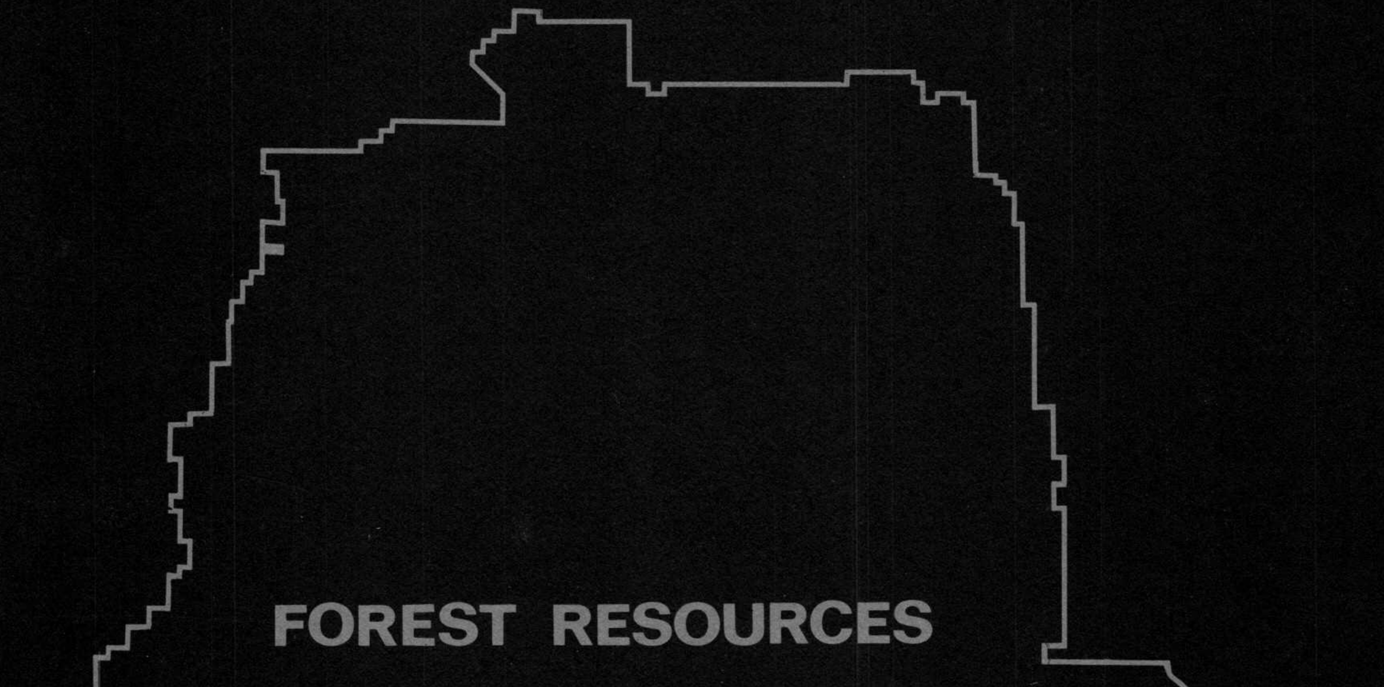
WHITEMUD RIVER WATERSHED
RESOURCE STUDY

PHASE I



FOREST RESOURCES

H. Veldhuis
D.B. Forrester
R. Bukowsky
and
J. Thie

MINES · RESOURCES · ENVIRONMENTAL MANAGEMENT

RESOURCE PROJECTS

Jean Thie

FOREST RESOURCES OF THE WHITEMUD WATERSHED AREA

by

H. Veldhuis - Forestry Co-ordinator
D. Forrester - Senior Resource Technician
R. Bukowsky - Resource Technician
J. Thie - Chief, Forestry Sector

Resource Extension and Development Branch
Manitoba Department of Mines, Resources and Environmental Management

July, 1972

ABSTRACT

The objectives of the study are to describe existing *and* potential *forest resources. The results obtained in achieving the goals should provide a basis for estimating and planning better and more intensive uses of forest vegetation.*

Prior to settlement a large part of the watershed area had tree cover of some kind. Large tracts of land have been cleared during settlement and much timber was used for construction and fuel. Many saw mills were once located in the area, but have not disappeared and the use of the forest resource has dwindled to almost nothing at present.

The forest cover comprises about 21.5% of the watershed area. Of these lands about 10.8% is Productive Woodland and about 10.7% is Non-Productive Woodland. The lands within the Riding Mountain National Park boundary are heavily wooded, often with good stands of coniferous and deciduous species. In the remainder of the watershed, tree cover is almost exclusively deciduous, which is mainly trembling aspen. The stands and groves are often affected by grazing and stubble burning, resulting in poorly stocked and inferior stands. Many hundreds of miles of shelterbelts have been planted over the years in the watershed. Success of the plantings has varied widely as a result of limited knowledge of the requirements of certain species.

The forest capability is better than indicated by the present cover. The major limiting factor for tree growth is the subhumid climate, resulting in an unfavourable evapotranspiration budget on well drained sites. About 40-50% of the total area can support class 5 growth (C.L.I. classification system), 30-35% and 20-25% fall in class 6 and 7 respectively. Class 3 and 4 occur in small quantities (about 5% altogether). The highest classes are mostly found in the Riding Mountain area and along streams and rivers in the Lowlands.

It is recommended that the approach in future studies should be based on a cultural forestry viewpoint rather than on a commercial exploitation viewpoint. Detailed studies are necessary to evaluate the effects of natural vegetation on hydrological regime and erosion and what effect may be expected from reforestation and afforestation.

ACKNOWLEDGEMENTS

This technical report was not born without the many pains which seem to have been associated with the Whitemud River Watershed Study, especially in its initial phases.

As soon as the actual work on the forestry input started, many problems disappeared. The Forestry Sector staff of Resource Projects; J. Thie, D. B. Forrester, R. Bukowsky and myself prepared this report.

We received much information and assistance from M. Kaye, Chief, Forestry Research; C. D. Rannard, Chief, Forestry Operations and his technician, B. R. Gilmore, and C. B. Gill, retired Chief of Forest Management. L. A. Lange, Superintendent of Riding Mountain National Park; G. H. McColm and R. C. MacKenzie of the Western Region and the Forest Management Institute in Ottawa also provided very valuable information.

The manuscript was, as usual, very capably typed by Miss Elizabeth Maticio, while the drafting was done by B. J. Lezak and H. Schell.

