

CONVERTING ASPEN STANDS TO WHITE SPRUCE
BY PLANTING AND SEEDING
ON SCALPED STRIPS, MANITOBA

Project MS-226

by

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INTRODUCTION

In 1962 a project was begun to test the hypothesis that aspen stands can be converted to mixed coniferous-deciduous stands by planting or seeding white spruce (Picea glauca (Moench) Voss) on scalped strips spaced at approximately regular intervals.

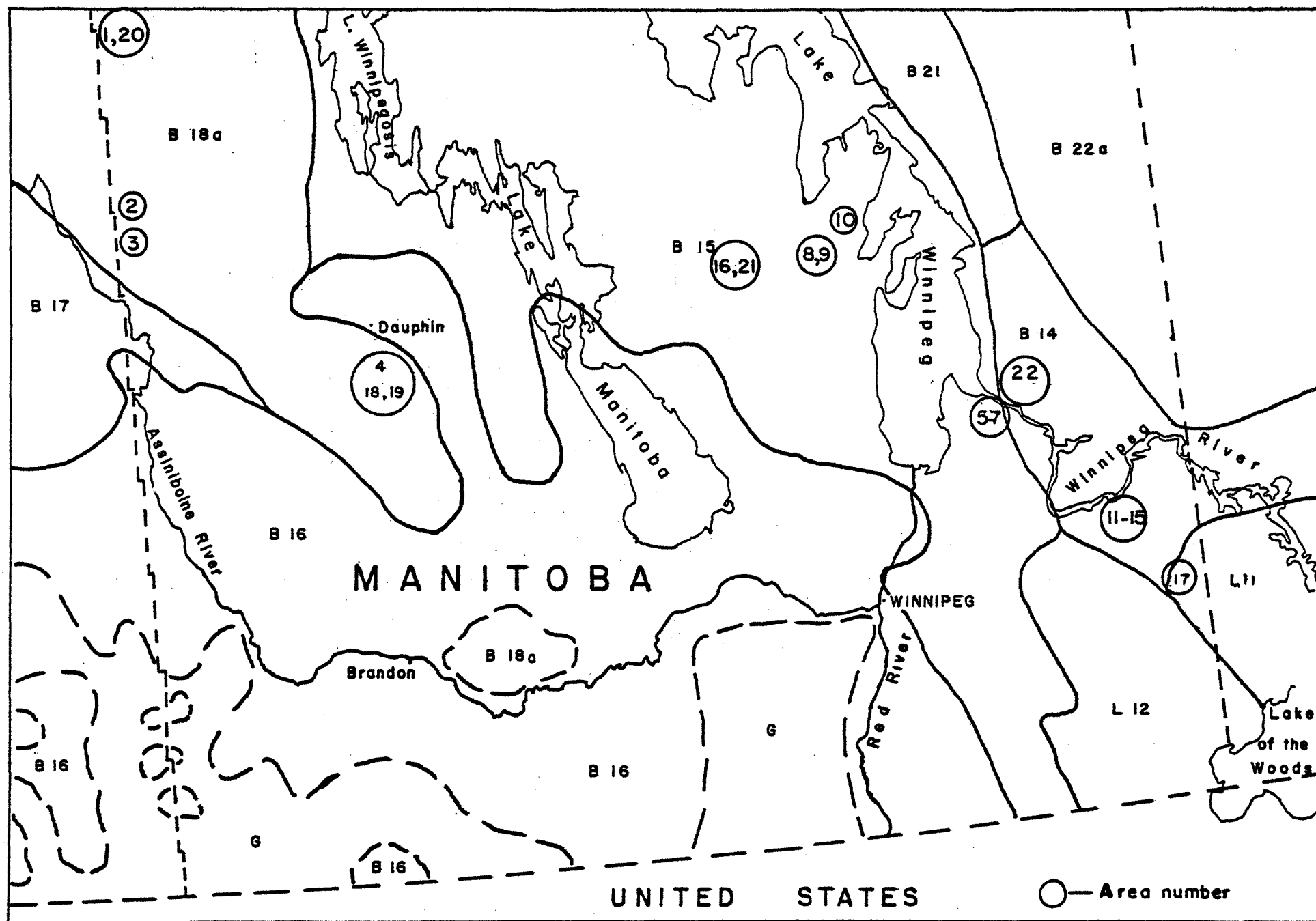
To date twenty-two areas have been established in aspen stands located throughout Manitoba (Figure 1). These stands vary in size from 3 - 160 acres, in age from 15 to 100 years, and are located on very dry to very moist (moisture regimes 0 to 6) fine gravel, sandy loam, clay and loam, and clay textured soils. Scalped strips were prepared in each stand using a bulldozer equipped with a straight blade. Planting and seeding of white spruce on the strips was carried out either in the autumn or in the spring.

The success or failure of the two treatments on all areas will be assessed using temporary plots five years following their establishment. Early survival and growth of seeded and planted seedlings is being determined on selected sites under specific stand conditions by means of a small number of observation plots². Results from these plots, along with general descriptions of the areas treated up to 1963 are contained in the establishment report prepared by Waldron (1964a). Descriptions of areas established in 1964 are contained in a progress report by Waldron (1965).

A detailed ecological study, Project MS-227, "Early survival and growth of planted and seeded white spruce as affected by seedbed type occurring on scalped strips prepared in aspen stands, Manitoba", is being carried out on two of the experimental areas (Waldron 1964b). Other detailed studies will be carried out to solve specific problems as they arise.

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² For more details on methods the reader is referred to the project plan (Waldron 1962).



Location of Experimental Areas, Project MS 226, Manitoba

DESCRIPTION OF TREATMENTS - 1965

Area No. 4 - Riding Mountain Forest Experimental Area

Observations made in the summer of 1964 indicated that excessive competition by lesser vegetation and aspen suckers was threatening the vigour and even survival of the transplants set out on scalped strips in May 1963. On July 28, 1965, a four-man crew using 2 solo mist blowers applied 38 gallons of an aqueous solution containing 2,4,5-T³ and 2,4,-D⁴ to all scalped strips except rows 1 to 5 in area No. 4-1. One half pound acid equivalent per acre of each herbicide was applied. The maximum temperature for the day was 77°F and it was clear and calm. The area was inspected by M. Pratt in September and was found to have a fair to good top-kill of hazel, rose, and aspen suckers.

Area No. 8 - Fish Road

Observations made in the early summer of 1965 indicated that the scalped strips supported a heavy cover of aspen suckers and lesser vegetation, particularly on the fresh to moist sites. It was decided that a herbicide spraying program was necessary in order to relieve transplants and seedlings from the intense competition.

Between 7 and 10 a.m. on August 5, 1965 aerial spraying with 2,4-D and 2,4,5-T was carried out on Areas No. 8 and 9 at Fish Road and Areas No. 16 and 21 at Mantago Lake. The weather was clear and calm. Spray was applied at a rate of 4 gallons per acre and contained 1 lb. acid equivalent 2,4,-D and 1 lb. acid equivalent 2,4,5-T.

