	si. l. - l.	< 10%	platy	rooted
12									
10-20"	B_C				buff brown	Sa. c. l.	10% with coal chips	- finely blocky	rooted
18									
24		~~~	~~~	~~~	unconformity				
20-36"	C				grey	medium sand with loamy sand lenses.	10% coal and grit		rooted
36									
36-72" ↓	C_{Ca}			X	grey	coarse sand and fine gravel	80%	granular	well rooted
48						→ ¼" ϕ.			

REMARKS

* Compactness, Concretions, Consistency, Rooting, etc.

Date 7/19/62

Per P. Duffy.

Stand Structure, History and Succession

Fig. 11. (Cont'd) Minor Vegetation Marlboro 1962

Class Shrub			Class Herb - grass			Class Moss		
Species	%	Soc.	Species	%	Soc.	Species	%	Soc.
Salix sp.	20		Epilobium			Plagiozium		
Shepardia			angustifolium	50		schreberi	10	
Canadensis	10		Cornus					
Rosa			Canadensis	20				
aciculavis	10		Fragavia					
Viburnum			vesca	<10				
edule	<10		Lathyrus					
Ledum			ochroleucus	10				
groenlandicum	<10		Grass	20				
			Vaccinium					
			ovalifolium	20				
			Arctostaphylos					
			uva-ursi	20				
			Mitella nuda	<10				
			Linnea borealis	<10				
			Mianthemum					
			Canadensis	<10				
			Viola sp.	<10				
			Aster	10				
			"Indian Paintbrush"	<10				
			Petasites					
			palmatus	<10				

Aspen Dominants		
Height's	Diameter	Age
63	10.6	59
59	10.4	57
63	10.8	69
66	12.1	67
69	12.3	77
71	9.4	72
64	11.4	68
61	11.1	59
66	9.8	60
70	10.8	58
70	11.2	63
71	9.7	60
68	9.8	64
Means 66.2	10.7	64.1

Soil Samples for available moisture determinations

Ae, Bf, C / } 1 Sample @ 7" depth.

Bt_1 1 Sample

Bt_2 1 Sample

C. 1 Sample

Plot Site

Dominant Stratum

Class	Prim.	Sec.
Tall Shrub (+3')		
Med. Shrub (6"-3')		
Tall Herb & Grass (+1')		
Med. Herb & Grass (6"-1')		
Low Herb & Shrub (-6")		
Moss or Lichen		
Reproduction		

Species Reproduction	%	Soc.

Basal area - relascope (10 factor)

Compartment		
1	140	150
2	80	170
3	280	260
4	180	110
5	180	220
6	240	360
7	80	200
8	210	270
9	210	110
Σ	383	
$\bar{x}$	192 sq ft.	

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17

Fig. 11 (Cont'd) SITE DESCRIPTION Marlboro

Site Features					
L.C.	M.R.	P.			
4	1	2			

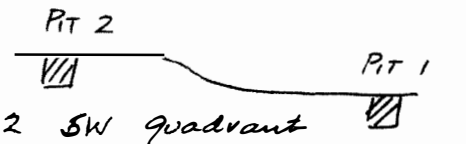
Plot No. 2 | Location Marlboro - 1962 T. 53 R 20 W 5th

PHYSIOGRAPHY

Regional Description

Section 13, NE ¼, NE 40

Relief Sketch



Pit 2 SW quadrant of plantation

Local Relief

Slope 2-3%

Aspect Northeast

Elevation & Topog. Pos. 3290

Material - Fobric Alluvium: Till smear found at Pit 1 does not include this upland for the loamy soil is only 10-12" deep here. Could be an old alluvium capped by a younger (sandy) alluvium which is capped by till smear - local washed and eroded

- Petrography

Bedrock - Depth

- Mineralogy
- Relief

Soil Moisture Quality

Water Table Location

Physiographic Site: Fine alluvium / coarse older (?) alluvium

VEGETATION

Cover Type: B 3A

Minor Vegetation Type: Salix - Shepardia; Rosa - Grass

SOIL PROFILE

Sketch	Hor.	L.L.	pH	CO_3	Colour	Texture	Stones	Structure	Horizon * Modifications
0 — 2"	L				Broad leaved litter				
1"	F								
1"	H				Black matted mull				well rooted
0-2"	A_e				Grey reddish brown	Si. l. - l.	< 10	platy	well rooted
6 — 2-6"	B_f	discontinuous			Yellow brown	Si. l. - l.	< 10	platy	well rooted
6-10"	C/				buff brown	si. l. - l.	< 10	platy	well rooted
12 — 10-14"	B_t				dark reddish brown	Sa. c. l.	< 10	finely nutty	rooted
14-28"	C_1				grey brown	medium sand -		granular	well rooted
24 — 28-34"	C_2				grey brown	Sa. c. l.	80% with coal chips		rooted
34-48"	C_3				grey brown	Coarse sand and very	fine gravel		rooted
48 — 48"+	C_{ca}			X	grey brown	coarse sand and very	fine gravel		few roots

REMARKS

Vegetation and tree heights omitted.