TABLE OF CONTENTS

	Page
ABSTRACT	1
ACKNOWLEDGEMENTS	3
LIST OF FIGURES	6
LIST OF TABLES	9
INTRODUCTION	11
GENERAL DESCRIPTION	13
Physiography	13
Climate	16
Soils	19
Site Regions	20
FOREST HISTORY	25
Post Glacial Tree Cover	25
Tree Cover During Settlement	27
Forest Utilization	30
Fires and Other Disturbances	33
PRESENT DISTRIBUTION AND CONDITION OF FORESTS	35
Lands Presently Under Tree Cover	35
Forest Composition and Condition	38
Regeneration	47
Volumes	49
Tree Planting	52
LAND CAPABILITY FOR FORESTRY	61
Classification System	61
Capability Classes	62
Capability Subclasses	64
Classification Methodology	65
Capability Ratings	66
SUMMARY AND CONCLUSION	79
RECOMMENDATIONS	83
REFERENCES	85

LIST OF FIGURES*

Figure		Page
1	Physiographic Regions	14
2	West Lake Plain. Till over shale bedrock. Twp. 17, Rge. 14-15W	17
3	Minnedosa-Reston Till Plain. Very gently undulating ground moraine. Note the erosion of the knolls	17
4	Riding Mountain Till Plain. Rolling ground moraine. Mixed stands of trembling aspen and white spruce. Sec. 13, Twp. 18, Rge. 16W. Note barren shale ridge in foreground	17
5	Riding Mountain Till Plain. Recent alluvium and alluvial terraces. Gently undulating. Black spruce and tamarack stand in depression. Sec. 34, Twp. 17, Rge. 16W	18
6	Upper Assiniboine Delta. Coarse to medium textured lacustrine, blown into dunes. Trembling aspen and bur oak tree cover. Sec. 20, Twp. 13, Rge. 13W	18
7	Lower Assiniboine Delta. Alluvium over lacustrine deposits and till. Sec. 7, Twp. 17, Rge. 14W	18
8	Site Regions	20
9	Ecologically Significant Site Regions	21
10	Riding Mountain Till Plain. White spruce stand on imperfectly drained loamy till	23
11	Riding Mountain Till Plain. Mixed stand of trembling aspen and white spruce on imperfectly drained loamy till. Sec. 29, Twp. 17, Rge. 17W	23
12	Upper Assiniboine Delta. Trembling aspen on medium textured, imperfectly drained lacustrine deposits. Sec. 14, Twp. 15, Rge. 15W	23
13	Upper Assiniboine Delta. Coarse textured lacustrine deposits blown into dunes. Tree cover of trembling aspen and bur oak	24
14	Upper Assiniboine Delta. Trembling aspen stand on imperfectly drained, medium textured lacustrine deposits. Sec. 14, Twp. 15, Rge. 15W	24

List of Figures (Cont'd)

Figure		Page
15	West Lake Plain. Trembling aspen stand on loamy highly calcareous, imperfectly drained till. Sec. 7, Twp. 19, Rge. 12W.	24
16	Vegetation Map (Historical)	28
17	Subwatershed Districts	36
18	Site Regions	38
19	Riding Mountain Till Plain. Good stand of jack pine (mixed with younger white spruce) on well drained loamy till...	39
20	Riding Mountain Till Plain. Trembling aspen stands on alluvium and alluvial terraces. Sec. 34, Twp. 17, Rge. 16W.	39
21	Upper Assiniboine Delta. Trembling aspen stand on imperfectly drained medium textured lacustrine deposits. Sec. 13, Twp. 15, Rge. 15W. Note the invasion of the wetter area by trembling aspen suckers	39
22	Color Infrared. Scale 1:128,000. Twp. 17-18, Rge. 16-17W. Riding Mountain Till Plain. (1) Eroded fields	40
23	Color Infrared. Scale 1:128,000. Twp. 17-18, Rge. 15-16W. Riding Mountain Till Plain. (1) Coniferous tree cover (white spruce). (2) Deciduous tree cover (trembling aspen). (3) Active eroding areas in gullies	40
24	True Color. Scale 1:110,000. Twp. 18-17, Rge. 16-15W. Riding Mountain Till Plain, Manitoba Escarpment. (1) Active eroding spots in gullies	40
25	True Color. Scale 1:110,000. Twp. 17, Rge. 16-15W. Riding Mountain Till Plain. (1) Active eroding spots in gullies	40
26	Duned medium sand in Lower Assiniboine Delta. Vegetation of trembling aspen and bur oak and grasses	42
27	Bank of Whitemud River. Vegetation of hardwoods such as bur oak, elm and ash	42
28	Bank of Whitemud River. Vegetation of elm, ash and maple	42
29	True color. Scale 1:110,000. Minnedosa-Reston Till Plain. Note the erosion of the cleared lands and the confinement of tree cover to the non-arable areas	43

List of Figures (Cont'd)

Figure		Page
30	True color. Scale 1:40,000. Minnedosa-Reston Till Plain. Note the numerous depressions and the lack of trees	43
31	True color. Scale 1:44,000. Twp. 12, Rge. 16W. Minnedosa-Reston Till Plain. Note numerous depressions and the lack of tree cover	43
32	True color. Scale 1:44,000. Twp. 12, Rge. 13W. Upper Assiniboine Delta. (1) Dunes. Note the vegetation on north facing slopes and the almost barren south facing slopes. (2) Trembling aspen in moister locations and sedge type vegetation in the very wet depressions	43
33	Tree cover along river in Upper Assiniboine Delta	45
34	Trembling aspen stand in West Lake Plain	45
35	Trembling aspen stand in West Lake Plain. Note the damage by fire and cattle	45
36	True color. Scale 1:11,000. Twp. 12, Rge. 13W. Enlargement of picture 32	46
37	True color. Scale 1:44,000. Twp. 12, Rge. 13W. Upper Assiniboine Delta. Peat filled gullies. Acting as sponge for runoff	46
38	True color. Scale 1:44,000. Twp. 14-15, Rge. 13W. Lower Assiniboine Delta. Note the dense tree cover along Whitemud River	46
39	Site Regions	66
	Black and White Stereopairs (LIFT Photography):	
40	Riding Mountain Till Plain, Twp. 17, Rge. 16W	71
41	Minnedosa-Reston Till Plain, Twp. 13-14, Rge. 17-18W	71
42	Upper Assiniboine Delta, Twp. 12, Rge. 14W	72
43	Upper Assiniboine Delta, Twp. 12, Rge. 13W	72
44	Lower Assiniboine Delta, Twp. 15, Rge. 13W	73
45	West Lake Plain, Twp. 15, Rge. 10W	73