On October 18, 1965, R. M. Waldron made a visual check of the sprayed area and reported the following results: a good leaf kill of young aspen trees and suckers was obtained; leaf kill was excellent on hazel, willow and lesser vegetation. White spruce, black spruce and red pine planting stock was not affected by the spray; however, damage to jack pine was noted. The damage which took the form of "needle kill" was moderate to heavy; terminal and lateral buds did not appear to be affected. On seeded strips some jack pine seedlings were badly damaged or killed where they were not shaded by vegetation. Damage to established white spruce germinants appeared to be light.

³Standard Chemical 2,4,5-T, 76.8% acid equivalent.

⁴Standard Chemical 2,4-D, 80.0% acid equivalent.

Area No. 9 - Fish Road andArea No. 16 - Mantago Lake

Aerial spraying with herbicides was carried out on August 5, 1965 using the same techniques and obtaining similar results as outlined under Area No. 8.

Area No. 17 - West Hawk Lake

Between August 17 and August 25, 1965, the Manitoba Dept. of Mines and Natural Resources applied, with solo mist sprayers, an aqueous solution of Green Cross Low Volatile Brush Killer "64" to the scalped strips north of Highway No. 4. The west half of the area was sprayed twice with a solution of 4,000 p.p.m. while the east half was sprayed only once with a solution of 8,000 p.p.m. The operation was carried out on sunny days after 10 a.m. when the dew had evaporated. Average daily maximum temperature during the period was 71°F and average daily minimum was 44°F at Rennie, the nearest weather station.

Area No. 19 - Riding Mountain Forest Experimental Area

In the autumn of 1964 scalped strips were prepared in an open, overmature, trembling aspen stand containing a dense understorey of Corylus cornata Marsh. on a fresh (moisture regime 3) clay loam textured soil in Section 35, Township 20, Range 19, W.P.M. (Appendix - Figures 1 and 2). The scalped strips were prepared using a 11½ foot wide blade on a TD-19 bulldozer. The total area was 4 acres and the 21 strips were each about 4 chains long, 10 feet wide, and separated by undisturbed strips 20 feet wide. Mineral soil was completely exposed on the strips.

(i) Planting

Two species, jack pine and white spruce, were planted. Approximately 500 of the transplants were jack pine and 2,800 were white spruce. Stock was obtained from the Manitoba Department of Mines and Natural Resources Nursery at Hadashville. In 1965 from May 17th to 19th, planting was carried out using the slit method of planting with two staggered rows of transplants at four to five foot spacing along the edges of each strip.

During planting, a fifth of an inch of rainfall occurred in generally cloudy weather. Average daily temperature was 41°F. Observations made at the time of planting indicated that soil moisture was adequate.

On July 7, 1965, six observation plots were established on each of two strips planted with jack pine and 12 observation plots were established on a single strip planted with white spruce. Plot data is shown in Table 1. To protect the jack pine from elk browsing, a 7-foot high barbed-wire fence was built around the sample plots.

TABLE 1
AVERAGE HEIGHT OF 1965 TRANSPLANTS

Species	No. of Observation Plots	No. of Transplants	Average Height (Ins.)
Jack pine	12	105	3.0
White spruce	12	119	5.5

Area No. 21 - Mantago Lake

In March, 1965, strips were bulldozed in a dense, 16-year-old aspen stand on very dry to very moist (moisture regimes 0 to 6), fine gravel, sandy loam and clay loam textured soils in Section 20, Township 26, Range 3, W.P.M. (Appendix - figures 3, 4 and 5). Scalping was done between March 22 and 25 using a D-7 tractor equipped with a straight blade. The strips were about 11 feet wide and were separated by 15 feet of undisturbed aspen. Six passes were made on each strip in an attempt to provide mineral soil exposure. However, heavy snow and frozen ground in conjunction with a cable actuated bulldozer blade enabled the removal of only the aerial portion of the vegetation. As a result, on May 3, 1965, it was necessary to have a Manitoba Department of Mines and Natural Resources bulldozer (TD-9) rescalp the strips which were to be planted and seeded. In addition, the centre of two strips to be seeded were furrowed with a Middlebuster fireline plough. The area was split between two blocks, (1/65 and (2/65) (Appendix - figure 3). One block (1/65) was located on a ridge and was characterized by the presence of dry and very dry sandy and gravelly soils (Appendix - figure 5), while the second block (2/65) was on a lower flat that was characterized by a variety of soil textures that ranged in soil moisture from dry to very moist (Appendix - figure 5). In May, a survey was carried out to determine the distribution of seedbed types (Table 2).

TABLE 2

EXPOSURE FOLLOWING SCALPING ON VARIOUS MOISTURE REGIMES

Moisture Regime	SEEDBED TYPES		No. of Observation Points
	Mineral soil (% Exposed)	Humus	
0 - 1	100	0	256
2 - 3	96	4	115
4	91	9	344
5 - 6	24	76	152
ALL	83	17	867

(i) Planting

Two species, jack pine and white spruce, were planted. All stock was of Manitoba origin and was obtained from the Manitoba Department of Mines and Natural Resources Nursery at Hadashville.

Stock was lifted in the nursery in the early spring and heeled-in. After being transported in plastic bags to the planting site, stock was heeled-in until planted. Planting stock measurements, based on 25 plants per species, are summarized in Table 3.

TABLE 3

1965 PLANTING STOCK MEASUREMENTS

Species	Average root length (inches)	Average stem length (inches)	Average root ¹ weight (grams)	Average top ¹ weight (grams)	Root/shoot ratio ¹
White spruce	11.4	6.0	0.82	2.35	0.35
Jack pine	9.1	3.3	0.43	1.15	0.37

¹Oven-dry weight: dried at 105°C for 48 hours.

The block (1/65) on the ridge had an area of 1.0 acres with strips of about 13 chains in length. The other block (2/65) on the flat, was 2.0 acres in size with strips about 25 chains long. In both locations one randomly chosen strip was planted to jack pine and one to white spruce. A single row of transplants at six foot spacing was set out in the centre of each planted strip. Altogether 867 seedlings were planted by a six-man crew provided by the Manitoba Department of Mines and Natural Resources, using the slit method with planting spades.

Planting commenced on May 5 and was completed that day. The day was cloudy and warm. Rainfall occurred in the evening and again during the morning of the 6th. Maximum temperature at Gimli on May 5 was 59°F.

On dry and fresh sites, soil moisture appeared to be adequate during planting; however, moist and very moist sites were flooded and on May 14, 27 seedlings were planted in two low spots.

Observation plots were established on May 10, 1965. Details are shown in Table 4.

TABLE 4

AVERAGE HEIGHT OF TRANSPLANTS BY MOISTURE REGIME

Moisture Regime	White Spruce			Jack Pine		
	No. of Plots	No. of Transplants	Average Height (In.)	No. of Plots	No. of Transplants	Average Height (In.)
0	13	106	6.3	13	102	2.8
1	6	27	5.1	6	21	2.7
2	4	23	5.9	3	19	2.5
3	6	51	6.0	3	22	3.4
4	20	161	5.8	21	183	3.8
5	7	42	6.8	6	27	3.6
6	6	38	6.3	6	45	4.4
All	62	448	6.0	58	419	3.5

Two seedbed types were identified, mineral and humus, with each transplant being placed in the appropriate type.