Site is capable of a late summer drought. Water percolates deep in the profile. No apparent ground water table even to 72"

* Compactness, Concretions, Consistency, Rooting, etc.

Date 7/19/62
Per P. Duffy

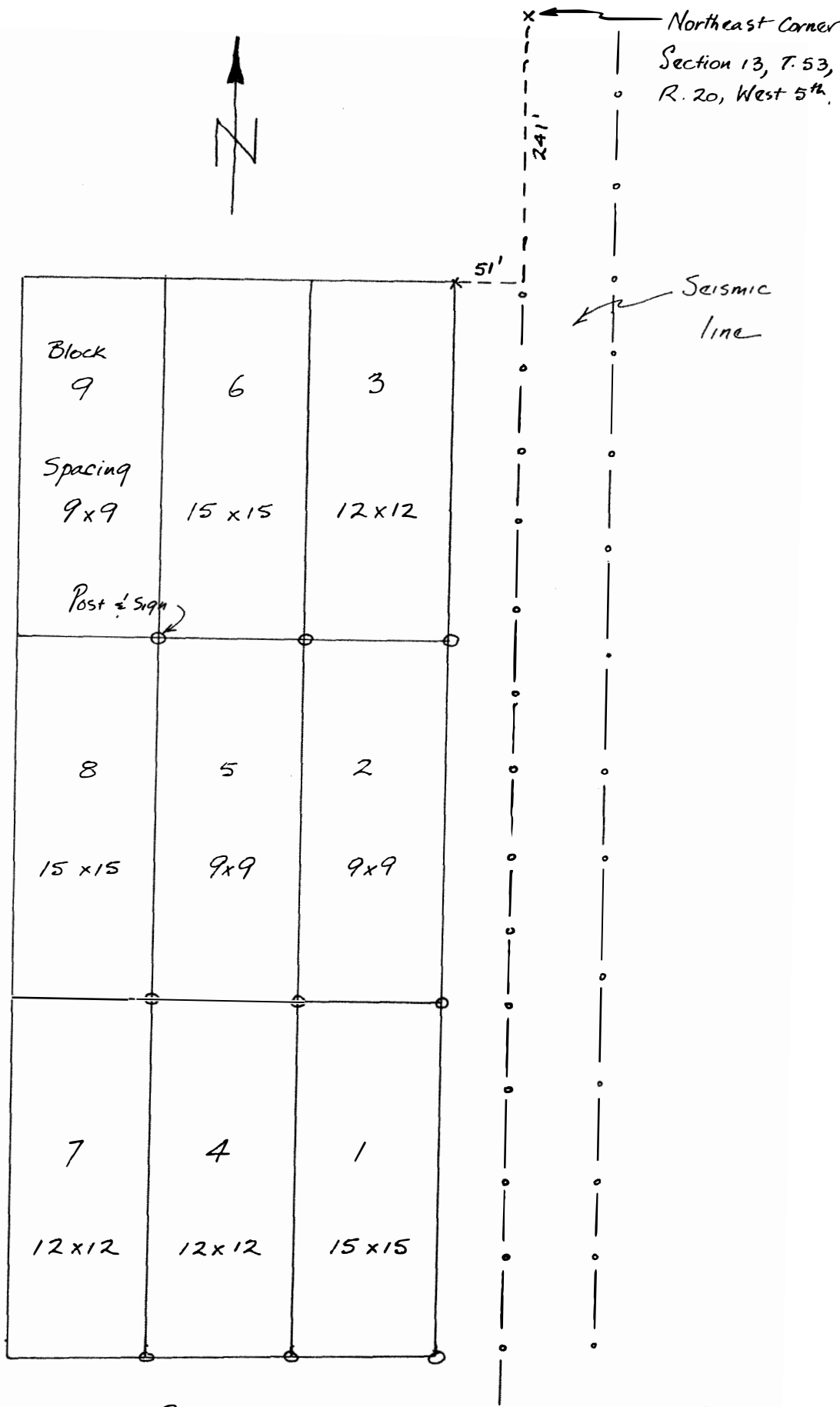


Figure 12. Marlboro – 1962 Plantation, Edson Forest Division, Alberta

Scale: ——— = 2 chains

2. Sundance Creek - 1962 (Figures 13 and 14)

The site is on the north terrace of the Sundance Creek Valley about two miles northwest of Highway 16. The soil is shallow, up to 20 inches of gravelly loam overlying a deep deposit of coarse sand and gravel. Such soils are extensive in the vicinity of Sundance Creek.