List of Figures (Cont'd)

Figure		Page
46	West Lake Plain, Twp. 19, Rge. 12W	74
47	West Lake Plain-Lower Assiniboine Delta, Twp. 16, Rge. 14W	74
	Hypothetical Crosscuts Showing Relation of Site to Capability for Forestry:	
48	Riding Mountain Till Plain, Riding Mountain Escarpment and West Lake Plain	75
49	Minnedosa-Reston Till Plain and Upper Assiniboine Delta	76
50	Upper Assiniboine Delta, Manitoba Escarpment and Lower Assiniboine Delta	77
51	a) Beach ridge, b) Ridge and swale, c) Undulating till, d) Dune	78

LIST OF TABLES

Table		Page
1	Woodland categories averages per subwatershed district	37
2	Shelterbelt trees and shrubs planted in Manitoba (Indian Head Planting Stock), 1901-1971	54
3	Trees planted in Spruce Woods Forest Reserve, 1904-1929	56
4	Trees planted in Spruce Woods Forest Reserve, 1945-1971	58

LIST OF MAPS

(In packet)

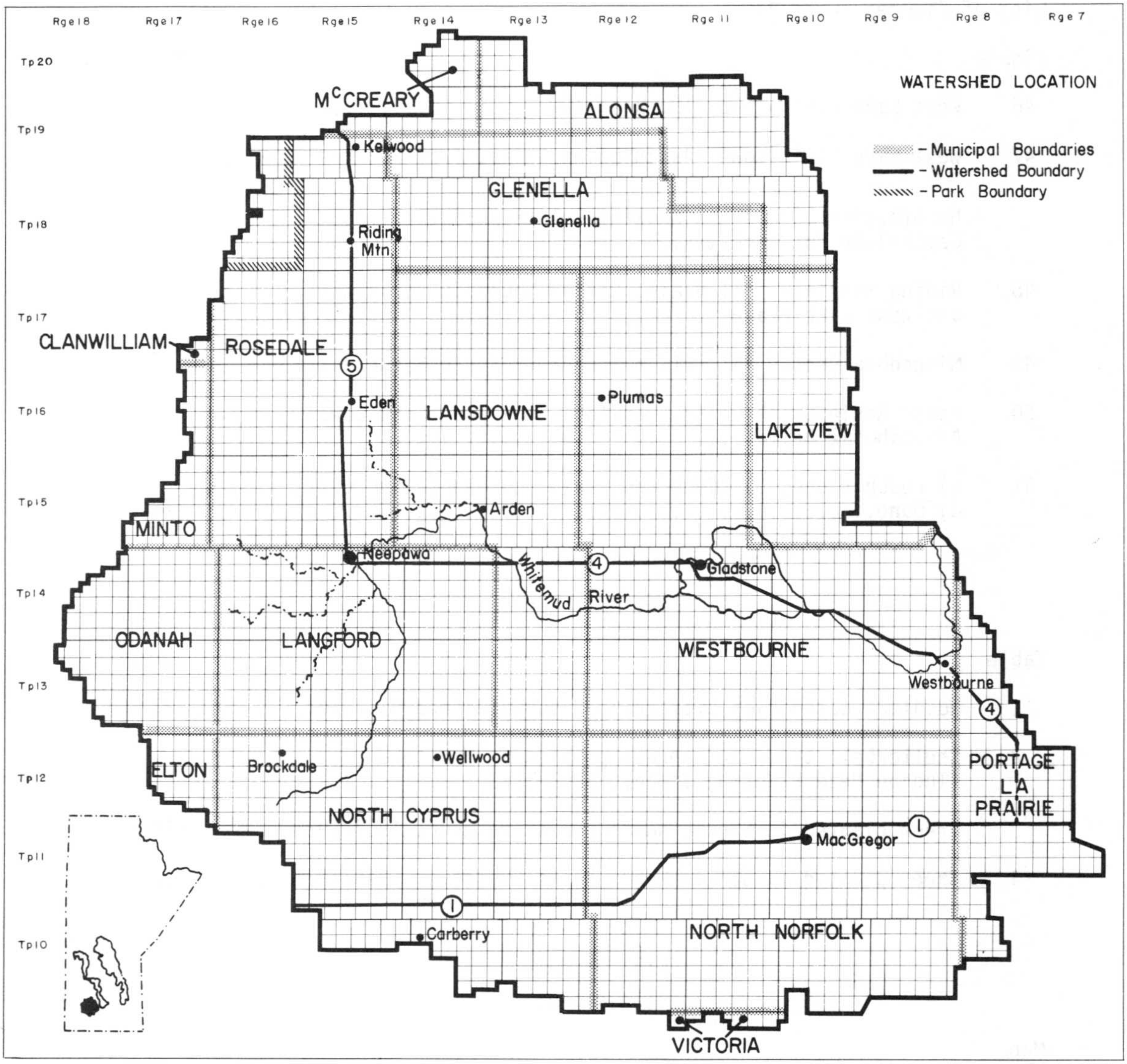
Map	
1	Tree Cover Distribution
2	Land Capability for Forestry

---

* Figures 2, 3, 5, 15, 20, 26, 28, 34 and 35 provided by the Wildlife Sector, Resource Projects.

Figure 16 prepared after a map by A. B. Ransom.

WHITEMUD RIVER WATERSHED RESOURCE STUDY AREA



INTRODUCTION

In 1953 several reeves and mayors, deeply concerned that the attempts to control water runoff were failing in the watershed, met in Neepawa. They realized that problems of the removal of topsoil as a result of erosion, declining assessments, increased rates of land abandonment, regular flooding of the Whitemud River, could not be dealt with by single municipality efforts. Such problems had to be combatted on a regional scale and it became apparent that the most effective means of overcoming the problems of soil and water erosion would be in terms of watershed management.

Since 1953 a Whitemud River Watershed Committee has existed in one form or another. In response to the appeals made by the committees the Whitemud River Watershed Resource study was initiated in the spring of 1970. This study has been conceived as an integrated approach to resource management as outlined in the Phase I Prospectus.

The objectives of the forestry input are to describe existing and potential forest resources in the study area - "Results obtained in achieving the objectives should provide a basis for estimating and planning better and more intensive uses of productive and unproductive natural vegetation. They can be of assistance in evaluation of reforestation or afforestation procedures to reduce apparent problems of soil erosion and inundation. Only after knowing the past and present distribution of the natural vegetation can attempts be made to find relations between the hydrological regime of the area and the natural vegetation. Knowledge in this area could provide alternative solutions to an engineering approach to the problems". - (Phase I Prospectus).