(ii) Seeding

Two species, jack pine and white spruce, were sown on the scalped strips. The jack pine seed was collected in south-eastern Manitoba by the Manitoba Forest Service (seed lot 152) and in the spring was treated with Arasin, Endrin, and aluminum flakes. Upon testing, the seed viability proved to be 89 per cent. For the block on the ridge two strips, one of which had been furrowed down the centre with a Middlebuster fireline plough, were sown on May 10th with jack pine seed at a rate of 1 pound per acre. The same procedure was followed for the block on the flat. The white spruce seed testing 55 per cent viable was collected at Riding Mountain Forest Experimental Area in the fall of 1964. The next spring it was treated with Arasan, Endrin, and aluminum flakes prior to field sowing. On the ridge block two strips; one which had been scalped and one scalped and furrowed were seeded on May 7th with white spruce at the rate of 2 pounds per acre. Two identically treated strips in the block on the flat were seeded with white spruce.

Soil moisture at the time of sowing was rated as excellent for germination on the moderately moist sites (moisture regime 4), excessively desiccated on the fresh to very dry sites (moisture regimes 3 to 0) and flooded on the moist to very wet sites (moisture regimes 5 to 7). No rain fell from a week to ten days after sowing but rainfall for the rest of May, June, and July was average for the district (Gimli) and sufficient for germination on fresh sites.

(iii) Aerial Spraying

Aerial spraying with herbicides was carried out on August 5, 1965, using the same methods and obtaining similar results as those under Area No. 8. However, in this area jack pine transplants suffered heavy damage to the top needles and buds; moderate mortality is expected. Recently germinated jack pine seedlings on the seeded strips were badly damaged or killed where they were not shaded by other vegetation or located in favourable micro-topographic positions. Mortality was especially severe on the ridge. Damage to white spruce germinants appeared to be considerably lighter.

Area No. 22 - Pine Falls

Between May 12 and 17, 1965 scalped strips were prepared in a moderately dense stand of young and mature trembling aspen and balsam poplar on a moist (moisture regime 4) clay textured soil and Section 15, Township 19, Range 10, E.P.M. (Appendix - figures 6 and 7). The average strip was ten feet wide and strips were separated by approximately 14 feet of undisturbed stand. Mineral soil exposure appeared to be almost complete.

(i) Planting

During the third week in May, 1965 approximately 1,400 white spruce transplants were set out using both the slit and hole method of planting at 6-foot spacing. Transplant data is shown in Table 5.

TABLE 5
1965 PLANTING STOCK MEASUREMENTS

Species	Average Root Length (in.)	Average Height (in.)	Average ¹ Root Weight (gms.)	Average ¹ Top Weight (gms.)	Root/shoot Ratio (by weight)
White ² spruce	8.0	4.8	0.57	1.65	0.34

¹Oven dried at 105°C for 48 hours.

²Based on 25 transplants.

The weather during planting was good. Almost a half an inch of rain fell on the 19th and 20th of May while daily air temperatures averaged 48°F.

On June 17, 1965, observation plots were established on four strips; data are shown in Table 6.

TABLE 6
AVERAGE HEIGHT OF WHITE SPRUCE TRANSPLANTS BY PLANTING METHOD

Method of Planting	Strip No.	No. of Observation Plots	No. of Transplants	Average Height (in.)
Slit planting	11 13	19	169	5.8
Hole planting	4 7	17	158	6.0
All planting		36	327	5.9

(ii) Seeding

White spruce extracted from the 1964 cone crop at the Riding Mountain Forest Experimental Area and treated with Arasan, Endrin and aluminum flakes was sown on two scalped strips on June 8, 1965. The viability of the seed was 55 per cent and it was sown at a rate of 1.5 pounds per acre.

Soil moisture at the time of seeding was satisfactory, with the exception of a few flooded depressions. Rainfall during June and July - 6.35 inches at Pine Falls - was adequate for promoting germination.

RESULTS

(i) Transplant survival through to 1965

Early survival of white spruce transplants has generally been over 60 per cent except on the moist and wet sites (moisture regimes 5 and 6) where survival has varied from 91 per cent to complete mortality (Table 7).

TABLE 7
SURVIVAL OF WHITE SPRUCE TRANSPLANTS ON EACH AREA

Planted				Moisture Regime	% Survival of Transplants									
					1962		1963		1964		1965		1966	
Area	Species	# trees	Date		Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
1	w.S.	223	1962	3	97.8		86.8		86.4					
2	w.S.	177	1962	3,4,5	99.4		96.6		95.5					
3	w.S.	161	1962	3,4	94.4		83.9		82.0					
4	w.S.	101	1963	3			100.0		96.0		94.1			
5	w.S.	162	1962	5,6	95.7		76.5		71.6					
6	w.S.	273	1963	3			100.0		95.6		95.6			
	w.S.	50	1963	3			100.0		96.0		82.0			
	w.S.	75	1963	5			61.3		56.0		54.7			
7	w.S.	258	1964	3,4					100.0		85.6		84.5	
2row	w.S.	11	1962	2	100.0		100.0	100.0			90.9			
	w.S.	57	1962	3	100.0		91.2	89.5			89.5			
	w.S.	102	1962	4	95.1		80.4	80.4			80.4			
	w.S.	24	1962	5	91.7		54.2	50.0			50.0			
	w.S.	20	1962	6	40.0		0.0	0.0			0.0			
	w.S.	20	1962	2	100.0		85.0	85.0			80.0			
	w.S.	71	1962	3	98.6		83.1	74.6			74.6			
	w.S.	57	1962	4	96.5		87.7	80.7			80.7			
	w.S.	86	1962	5	79.1		32.6	25.6			24.4			
	w.S.	6	1962	6	33.3		0.0	0.0			0.0			
9	w.S.	168	1963	3			100.0	97.6	96.4		96.4		95.8	
	w.S.	224	1963	4			100.0	93.7	92.0		91.1		91.1	
	w.S.	92	1963	5			100.0	80.4	77.2		76.1		76.1	

TABLE 7

Planted				Moisture Regime	% Survival of Transplants									
					1962		1963		1964		1965		1966	
Area	Species	# trees	Date		Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
10	w.S.	125	1962 ^F	5		100.0	96.7		91.8		91.2			
11	w.S.	99	1962	3	100.0	65.6			56.6					
	w.S.	50	1962	4	100.0	88.0			80.0					
	w.S.	50	1962	5	100.0	96.0			88.0					
12	w.S.	3	1960 ^F	3	100.0				66.7				66.7	
	w.S.	129	1960 ^F	4	63.6				61.2				61.2	
	w.S.	152	1960 ^F	5	72.4				60.5				60.5	
	w.S.	116	1960 ^F	6	62.1				40.5				39.7	
16	w.S.	100	1964	0					100.0		86.0			
	w.S.	30	1964	1					100.0		90.0			
	w.S.	45	1964	2					100.0		80.0			
	w.S.	33	1964	3					100.0		87.9			
	w.S.	153	1964	4					100.0		88.9			
	w.S.	33	1964	5					100.0		42.4			
	w.S.	4	1964	6					100.0		50.0			
	w.S.	6	1964	7					100.0		16.7			
17	w.S.	100	1963 ^F	3					90.0	86.0	86.0		86.0	
	w.S.	100	1963 ^F	4					98.0	93.0	93.0		90.0	
	w.S.	101	1963 ^F	6					97.0	52.5	50.5		43.0	
¹ 18	w.S.	182	1964	3,4					98.9		93.4		93.4	
19	w.S.	119	1965	3							98.3		96.6	
20	w.S.	277	1963 ^F	3					99.3		92.0			

¹

13 trees out of sample by bulldozer.