The forest cover is comprised of pure 70-year-old aspen with scattered white spruce (Figure 11). The height growth of aspen is less than one foot per year and the site is less productive in terms of aspen height growth than the Marlboro - 1962 site. The Marlboro site has a sandy clay loam cap which has a more favourable soil moisture storage capacity than the coarse sand and gravel at the Sundance Creek site. All aspen dominants which were cored for age showed substantial decay.

Average height growth for white spruce is over one foot per year. Total basal area for the stand was 171 square feet per acre, somewhat less than at the Marlboro site (Table 3).

Vegetation competition is light (2) because of the droughty soil profile.

3. Swanson Road - 1962 (Figures 15 and 16)

The plantation is on the left side of the Swanson road about 2 miles northwest of the Highway 16 turnoff. The surface material may be an eroded till sheet overlying an older alluvial plain. The soil is a stony, fresh, loam to clay loam.

The average dominant height in the 70-year-old aspen is 75 feet and the average basal area is 230 square feet per acre; the best of the four sites involved in this study.

Department of Northern Affairs and National Resources
FORESTRY BRANCH

F 862 (5-58)

20

Figure 13. SITE DESCRIPTION

Site Features					
L.C.	M.R.	P.			
4	1	1			

Plot No. 3

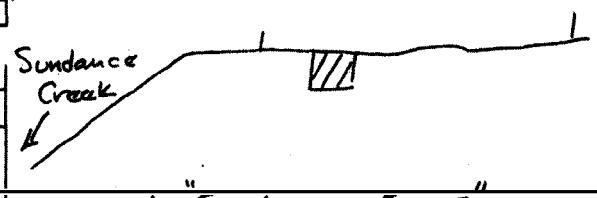
Location Sundance Creek – 1962. T. 53, R. 19, W5th Section 16, SW¼, NW and NE 40's.

PHYSIOGRAPHY

Regional Description

Section 16, SW¼, NW and NE 40's.

Relief Sketch



Local Relief

Slope 0–1%

Aspect South

Elevation & Topog. Pos. 3350'

Material - Fabric terrace of ancestral "Sundance River".

- Petrography

Bedrock - Depth

- Mineralogy
- Relief

Soil Moisture Quality

Water Table Location

Physiographic Site

Gravelly alluvium – terrace

VEGETATION

Cover Type

B3A

Minor Vegetation Type

Shepardia – Rosa
Paintbrush – Lathyrus
Grass

SOIL PROFILE

Sketch	Hor.	L.L.	pH	CO_3	Colour	Texture	Stones	Structure	Horizon * Modifications
0	L				broad leaved litter				
3"	F								
	H				dark brown matted –	fibrous mull			well rooted
6									
0–4"	Ae				gray reddish brown	si. l. – loam	10% gravel	platy	well rooted
4–9"	Bf				buff brown	si. l – loam	20% gravel	weakly platy	well rooted
12 9–19"	Bt				reddish brown	Sa. c. l.	40% gravel	finely nutty	well rooted
18									
19–25"	C				gray brown	l. sand and gravel	70% gravel	granular	well rooted
24									
25" +	Cca				gray	coarse sand and gravel	90% gravel	granular	rooted
36									
48									

REMARKS

* Compactness, Concretions, Consistency, Rooting, etc.

Date July 18, 1962.
Per P. Duffy

Stand Structure, History and Succession

Figure 13 (cont'd) Minor Vegetation

Class Shrub		
Species	%	Soc.
Shepardia Canadensis	20	
Viburnum edule	<10	
Rosa acicularis	20	
Salix sp.	<10	

Class Herb		
Species	%	Soc.
Lathyrus ochroleucus	40	
Arctostaphylos uva-ursi	20	
Linnea borealis	20	
Viola sp.	10	
Maianthemum Canadense	<10	
Cornus Canadensis	10	
Indian paintbrush	10	
Calamagrostis sp.	10	
Aster	<10	
Aralia nudicaulis	<10	
Gallium boreale		
Vaccinium ovalifolium	30	
Mitella nuda	<10	

Class Moss - Lichen		
Species	%	Soc.
Plaurozium schrabari	<10	
Hylocomium splendens	<10	
Peltigera aphthosa	10	

Plot | Site

Dominant Stratum

Class	Prim.	Sec.
Tall Shrub (+3)		
Med. Shrub (6"-3')		
Tall Herb & Grass (+1')		
Med. Herb & Grass (6"-1')		
Low Herb & Shrub (-6")		
Moss or Lichen		
Reproduction		