To achieve the objectives an attempt has been made to answer the following questions:

- *What is the present distribution and condition of the forest resource in the watershed?*
- *What is the forest capability in the watershed?*

GENERAL DESCRIPTION

The Whitemud Watershed area is comprised of 1,777,291 acres in south-central Manitoba of which 17,752 acres lie within the boundary of Riding Mountain National Park.

The population of the area is concentrated in the arable regions. The three main service centers are the town of Neepawa, Gladstone and Carberry. In the well settled areas good roads are plentiful. Highways #1 and #4 traverse the area from east to west in the southern and central part respectively. Highway #5 traverses the area from Neepawa to the north. In addition to these three main routes there are many other good roads with either paved or gravel surface. The more sparsely populated areas lack a good road system. The existing railways are adequate to serve the needs of the region.

The main source of income is agriculture and related industries and services. Recreation and tourism provide some income for the area around Riding Mountain National Park. Forest operations are of no importance to the economy. Some sawmills were operated in the area using timber from Riding Mountain. Locally, some timber is cut for household and farm use.

Physiography

The Manitoba Escarpment traverses the area from the northwest corner to the southeast part, following the 1100-foot contour. The Escarpment divides the area into two broad physiographic units; the Western Upland above the Escarpment on the west and the Manitoba Lowland below the Escarpment on the east.

Relief in the Watershed varies from 2250 feet above sea level on the Riding Mountain Upland to about 825 feet (A.S.L.) in the southwestern part. East of the Escarpment the land slopes very gradually to the east. The rise in elevation on the escarpment and especially on the east slope of the Riding Mountain is very sharp.

The underlying bedrock ranges from dolostone, limestone, shale and gypsum east of the Escarpment to shale and sandstone west of it. The

WHITEMUD RIVER WATERSHED RESOURCE STUDY AREA

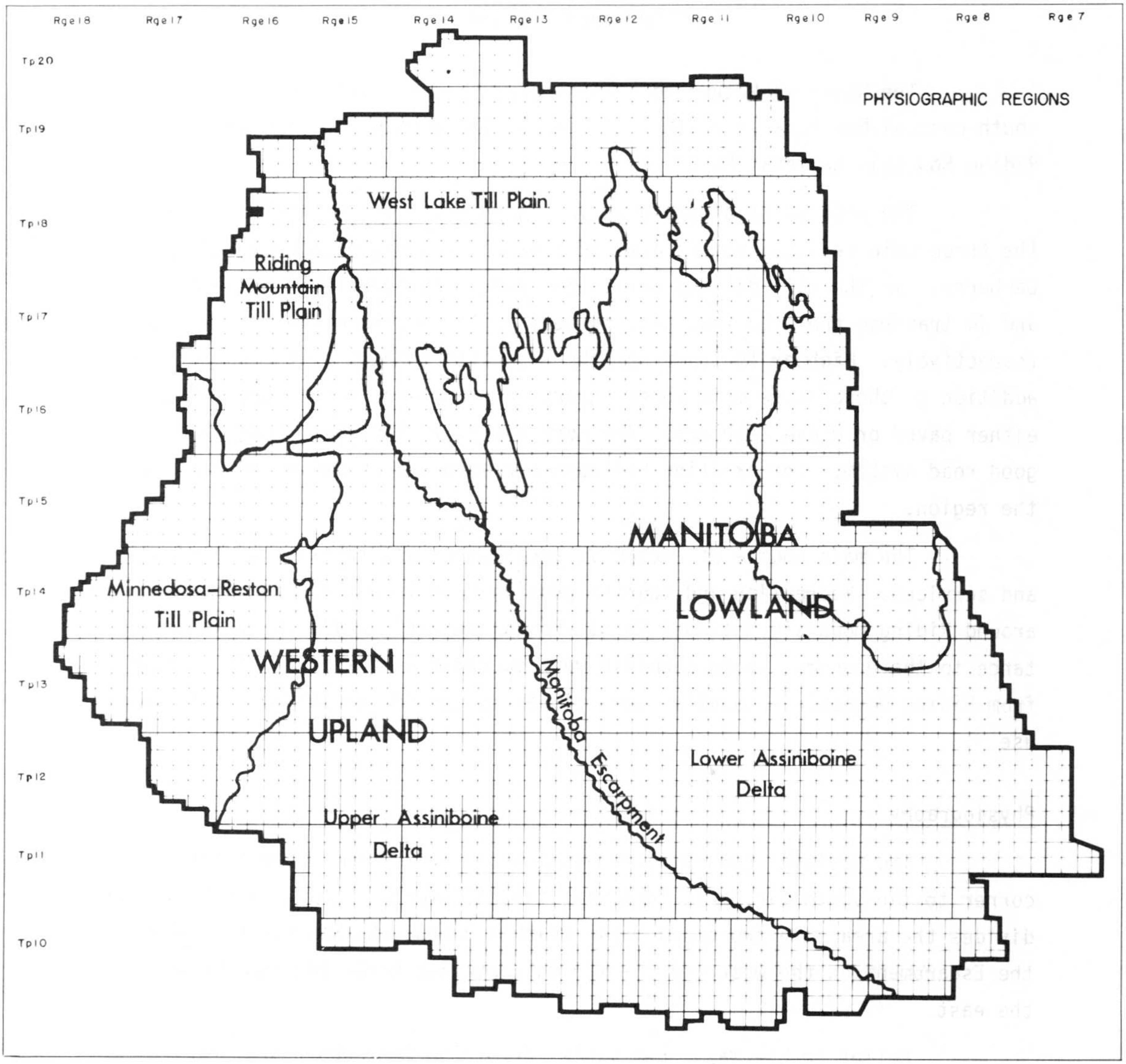


Figure 1. Physiographic Regions.

shale bedrock is exposed or close to the surface in many places along the east slope of Riding Mountain.

Landforms and Physiographic Regions (Fig. 1). The Whitemud Watershed area, including the Riding Mountain, was covered by ice during the last glaciation, of the Wisconsin ice age. Land ice covered the area also during previous ice ages. The glacier covered the area with till deposits composed of materials derived from the bedrock formations underlying the area proper; from bedrock formations to the north and east and from other materials it advanced over.

The most extensive glacial till deposit is the ground moraine, characterized by a topography of a succession of low knolls and depressions. The material is unsorted, contains stones and boulders and textures range from loam to clay loam. Ground moraine covers most of the *West Lake Plain* east of the Escarpment, the *Riding Mountain Till Plain* and the *Minnedosa-Reston Till Plain* both west of the Escarpment.