^F

Autumn

TABLE 7

Planted				Moisture Regime	% Survival of Transplants									
					1962		1963		1964		1965		1966	
Area	Species	# trees	Date		Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
21	w.S.	106	1965	0							100.0		88.7	
	w.S.	27	1965	1							100.0		81.5	
	w.S.	23	1965	2							100.0		100.0	
	w.S.	51	1965	3							100.0		90.2	
	w.S.	161	1965	4							100.0		74.5	
	w.S.	42	1965	5							100.0		21.4	
	w.S.	38	1965	6							100.0		0.0	
22	w.S.	327	1965	4							99.4		47.7	

TABLE 8

SURVIVAL OF JACK PINE, RED PINE AND BLACK SPRUCE TRANSPLANTS ON EACH AREA

Planted				Moisture Regime	% Survival of Transplants									
Area	Species	# trees	Date		1962		1963		1964		1965		1966	
					Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
7	b.S.	235	1964	3,4					100.0		93.6		93.6	
8	b.S.	40	1962	2	100.0		92.5	92.5			92.5			
	b.S.	96	1962	3	100.0		99.0	99.0			99.0			
	b.S.	17	1962	4	100.0		88.2	88.2			88.2			
	b.S.	45	1962	5	100.0		86.7	75.6			75.5			
	b.S.	7	1962	6	100.0		71.4	71.4			71.4			
	j.P.	5	1962	2	100.0		100.0	100.0			100.0			
	j.P.	81	1962	3	97.5		95.1	90.4			87.6			
	j.P.	65	1962	4	96.9		93.8	90.8			90.8			
	j.P.	22	1962	5	72.7		36.4	36.4			36.4			
	r.P.	41	1962	2	87.8		65.8	63.4			63.4			
	r.P.	73	1962	3	97.3		80.8	76.7			79.5			
	r.P.	58	1962	4	93.1		70.7	60.3			56.9			
	r.P.	34	1962	5	91.2		11.8	5.9			8.8			
	r.P.	27	1962	6	66.7		3.7	3.7			3.7			
9	j.P.	64	1963	3			100.0	89.1	89.1		87.5		85.9	
	j.P.	221	1963	4			99.6	79.7	78.3		78.3		71.9	
	j.P.	88	1963	5			100.0	70.4	69.3		63.6		65.9	
	j.P.	7	1963	6			100.0	42.9	42.9		28.6		42.9	
	w.P.	4	1963	2			100.0	100.0	100.0		100.0		100.0	
	w.P.	22	1963	3			100.0	95.4	95.5		95.4		95.4	
	w.P.	44	1963	4			100.0	95.5	95.5		95.5		90.9	
	w.P.	14	1963	5			100.0	100.0	100.0		92.8		92.8	
	w.P.	7	1963	6			100.0	100.0	100.0		100.0		100.0	
	r.P.	7	1963	2			100.0	100.0	100.0		100.0		100.0	

2

Road construction removed 12 M.R.3 and 10 M.R.4 b.S. from sample.

TABLE 8

Planted				Moisture Regime	% Survival of Transplants									
					1962		1963		1964		1965		1966	
Area	Species	# trees	Date		Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
9	r.P.	89	1963	3			100.0	94.4	92.1		89.9		89.9	
	r.P.	170	1963	4			99.4	87.7	85.9		84.7		83.5	
	r.P.	40	1963	5			100.0	80.0	82.5		82.5		80.0	
	r.P.	13	1963	6			100.0	61.5	61.5		61.5		61.5	
	b.S.	118	1963	3			100.0	92.4	92.4		91.5		90.7	
	b.S.	217	1963	4			100.0	80.6	80.6		79.7		79.3	
	b.S.	78	1963	5			100.0	60.2	60.2		60.2		53.8	
	b.S.	16	1963	6			100.0	18.8	18.8		18.8		18.8	
16	r.P.	94	1964	0					100.0		45.7			
	r.P.	36	1964	1					100.0		66.7			
	r.P.	42	1964	2					100.0		47.6			
	r.P.	56	1964	3					98.2		66.1			
	r.P.	114	1964	4					100.0		60.5			
	r.P.	42	1964	5					100.0		31.0			
	r.P.	11	1964	6					90.9		0.0			
	r.P.	1	1964	7					100.0		0.0			
	b.S.	101	1964	0					100.0		67.3			
	b.S.	42	1964	1					100.0		76.3			
	b.S.	41	1964	2					100.0		26.8			
	b.S.	44	1964	3					100.0		65.9			
	b.S.	128	1964	4					99.2		83.6			
	b.S.	33	1964	5					100.0		75.8			
	b.S.	14	1964	6					92.8		78.6			
	j.P.	97	1964	0					100.0		85.6			
	j.P.	27	1964	1					100.0		88.9			
	j.P.	47	1964	2					100.0		91.5			
	j.P.	28	1964	3					100.0		82.1			
	j.P.	149	1964	4					100.0		91.3			
	j.P.	30	1964	5					100.0		90.0			
	j.P.	7	1964	6					100.0		85.7			

TABLE 8

Planted				Moisture Regime	% Survival of Transplants									
					1962		1963		1964		1965		1966	
Area	Species	# trees	Date		Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
16	J.P.	11	1964	7					100.0		72.7			
19	J.P.	105	1965	3							98.1		96.2	
21	J.P.	102	1965	0							100.0		92.2	
	J.P.	21	1965	1							100.0		95.2	
	J.P.	19	1965	2							100.0		84.2	
	J.P.	22	1965	3							100.0		90.9	
	J.P.	183	1965	4							100.0		96.2	
	J.P.	27	1965	5							100.0		92.6	
	J.P.	45	1965	6							100.0		28.9	