Aspen dominants

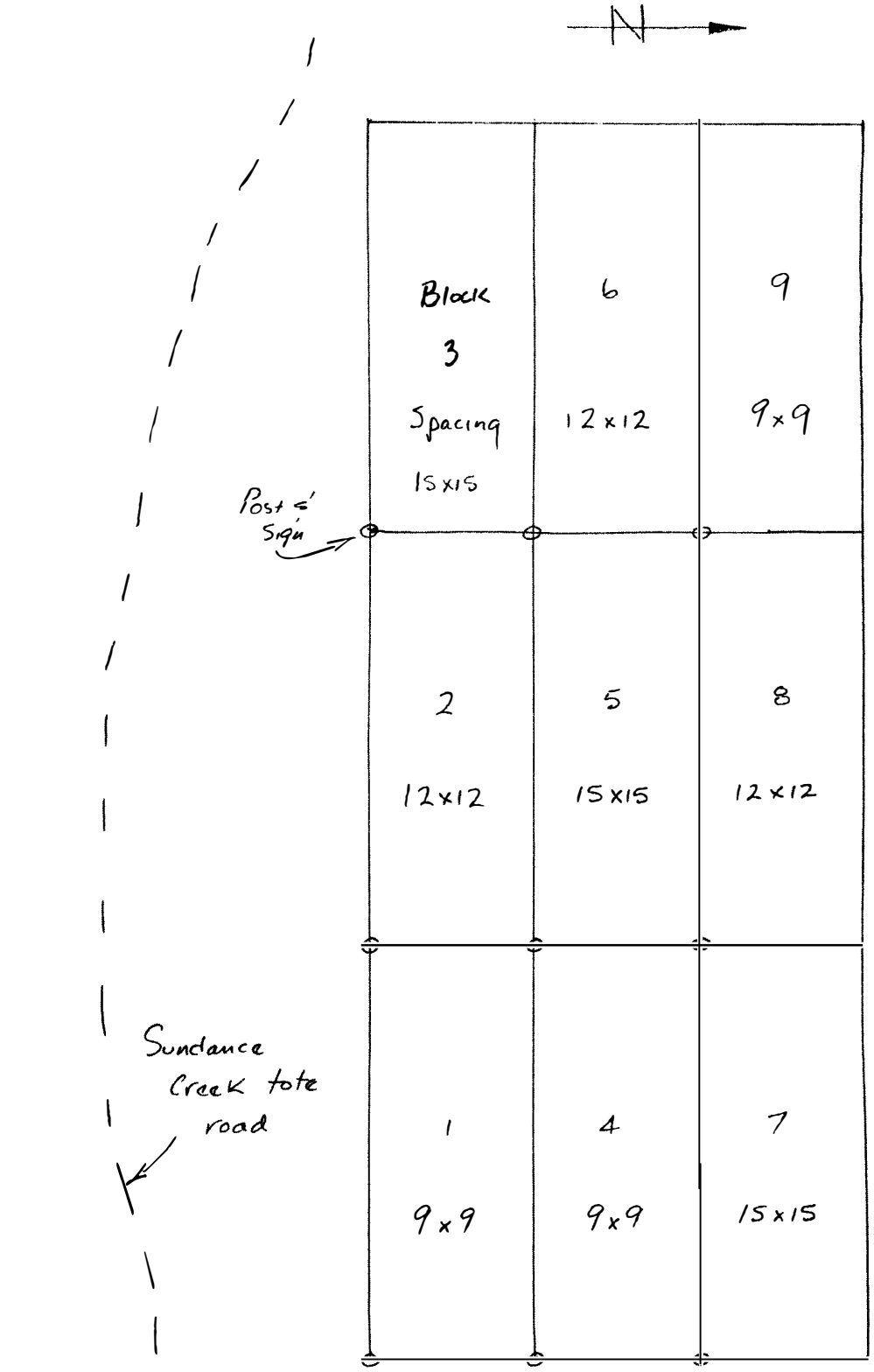
	Height	ϕ	Age
1	66	10.6	63
2	63	8.6	63
3	67	9.1	66
4	65	8.5	59
5	69	11.2	71
6	58	10.0	73
7	63	10.4	68
8	61	10.9	74
9	61	8.5	64
10	65	9.5	77
	$\bar{x}$ 63.8	9.73	67.8

White spruce dominants

	Height	ϕ	Age
1	67	15.1	55
2	70	15.0	57
3	61	12.0	54
4	66	10.8	52
5	71	11.7	47
6	58	8.4	43
7	66	12.0	53
8	65	11.9	49
9	65	11.8	45
10	75	11.6	58
	$\bar{x}$ 66.4	12.03	51.3

Note: decay in all aspen

Species Reproduction	%	Soc.
Basal area - relascope (10 factor)		
Compartment		
1	250	200
2	140	220
3	250	150
4	100	170
5	150	150
6	250	240
7	110	100
8	170	110
9	200	110
Σ	3070	
$\bar{x}$	171	



Tie to Southeast corner of Block 1.