The surface materials of the West Lake Till Plain (Fig. 2) are derived, for a large part, from limestone and dolostone, resulting in very calcareous deposits. The area is rather flat with a very gradual decline from west to east. Microrelief is caused by the ridge and swale topography and the occurrence of beaches. Drainage is poor in large parts of the plain as a result of the topography. The swales are very wet and large areas are poorly drained as a result of the direction of the beaches perpendicular to that of landfall.

The parent materials in the Minnedosa-Reston Till Plain and the Riding Mountain Till Plain are moderately calcareous. These materials are derived for a large part from non-calcareous bedrock such as shale and sandstone. The Minnedosa-Reston Till Plain (Fig. 3) is an undulating plain with knolls and numerous poorly drained depressions. The Riding Mountain Till Plain (Figs. 4 and 5) is composed of ground moraine deposits, end moraine deposits (deposits formed at the margin of the ice sheets) and glacio-fluvial (eskers, kames and outwash). The materials of the end moraine are often water modified, unsorted and very stony, with textures varying from sandy loam to clay loam. Glacio-fluvial material is very coarse in texture. As a result of the different kinds of surface deposits and the underlying bedrock configuration the topography is rough to hilly.

After the retreat of the ice sheet glacial Lake Agassiz covered the area below the 1300-foot contour. The Assiniboine River, draining glacial Lake Souris into Lake Agassiz, formed an extensive delta.

The *Upper Assiniboine Delta* (Fig. 6) (above the 1100-foot contour) is composed of coarse to medium textured deposits. The medium fine sand deposits form a smooth and level plain, underlain at a shallow depth by thick beds of stratified sands. Microtopography is caused by drainage channels incising the plain. Much of the coarse textured deposits are modified by wind action and blown into sand dunes causing a hilly topography. The medium textured deposits bordering the Escarpment are deeply incised by numerous ravines. Topography ranges from level to rough. The Upper Assiniboine Delta is well drained as a result of the permeability of the deposits.

The *Lower Assiniboine Delta* (Fig. 7) (below the 1100-foot contour) is a smooth sandy lacustrine plain with the thickness of the sandy deposits varying from 3 to 15 feet over lacustrine clays and till. As a result of the topography, impermeability of the sub-surface material, drainage in large areas is imperfect to poor.

The southeast portion of the watershed is covered by fine textured lacustrine deposits forming part of the Red River Plain.

As the lake level subsided the area east of the Escarpment was subjected to wave erosion. Many beaches were formed during the different stages of glacial Lake Agassiz. The tills of the West Lake Till Plain show strong evidence of being waterworked. The ridges often have a stony surface as a result of wave action.

Along the Manitoba Escarpment, especially along the east slope of Riding Mountain streams deposited alluvial sediments forming numerous fans. Alluvial sedimentation still occurs in the river valleys; in depressional areas organic deposits are being built up.

Climate

The climate of the area varies from boreal-temperate, dry subhumid in the Manitoba Lowland to boreal-temperate, normal (or median) subhumid in the Riding Mountain. Characteristic are the relatively short warm summers and long cold winters and low precipitation. The frost free

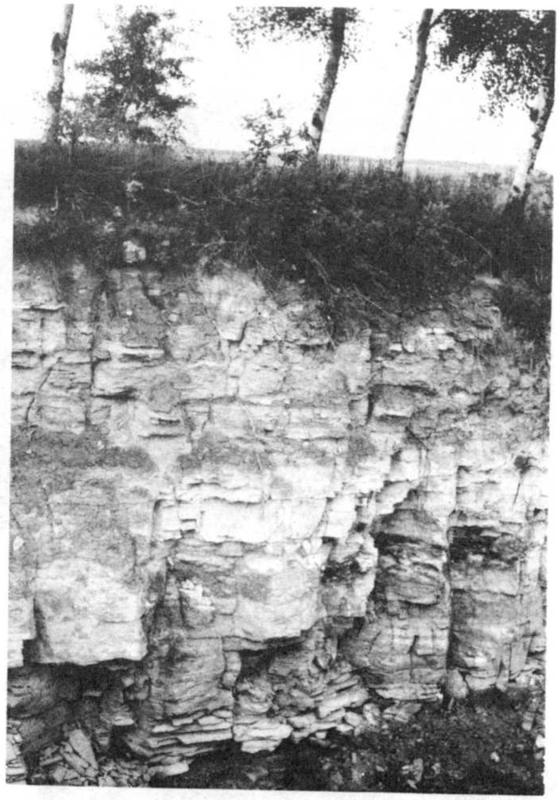


Figure 2.

West Lake Plain. Till over shale bedrock. Twp. 17, Rge. 14-15W.

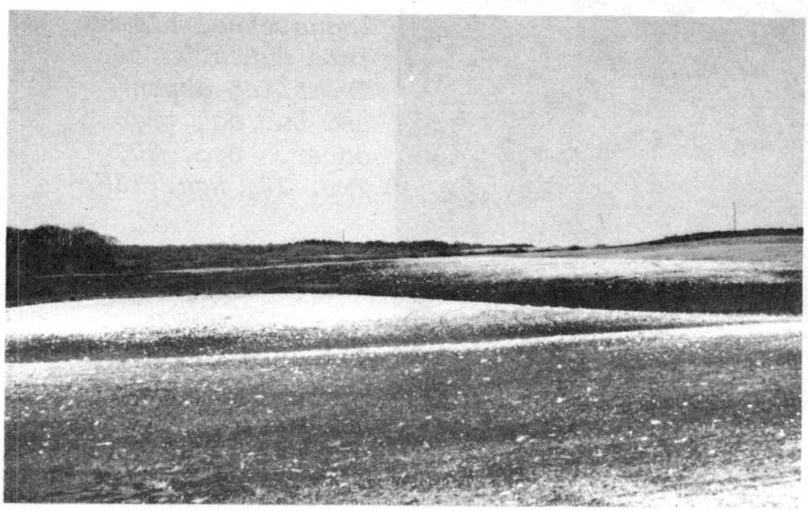


Figure 3.

Minnedosa-Reston Till Plain. Very gently undulating ground moraine. Note the erosion of the knolls.

Figure 4.

Riding Mountain Till Plain. Rolling ground moraine. Mixed stands of trembling aspen and white spruce. Sec. 13, Twp. 18, Rge. 16W. Note barren shale ridge in foreground.