TABLE 9

PER CENT STOCKING AND NUMBER OF SEEDLINGS PER ACRE FOR WHITE SPRUCE SEEDED AREAS

Seeded				Moisture Regime	Per Cent Stocking and Number of Seedlings Per Acre											
					1962		1963		1964		1965		1966		1966 ^F	
Area	Species	Lbs./acre	Date		%	#	%	#	%	#	%	#	%	#	%	#
1	w.S.	1.1	1961 ^F	3			0	0	Failure due to poor seed, 11 % viability.							
	w.S.	1.0	1963	3	reseeded				0	0	Failure due to late seeding, June 18.					
2	w.S.	2.5	1961 ^F	3,4,5			14.0	560	20.0	960			M.R.3	32.4	2000	
3	w.S.	1.8	1961 ^F	3,4		S + F	0.0	0	Failure due to poor seed, 11 % viability.							
6	w.S.	1.5	1962 ^F	3					36.9	2462						
	w.S.	1.5	1964 ^F	3	reseeded				F 83.2	10154	F 73.8	8615				
7	w.S.	1.5	1963 ^F	3,4,5							79.3	45600	M.R.3	93.8	34000	
											F 82.9	54400	M.R.4	66.2	20000	
													M.R.5	35.7	28000	
8	w.S.	1.3	1962	3,4	F 98.0	22800	96.0	16400	F 92.0	16400					84.0	18000
	w.S.	1.3	1962	5,6	F 90.0	23000	F 90.0	15200	F 50.0	8800					42.0	9200
							F 32.0	7600								
9	w.S.	1.0	1963	2,3,4,5,6			F 63.0	10400	F 61.0	10800			F 63.0	11200		
10	w.S.	1.1	1962 ^F	5			0.0	0	Failure due to the use of Captan.							
	w.S.	1.4	1963	5			F 5.0	200	75.0	10800	F 55.0	9400				
11	w.S.	0.7	1960 ^F	3		14.7	570									
	w.S.	0.7	1960 ^F	4		37.5	3340									
	w.S.	0.7	1960 ^F	5		43.0	4000									
	w.S.	0.7	1960 ^F	6		0.0	0									

TABLE 9

Seeded				Moisture Regime	Per Cent Stocking and Number of Seedlings Per Acre											
					1962		1963		1964		1965		1966		1966 ^F	
Area	Species	Lbs./acre	Date		%	#	%	#	%	#	%	#	%	#	%	#
13	w.S.	1.0	1961 ^F	3	F 81.8	17091	81.8	16000			F 81.8	14545			90.9	15273
	w.S.	1.0	1961 ^F	4	F 60.0	18400	60.0	18000			F 100.0	22400			100.0	23200
	w.S.	1.0	1961 ^F	5	F 40.0	4400	30.0	3600			F 50.0	3200			80.0	4800
	w.S.	1.0	1961 ^F	6	F 50.0	4000	50.0	4000			F 30.0	1200			30.0	1200
							40.0	2400								
14	w.S.	1.0	1962	3	F 100.0	62800	100.0	61600			F 100.0	36400			100.0	36800
	w.S.	1.0	1962	6	F 80.0	5200	80.0	4800			F 10.0	400			10.0	400
16	w.S.	3.0	1964	0							70.0	3000	60.0	7000	45.0	7000
	w.S.	3.0	1964	1							10.0	2000	15.0	3000	15.0	2000
	w.S.	3.0	1964	2,3							95.0	23000	90.0	16000	60.0	12000
	w.S.	3.0	1964	4							85.0	13000	90.0	17000	85.0	14000
	w.S.	3.0	1964	6							40.0	5000	55.0	7000	50.0	6000
21	w.S.	2.0	1965	0							F 75.0	7500	65.0	4500		
	w.S.	2.0	1965	1							F 70.0	2500	45.0	2000		
	w.S.	2.0	1965	2							F 100.0	18500	100.0	21500		
	w.S.	2.0	1965	4							F 100.0	21000	100.0	19000		
	w.S.	2.0	1965	6							F 75.0	12500	70.0	13500		
	w.S.	2.0	1965	0	Furrowed scalp.						F 75.0	1000	60.0	1000		
	w.S.	2.0	1965	1			"	"			F 100.0	5000	80.0	6000		
	w.S.	2.0	1965	2			"	"			F 90.0	9500	100.0	9500		
	w.S.	2.0	1965	4			"	"			F 100.0	23000	100.0	25000		
	w.S.	2.0	1965	6			"	"			F 100.0	6000	95.0	6500		
22	w.S.	1.5	1965	4							F 100.0	32000	100.0	32000		

F - Autumn

TABLE 10
PER CENT STOCKING AND NUMBER OF SEEDLINGS PER ACRE FOR PINE SEEDED AREAS

Seeded				Moisture Regime	Per Cent Stocking and Number of Seedlings Per Acre											
					1962		1963		1964		1965		1966		1966 ^F	
Area	Species	Lbs./acre	Date		%	#	%	#	%	#	%	#	%	#	%	#
8	j.P.	1.0	1962	3,4	F 86.0	14000	80.0	12800	F 80.0	12000					70.0	8400
	j.P.	1.0	1962	5,6	F 74.0	11600	76.0	5200	F 52.0	2000					36.0	1200
	r.P.	1.3	1962	3,4	F 54.0	2400	34.0	2000	F 28.0	1600					18.0	1600
	r.P.	1.3	1962	5,6	F 28.0	1600	28.0	1600	F 28.0	1600					16.0	800
	r.P.	1.3	1962	5,6	F 76.0	6400	62.0	4800	F 34.0	2000						
9	j.P.	1.0	1963	2,3,4,5,6			F 89.0	28000	F 90.0	28400			78.0	17000		
	r.P.	1.3	1963	2,3,4,5,6			F 64.0	5600	F 65.0	4800			53.0	4000		
16	r.P.	1.5	1964	0							10.0	0	10.0	0	10.0	0
	r.P.	1.5	1964	1							20.0	1000	20.0	1000	15.0	0
	r.P.	1.5	1964	2,3							30.0	1000	25.0	0	10.0	0
	r.P.	1.5	1964	4							30.0	0	30.0	0	25.0	0
	r.P.	1.5	1964	6							30.0	1000	25.0	1000	5.0	1000
	j.P.	1.0	1964	0							60.0	4000	40.0	1000	35.0	1000
	j.P.	1.0	1964	1							35.0	1000	20.0	0	15.0	0
	j.P.	1.0	1964	2,3							40.0	6000	40.0	3000	15.0	1000
	j.P.	1.0	1964	4							70.0	17000	55.0	12000	45.0	12000
	j.P.	1.0	1964	6							85.0	21000	50.0	6000	20.0	1000
21	j.P.	1.0	1965	0							F 55.0	1000	30.0	500	30.0	500
	j.P.	1.0	1965	1							F 80.0	4500	45.0	2500	45.0	1500
	j.P.	1.0	1965	2							F 95.0	3500	75.0	1500	80.0	1500
	j.P.	1.0	1965	4							F 100.0	30500	100.0	25000	100.0	15000
	j.P.	1.0	1965	6							F 80.0	6500	55.0	4500	50.0	2000
	j.P.	1.0	1965	0	Furrowed scalp.						F 80.0	2500	45.0	1000		
	j.P.	1.0	1965	1			"	"			F 100.0	7500	80.0	2000		
	j.P.	1.0	1965	2			"	"			F 100.0	20500	95.0	6500		
	j.P.	1.0	1965	4			"	"			F 100.0	12000	100.0	3500		
	j.P.	1.0	1965	6			"	"			F 90.0	11500	65.0	5500		

Red pine seeding (3 areas) seems to have almost failed in two of the areas while the third area was moderately stocked at the last examination (1966).