Station 1 Intersection of lodgepole pine cover type and Sundance Creek tote road 0+00

2. 54° Azimuth 1+00
3. 86° " 2+00
4. 60° " 3+00
5. 60° " 4+00
6. 60° " 5+00
7. 60° " 5+14.

to Southeast corner Block 1.

Scale: ——— = 2 chains

Figure 14. Sundance Creek – 1962 Plantation, Edson Forest Division, Alberta.

The stony soil was a hindrance to planting; heavy cobbles in the surface horizons caused a substantial portion of the planted stock to be moved off of a strict spacing layout.

Vegetation competition is heavy (4) with Viburnum edule, and Vaccinium vitis-idea in the shrub layer and Aralia nudicaulis and grasses in the herb layer.

4. Bickerdike - 1962 (Figures 17 and 18)

The Bickerdike plantation is situated 200 yards north of Highway 16 on the southwest side of the Sundance Creek valley. The surface material is a deep, sandy, aeolian (?) deposit with rolling topography. The substantial clay fraction in the stoneless profile is evidence that the aeolian deposit may have been submerged by melt waters during post-glacial times.

The soil is a deep sandy loam with sandy clay loam in the B_t horizon and streaks of lime at the 45-inch level. This soil is common in the Bickerdike - Marlboro area.

The average dominant height in the 60-year-old aspen is 69 feet; the average basal area is 109 square feet per acre. The ground vegetation is comprised of Rosa acicularis, Cornus canadensis and Lathyrus ochroleucus and offers moderate competition (3) to planted stock.

FUTURE WORK

In the fall of 1962, a mortality survey was conducted to appraise losses over the first growing season. A similar survey will be conducted during the summer of 1963 to obtain an estimate of first year mortality. Results of these surveys will be the subject of a brief report. Annual surveys of mortality

Department of Northern Affairs and National Resources
FORESTRY BRANCH

F862 (5-58)

24

Figure 15. SITE DESCRIPTION

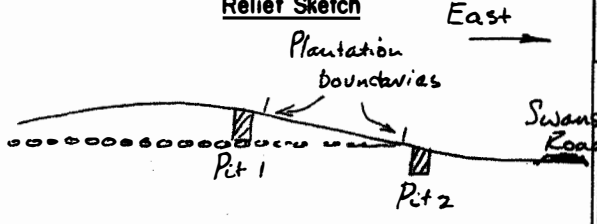
Site Features					
L.C.	M.R.	P.			
3	2	2			

Plot No. 4 (Pit 1) Location Swanson Road – 1962. T. 53, R. 19, W5

PHYSIOGRAPHY

Regional Description
Section 16, NW¼, SE40 SW¼, NW40

Relief Sketch



Local Relief
Slope 5%
Aspect NE
Elevation & Topog. Pos. 3400' 20% from slope top.

Material - Fabric – 36" stony clay loam till overlying
- Petrography alluvial gravel with lime at the
Bedrock - Depth unconformity.
- Mineralogy
- Relief Vegetation competition varies with overstory shading; planting stock may suffer adversely in the openings because of heavy shrub and grass.

Soil Moisture Quality
Water Table Location

Physiographic Site
Till / Alluvium

VEGETATION

Cover Type
B3A

Minor Vegetation Type
Salix – Shepardia
Viburnum – Avalia

SOIL PROFILE

Sketch	Hor.	L.L.	pH	CO_3	Colour	Texture	Stones	Structure	Horizon * Modifications
0	L				broad leaved litter				
3-4"	F								
	H				dark brown	matted mull			heavily rooted
6	0-6" Ae	(Sampled)			light reddish brown	loam	10% up to ½"ϕ	– granular and well aggregated –	well rooted
6-14"	B_f	(Sampled)			dark yellow brown	clay loam – 50% up to 10" ϕ		finely nutty structure	to granular – good structure – well rooted
12									
18									
14-36"	C				grey brown	gritty loam	70% gravel and stones up to 10"ϕ	– granular Coal chips	– well rooted
24									
36	36"+ C_{ca}			X	grey brown	gritty loam	80% gravel	granular	few roots
48									
	55"	lime deposited on rocks							

REMARKS Many stones to 12"ϕ in profile in very stony till, i.e. top 14-15". The stoniness was some hindrance to planting according to the AFS planting crew.

* Compactness, Concretions, Consistency, Rooting, etc.