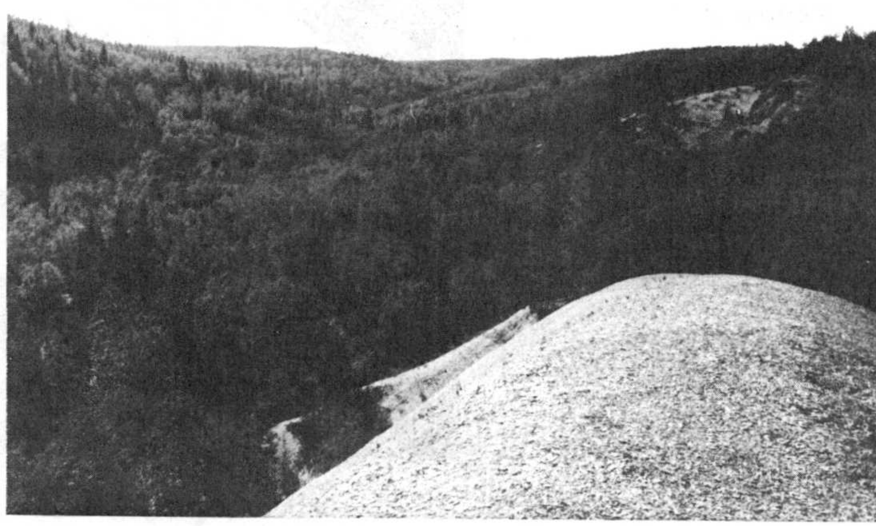
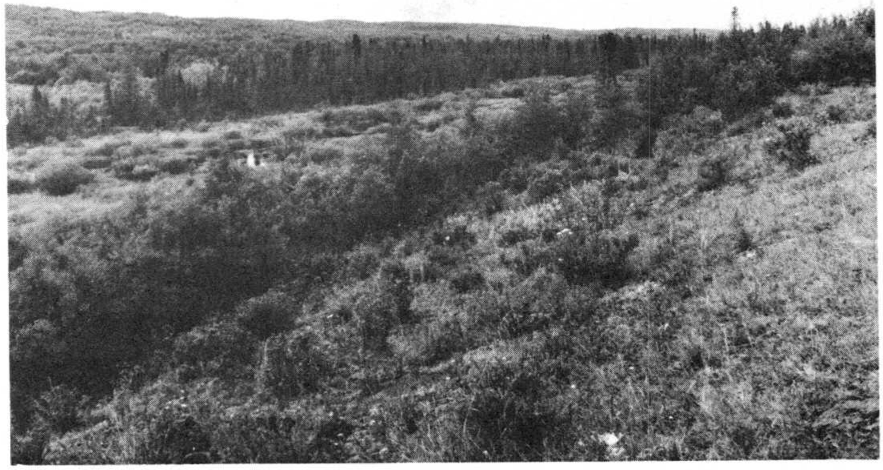


Figure 5.

Riding Mountain Till Plain. Recent alluvium and alluvial terraces. Gently undulating. Black spruce and tamarack stand in depression. Sec. 34, Twp. 17, Rge. 16W.



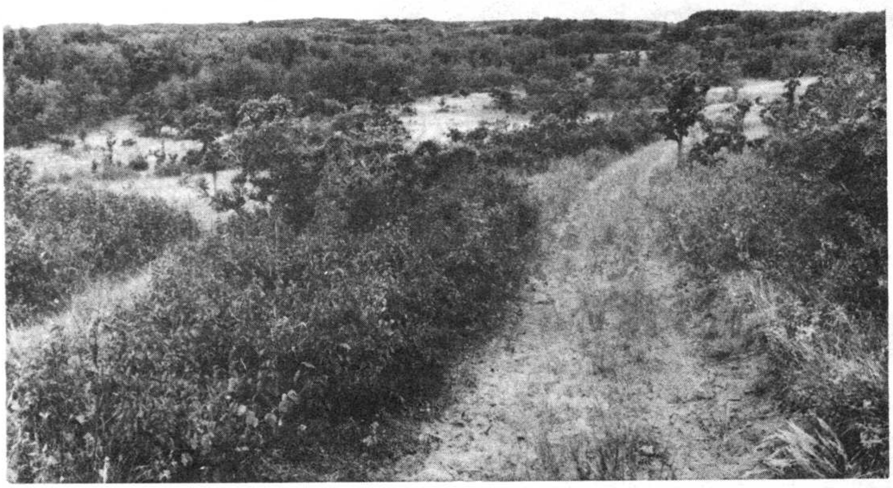
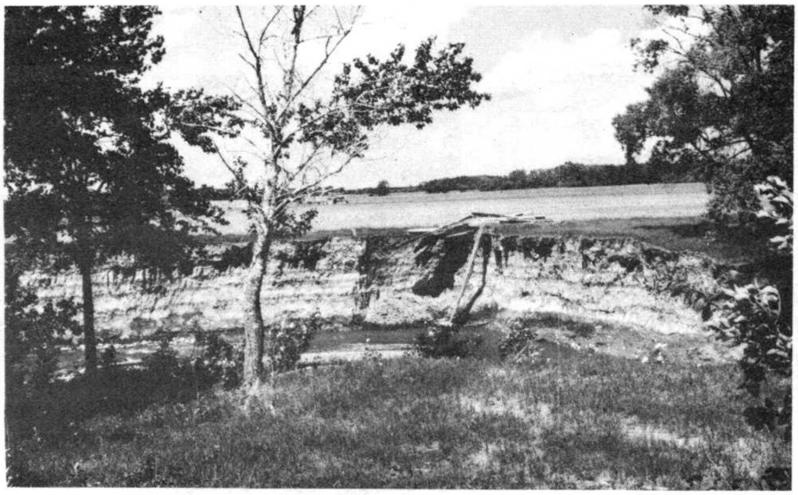


Figure 6.

Upper Assiniboine Delta. Coarse to medium textured lacustrine, blown into dunes. Trembling aspen and bur oak tree cover. Sec. 20, Twp. 13, Rge. 13W.

Figure 7.

Lower Assiniboine Delta. Alluvium over lacustrine deposits and till. Sec. 7, Twp. 17, Rge. 14W.



season varies from about 130 days in the very western part of the watershed to less than 95 days on Riding Mountain. The mean temperature in January is from -2^{0} to 0^{0} F in the Lowland and about -5^{0} F on Riding Mountain, while the mean temperatures for July are 66^{0} F to 68^{0} F and 63^{0} F respectively. Average annual precipitation varies from 17 to 18 inches in the eastern and southern portions of the area to about 22 inches in the Riding Mountain Area. Approximately 60 to 70 percent of the precipitation falls during the months of May to September. Potential evapotranspiration is between 22 and 23 inches in the Lowland and between 20 and 22 inches on Riding Mountain. Well drained sites[1] under forest cover, usually have a shortage of available moisture during parts of the growing season.