FUTURE WORK

Examination of the observation plots and the five-year assessments will be carried out for both planted and seeded areas as outlined in the project plan (Waldron 1962). Tables 11 and 12 show the years in which this work will be undertaken.

REFERENCES

- WALDRON, R.M. 1962. Converting aspen stands to white spruce by planting and seeding on scalped strips, Manitoba. Canada Dept. of Forestry, For. Res. Br., Unpublished MS., Man.-Sask. 62-16. 13 pp.
- _____ 1964a. Converting aspen stands to white spruce by planting and seeding on scalped strips, Manitoba. Canada, Dept. of Forestry, For. Res. Br., Unpublished MS., Man.-Sask. 64-MS-16. 34 pp.
- _____ 1964b. Early survival and growth of planted and seeded white spruce as affected by seedbed types occurring on scalped strips prepared in aspen stands, Manitoba. Canada, Dept. of Forestry, For. Res. Br., Unpublished MS., Man.-Sask. 64-MS-19. 33 pp.
- _____ 1965. Converting aspen stands to white spruce by planting and seeding on scalped strips, Manitoba. Canada Dept. of Forestry, For. Res. Br., Unpublished MS., Man.-Sask. 65-MS-1. 15 pp.

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TABLE 11

SCHEDULE OF EXAMINATIONS AND ASSESSMENT FOR PLANTED AREAS

Area No.	Area	Year of planting, observation, plot examination and five-year assessment																			
		1960	1962		1963	1964		1965		1966		1967		1968		1969		1970		1971	
		Autumn	Spring	Autumn	S	A	S	A	S	A	S	A	S	A	S	A	S	A	S	A	S
1	Porcupine Mt.		P		E		E						E-A								
2	Madge Lake		P		E		E						E-A								
3	Gill Meadow		P		E		E						E-A								
4	Riding Mountain				P		E		E					E-A							
5	Pine Falls		P		E		E						E-A								
6	Pine Falls				P		E		E					E-A							
7	Pine Falls						P		E		E					E-A					
8	Fish Road		P		E	E			E				E-A								
9	Fish Road				P		E		E		E			E-A							
10	Beaver Creek			P	E		E		E					E-A							
11	Nutimik		P	E			E						E-A								
12	Nutimik	P	E				E				E-A										
15	Falcon Lake																				
16	Mantago Lake						P		E				E			E-A					
17	West Hawk						P	E	E		E					E-A					
18	Riding Mountain						P		E		E					E-A					
19	Riding Mountain								P		E		E					E-A			
20	Porcupine Mt.					P	E		E							E-A					
21	Mantago Lake								P		E		E					E-A			
22	Pine Falls								P		E		E					E-A			

P - planting; E - examination; A - assessment.

TABLE 12

SCHEDULE OF EXAMINATIONS AND ASSESSMENT FOR SEEDED AREAS

Area No.	Area	Year of seeding, observation, plot examination and five-year assessment																				
		1960		1961		1962		1963		1964		1965		1966		1967		1969		1970		1971
		A	S	A	S	A	S	A	S	A	S	A	S	A	S	A	S	A	S	A		
1	Porcupine Mt.			S		E	E			Failure												
1	Porcupine Mt.						S			E				Failure								
2	Madge Lake			S		E	E			E				E-A								
3	Gill Meadow			S		E	E															
6	Pine Falls					S	E			E ²	E		E				E-A					
7	Pine Falls							S				E	E		E			E-A				
8	Fish Road				S	E	E	E		E					E-A							
9	Fish Road						S	E		E				E			E-A					
10	Beaver Creek					S	E	E	E								E-A					
10	Beaver Creek						S	E	E	E			E					E-A				
11	Nutimik	S			E									E-A								
13	Nutimik			S		E	E	E					E		E-A							
14	Nutimik				S	E	E	E					E			E-A						
16	Mantago Lake								S		E		E	E				E-A				
21	Mantago Lake										S	E	E			E				E-A		
22	Pine Falls										S	E	E			E				E-A		

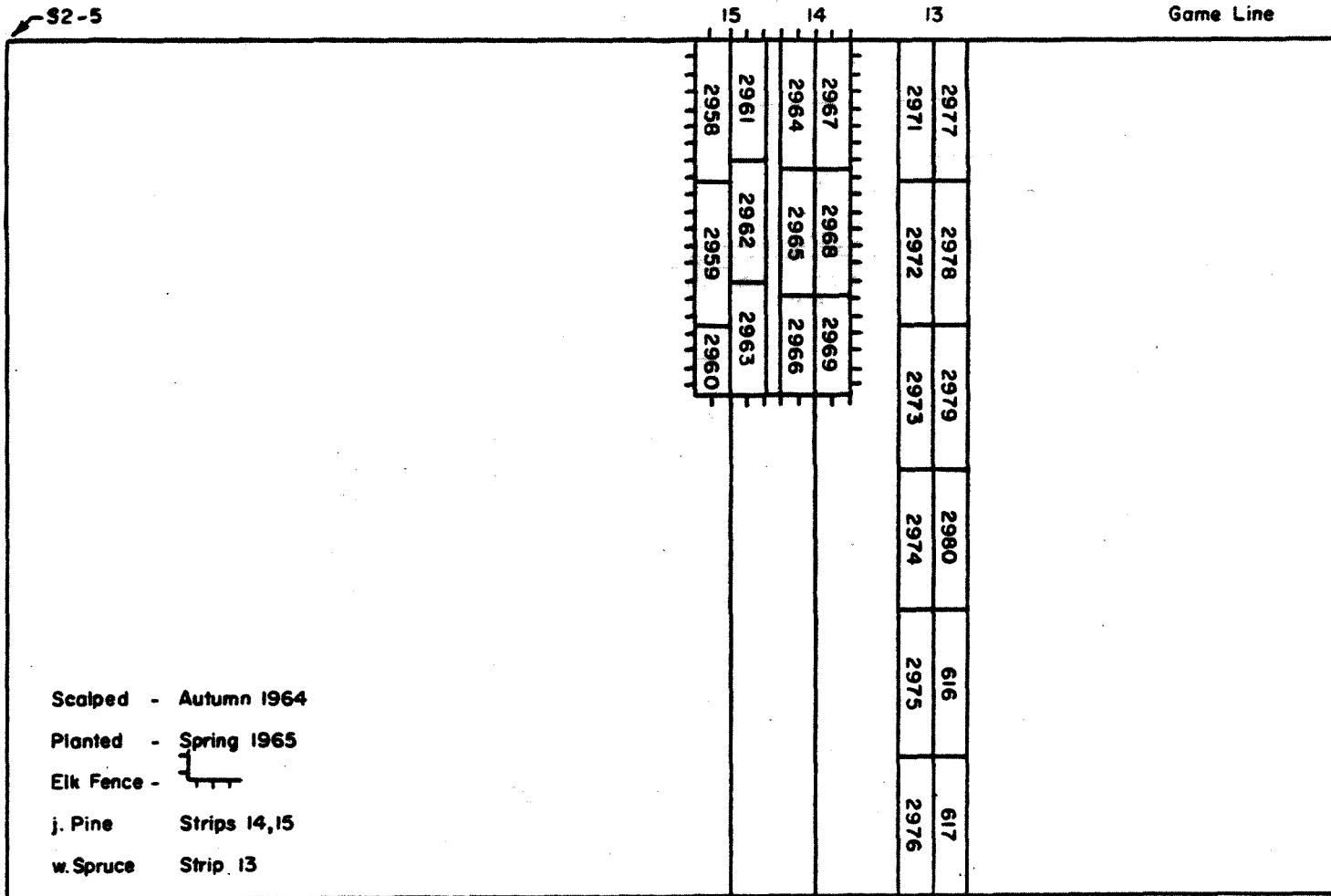
1 S - seeding; E - examination; A - assessment