Date July 18, 1962
Per P. Duffy

Stand Structure, History and Succession

Figure 15 (cont'd) Minor Vegetation

Class Shrub			Class Herb			Class Moss		
Species	%	Soc.	Species	%	Soc.	Species	%	Soc.
Shepardia canadensis	<10		Epilobium angustifolium	10		Pleurozium schreberi	<10	
Viburnum edule	25		"Peavine"	<10				
Salix sp.	10		Lathyrus ochroleucus	25				
Rosa acicularis	25		Aralia nudicaulis	25				
Alnus crispa	10		Cornus Canadensis	20				
Ledum groenlandicum	<10		Fragaria vesca	10				
			Mitella nuda	<10				
			Linnaea borealis	10				
			Grass – heavy in openings	25				
			Indian paintbrush	<10				
			Maianthemum canadense	<10				
			Arctostaphylos uva-ursi in openings	<10				
			Viola sp.	10				
			Gallium boreale	<10				
			Vaccinium ovalifolium	<10				

Aspen dominants

	Height	Ø	Age
1	71	10.4	72
2	70	11.7	72
3	74	10.4	71
4	73	10.3	76
5	76	12.9	73
6	79	11.4	69
7	78	12.1	72
8	71	10.6	78
9	78	12.7	77
10	76	12.4	69
$\bar{x}$	74.6	11.5	72.9

Plot | Site

Dominant Stratum

Class	Prim.	Sec.
Tall Shrub (+3')		
Med. Shrub (6"-3')		
Tall Herb & Grass (+1')		
Med. Herb & Grass (6"-1')		
Low Herb & Shrub (-6")		
Moss or Lichen		
Reproduction		

Species Reproduction	%	Soc.

Basal area – relascope (10 factor)

Compartment		
1	240	240
2	270	250
3	300	260
4	280	150
5	320	260
6	350	280
7	90	40
8	230	160
9	270	150
Σ	4140	
$\bar{x}$	230	