Soils

The development of soils is a result of the interaction of parent material, topography, precipitation, vegetation, man and time. Consequently, the soils differ from region to region but also within a specific region.

In the area outside the Riding Mountain Till Plain the most extensive soil, developed on well drained sites with a history of grass cover, is the Chernozemic Black. Areas which are wetter and have developed under tree cover rather than grass show evidence of degradation. Here the Chernozemic Dark Gray is common. Poorly drained areas have Gleysolic profiles and in very wet depressions Organic soils are found. On the medium textured deposits along the Manitoba Escarpment Luvisolic Dark Gray Wooded and Chernozemic Dark Gray soils have developed as a result of a long history of forest cover. In the duned areas profile development is very limited and most of these soils can be classified as Regosols. The soils developed on the highly calcareous till deposits of the West Lake Till Plain are very shallow Black soils on the well to slightly imperfectly drained sites and Gleysolic and Organic in the depressions.

On the Riding Mountain Till Plain the dominant soils are Luvisolic Gray Wooded and Dark Gray Wooded. These soils have developed under forest

---

[1] Site has been defined by the American Society of Foresters as "an area, considered as to its ecological factors with reference to capacity to produce forests or other vegetation; the combination of biotic, climatic and soil conditions of an area". (Soc. Am. For., 1952).

cover on various kinds of parent materials. Other soils such as Dark Gray, Black and Organic can also be found. Along the Escarpment especially along the east slope of the Riding Mountain and along streams, Regosols are found on alluvial deposits.

Site Regions

Two ecologically significant site regions[1], marked 5Sn and 5Sd on the index map are recognized in the watershed. The 5Sd region (Boreal-temperate, dry subhumid) includes the larger part of the study area. The remainder of the area lies within the 5Sn region (Boreal-temperate, normal [or median] subhumid).

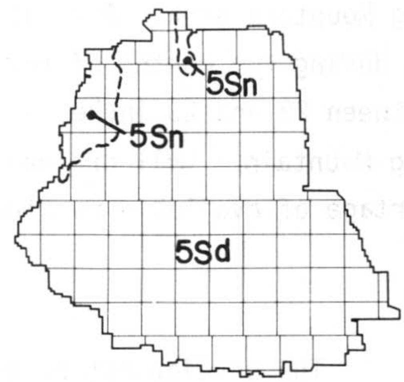


Figure 8. Site Regions.

Forest Vegetation. The *5Sn region* (Figs. 10 and 11) is characterized by a forest association, on the well-drained uplands, consisting of a mixture in varying proportions, of coniferous and deciduous tree species. The main components of this association are trembling aspen *(Populus tremuloides)*, balsam poplar *(Populus balsamifera)*, white birch *(Betula papyrifera)*, white spruce *(Picea glauca)* and balsam fir *(Abies balsamea)*, trembling aspen being the most abundant species. On drier sites jack pine *(Pinus banksiana)* is the dominant species. Jack pine will occur in pure stands but on upland sites jack pine grows in mixtures with black spruce *(Picea mariana)*. Black spruce and tamarack *(Larix laricina)* stands have developed in wet to very wet depressions; peat development is, however, not very deep in these areas. White elm *(Ulmus americana)*, green ash *(Fraxinus pennsylvanica* var. *subintegerrima)* and Manitoba maple *(Acer negundo)* occur

---

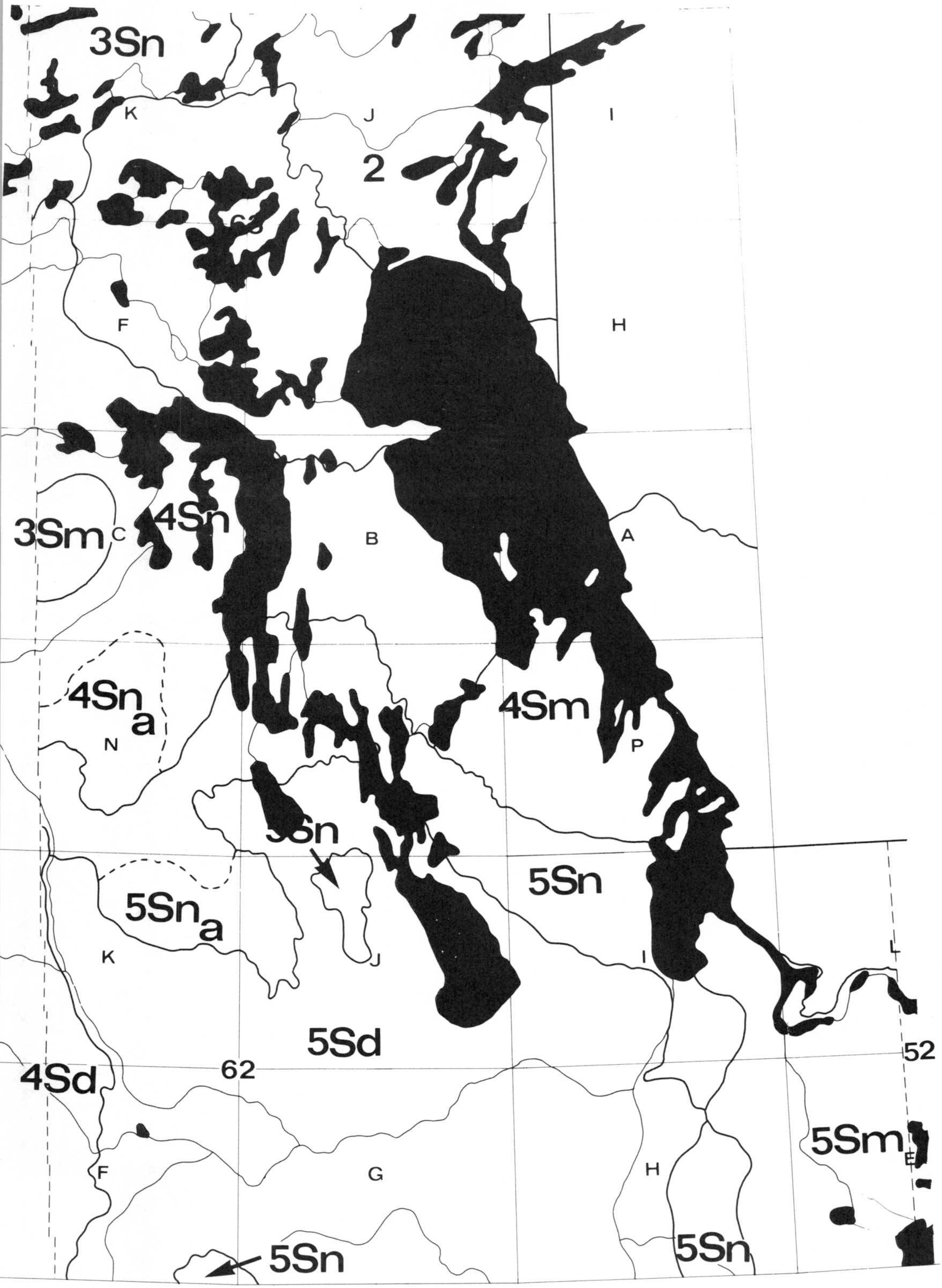
[1] A site region is a macroclimatic region with an effective climate indicated by a characteristic succession of vegetation on specific landforms and the consistent pattern of the response of vegetation to the features of the landform.