² Reseeded Spring 1964.

APPENDIX

AREA AND SAMPLE PLOT LOCATIONS

Twp. 21, Rge. 19, Sec. 2, W.P.M.



Twp. 20, Rge. 19, Sec. 35, W.P.M.

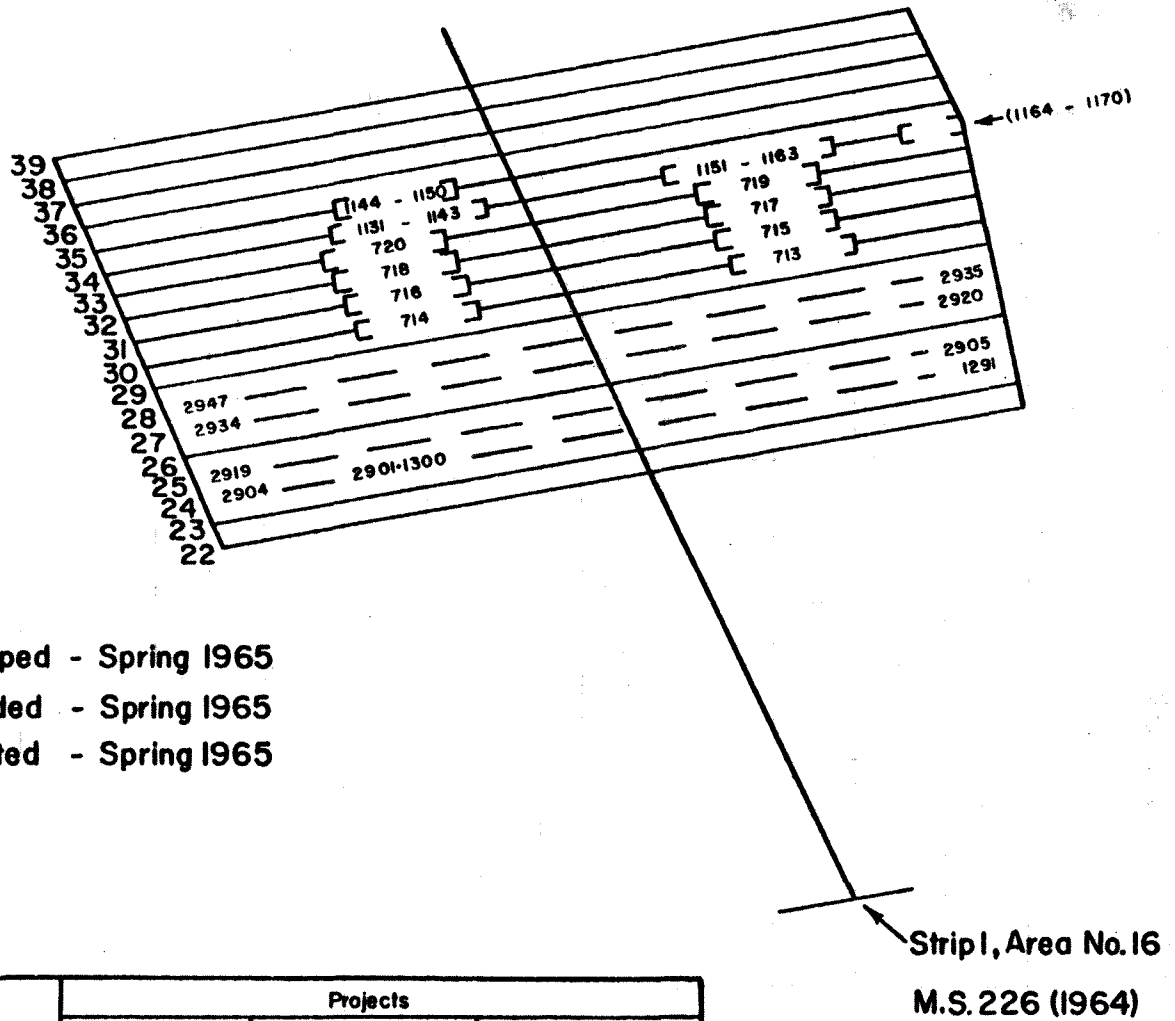


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Fig. 2 Area No. 19, Project M.S. 226
 Riding Mountain Forest Experimental Area, Manitoba

Twp. 26, Rge. 3, Sec. 20, W.P.M.

Mg. North



TREATMENT	Projects					
	M. S. 190		M. S. 226		M. S. 227	
	Strip No.	Plot No.	Strip No.	Plot No.	Strip No.	Plot No.
Planted w S	27	2920-2934	25	2905 - 2919	—	—
" j P	28	2935-2947	24	2901 - 2904 1291 - 1300	—	—
Seeded w S	31	715 - 716	32	717 - 718	—	—
" j P	30	713 - 714	33	719 - 720	34 35	1131 - 1170 1144 - 1150

0 1 2 3chs.