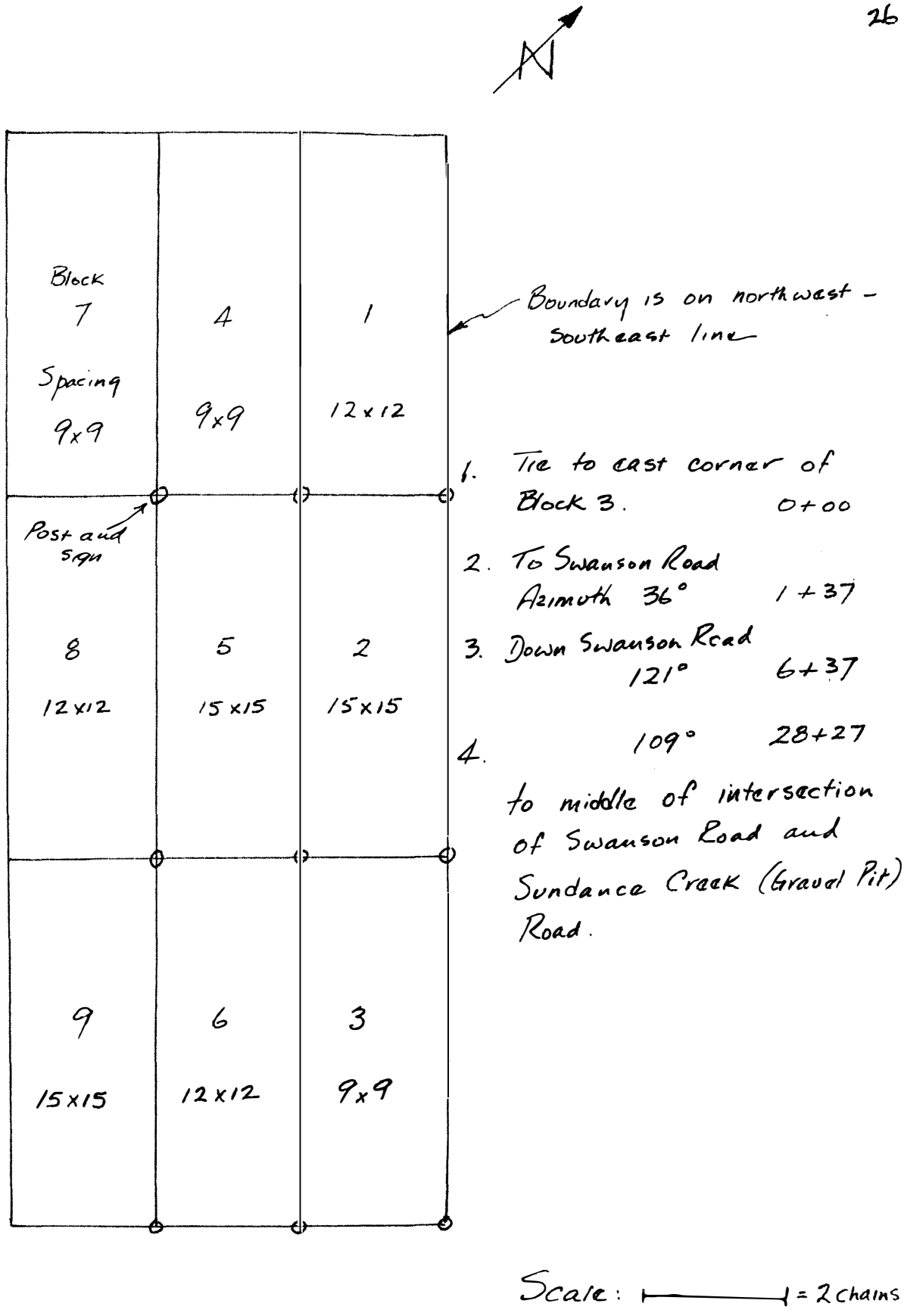


Figure 16. Swanson Road – 1962 Plantation, Edson Forest Division, Alberta.

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F 862 (5-58)

Figure 17 SITE DESCRIPTION

Site Features					
L.C.	M.R.	P			
5	1	2			

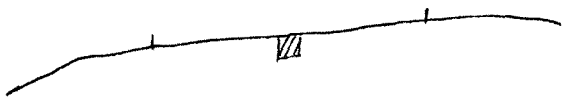
Plot No. 5 Location Bickerdike - 1962 T. 53, R. 19, W5R

PHYSIOGRAPHY

Physiographic Site: Aeolian - submerged (?)

Regional Description: Section 4, NE¼, NW¼ NE 40's

Relief Sketch: North →



Local Relief
Slope 4-5%
Aspect South
Elevation & Topog. Pos. 3300 Hilltop.

Material - Fabric
- Petrography

Bedrock - Depth
- Mineralogy
- Relief

Soil Moisture Quality
Water Table Location

VEGETATION

Cover Type: B 3A

Minor Vegetation Type: Salix - Rosa
Petasites - Cornus

SOIL PROFILE

Sketch	Hor.	L.L.	pH	CO_3	Colour	Texture	Stones	Structure	Horizon * Modifications
0	L				broad leaved litter				
3-4"	F								
	H				dark matted mull humus			well rooted	
6	0-3" Ae	(Sampled)			brown	sa. l.			well rooted
	3-10" Bf	(Sampled)			light brown	l. sand		granular	well rooted
12	10-15" Bt	(Sampled)			light brown	sa. c. l.		finely nutty	well rooted
18	15-45" C	(Sampled)			gray brown	s. l. with sa. c. l. lenses 4-6" deep		granular	rooted
24									
36	45"+ Cca				gray	fine sand	compacted		lime streaks in old root channels
48	60"								

REMARKS Particle size analysis, Bulk density, Available moisture } to be run on soil samples

* Compactness, Concretions, Consistency, Rooting, etc.

Date July 18, 1962.
Per P. Dotty

Stand Structure, History and Succession

Figure 17 (cont'd) Minor Vegetation

Class Shrub		
Species	%	Soc.
Rosa acicularis	25	
Shepardia Canadensis	<10	
Salix sp.	<10	
Alnus crispa	<10	

Class Herb		
Species	%	Soc.
Cornus Canadensis	40	
Petasites palmatos	10	
Fragaria vesca	<10	
Mitella nuda	<10	
Epilobium angustifolium	10	
Gallium boreale	<10	
Lathyrus ochroleucus	20	
Grass		
Indian paintbrush	<10	
Aster	<10	
Linnea borealis	<10	
"Peavine"	<10	
Streptopus sp.	<10	

Class Moss-Lichen		
Species	%	Soc.
Pleurozium schrabari	<10	

Aspen dominants

	Height	ϕ	Age
1	70	8.8	54
2	66	8.7	60
3	66	8.6	57
4	72	9.5	64
5	68	8.9	55
6	74	10.4	62
7	74	9.3	62
8	73	9.6	61
9	64	7.9	55
10	67	9.7	56
x̄	69.4	9.14	58.6

decay in core

Plot | Site

Dominant Stratum

Class	Prim.	Sec.
Tall Shrub (+3')		
Med. Shrub (6"-3')		
Tall Herb & Grass (+1')		
Med. Herb & Grass (6"-1')		
Low Herb & Shrub (-6")		
Moss or Lichen		
Reproduction		

Species Reproduction	%	Soc.