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**Fig. 4 Area No. 21 Project M.S. 226, Mantago Lake, Manitoba
(M.S. 190, 1965 Planting)**

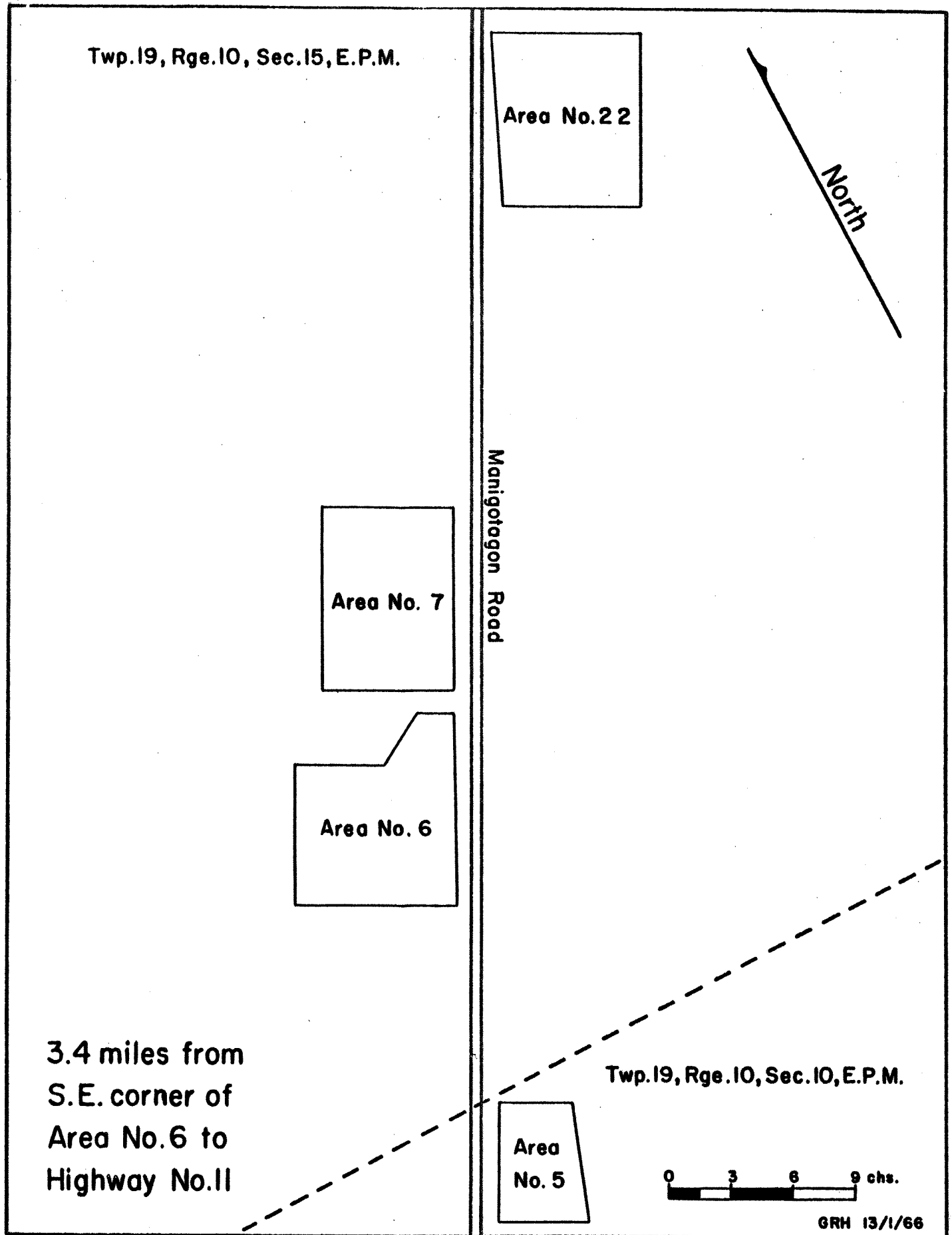


Fig. 6 Areas No. 5, 6, 7 and 22, Project M.S. 226,
Pine Falls, Manitoba

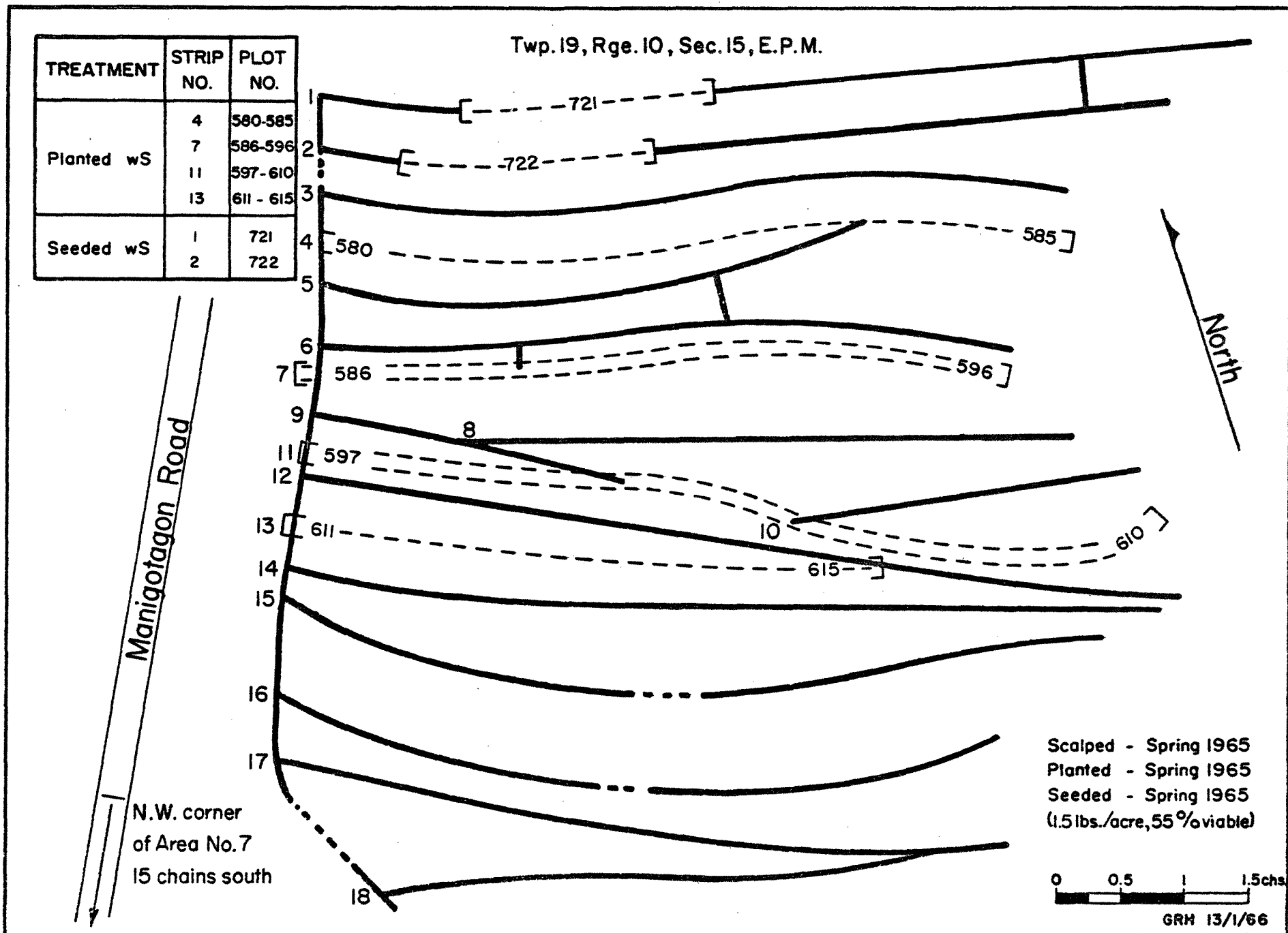


Fig. 7 Area No. 22, Project M.S. 226 Pine Falls, Manitoba