Basal area - relascope (10 factor)

Compartment

1	50	70
2	80	140
3	130	110
4	20	130
5	120	80
6	30	120
7	190	100
8	50	70
9	250	230
Σ	1970	
x̄	109	

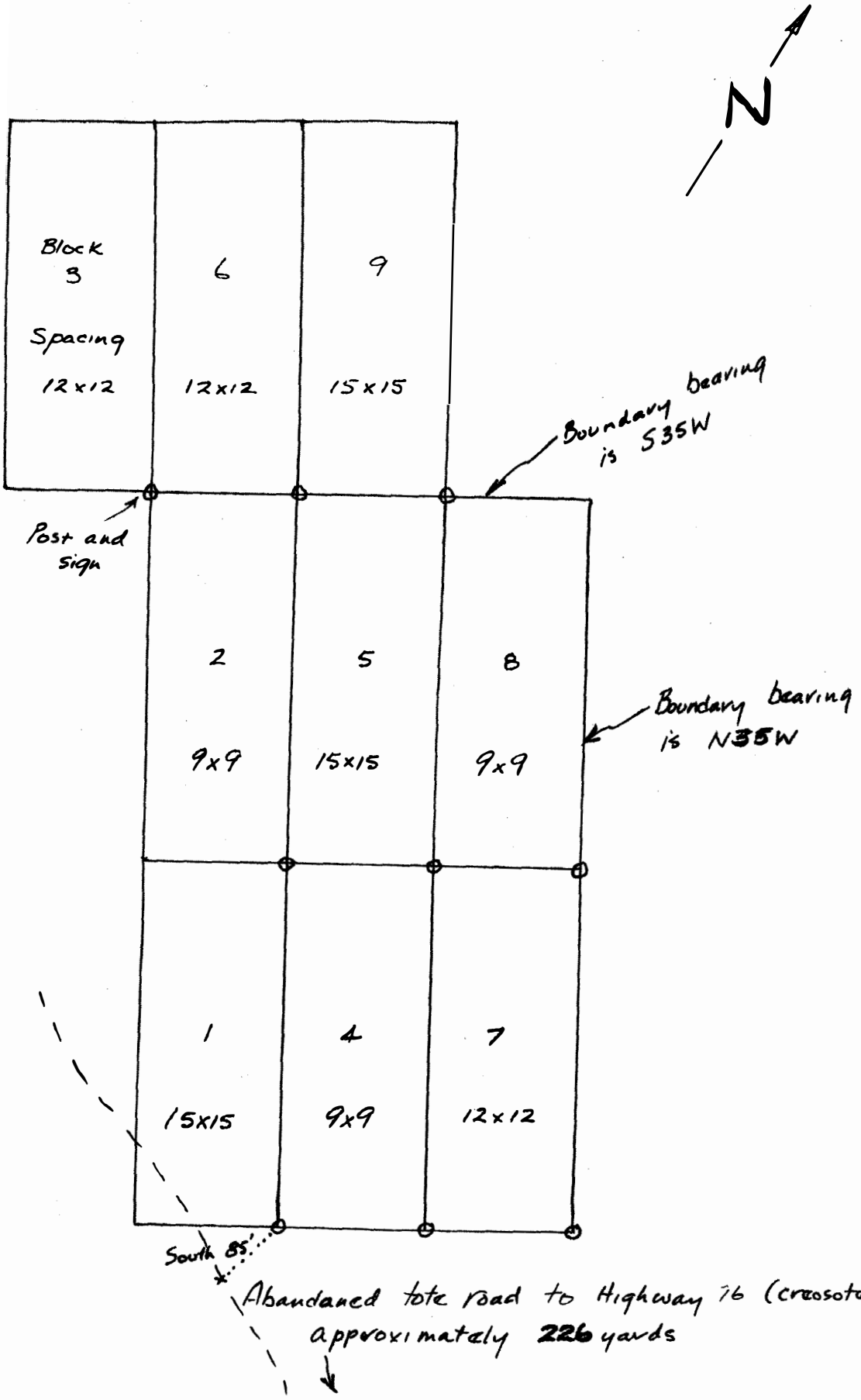


Figure 18.

Bickerdike – 1962 Plantation, Edson Forest Division, Alberta.

Scale: ⊢——⊣ = 2 chains

will be carried out until 1967 when the plantations will be fill-planted to full stocking. In 1967 and at prescribed intervals, surveys of height growth of the planted stock will be made and progress reports will be written. In 1972 a decision will be made as to when further surveys of height and volume growth should be made.

Arrangements have been made to have Alberta Forest Service staff plant two rows of white spruce at 12×12 spacing around each plantation. The "surrounds" at the Sundance Creek, Swanson Road and Bickerdike plantations will be planted in 1963. The Marlboro surround was installed in May, 1962.

ANALYSIS OF DATA

The data from periodic remeasurement of mortality, young growth, and volume growth will be compiled by sites, by spacing levels, and by blocks (replications). These separate effects will be analyzed using the following analysis of variance:

Source of Variation	Degrees of Freedom
Parent material (4)	3
Spacing levels (3)	2
PM × SL	6
Replication (blocks)	2
Error	22
Total	35

Mean values of mortality and growth will be computed for those effects which are shown to be significant and meaningful. It is expected that mortality will vary with parent material and that young growth and periodic yields will vary with parent material and spacing level. A significant parent material-spacing level interaction is also expected.

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