ECOLOGICALLY SIGNIFICANT SITE REGIONS

2	Boreal - Arctic
3Sn	Boreal Normal (or Median) Subhumid
3Sm	Boreal Moist Subhumid
4Sm	Moderate - Boreal, Moist Subhumid
4Sn	Moderate - Boreal, Normal (or Median) Subhumid
	$4Sn_a$ Slightly Cooler and Moister than 4Sn
4Sd	Moderate - Boreal, Dry Subhumid
5Sm	Boreal - Temperate, Moist Subhumid
5Sn	Boreal - Temperate, Normal (or Median) Subhumid
	$5Sn_a$ Slightly Cooler and Moister than 5Sn
5Sd	Boreal - Temperate, Dry Subhumid

in minor quantities mainly on alluvial soils. Bur oak is found on dry sites especially in the contact zone with the 5Sd region.

The *5Sd region* (Figs. 12, 13, 14 and 15) is characterized by the prevalence of trembling aspen. In the southern part of the region the occurrence is confined to small patches of trees, often ringing depressions. To the north the stands become larger and extensive areas are covered by forest. Balsam poplar is found throughout the region but is more prevalent in moist locations. Bur oak *(Quercus macrocarpa)* occurs throughout the region on sandy gravelly ridges on shallow dry soils, on dunes and along rivers. Bur oak is often mixed with species such as trembling aspen. White elm, green ash, Manitoba maple and to a lesser extent eastern cottonwood *(Populus deltoides)* and basswood *(Tilia americana)* are found along streams on alluvial soils.



gure 9. Ecologically Significant Site Regions

Figure 10.

Riding MOuntain Till Plain. White Spruce stand on imperfectly drained loamy till.

Figure 11.

Riding Mountain Till Plain. Mixed stand of trembling aspen and white spruce on imperfectly drained loamy till. Sec. 29, Twp. 17, Rge. 17W.

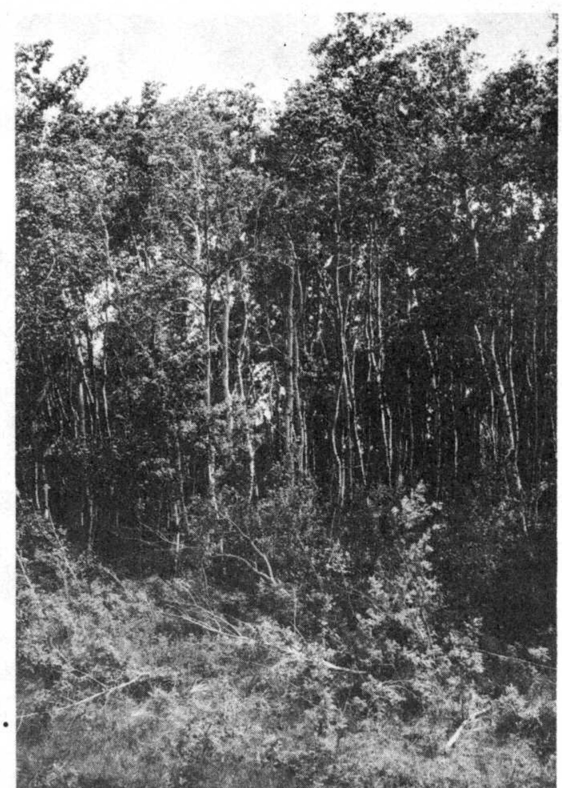


Figure 12.

Upper Assiniboine Delta. Trembling aspen on medium textured, imperfectly drained lacustrine deposits. Sec. 14, Twp. 15, Rge. 15W.

Figure 13.

Upper Assiniboine Delta. Coarse textured lacustrine deposits blown into dunes. Tree cover of trembling aspen and bur oak.

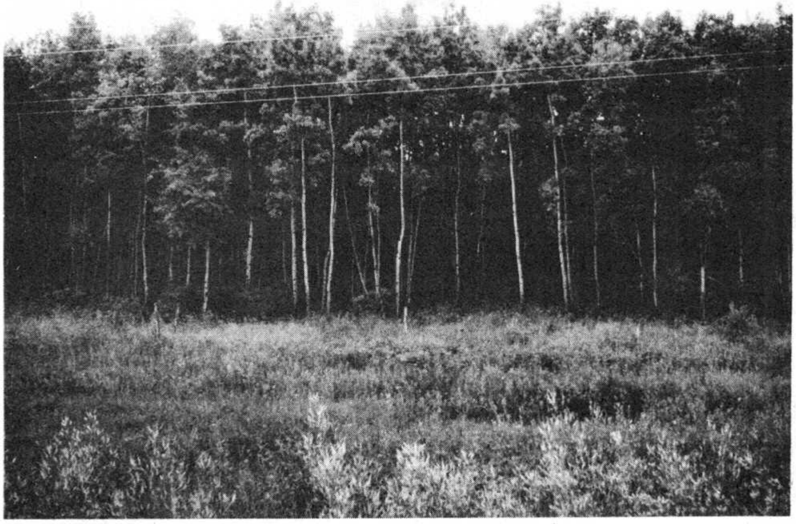


Figure 14.

Upper Assiniboine Delta. Trembling aspen stand on imperfectly drained, medium textured lacustrine deposits. Sec. 14, Twp. 15, Rge. 15W.

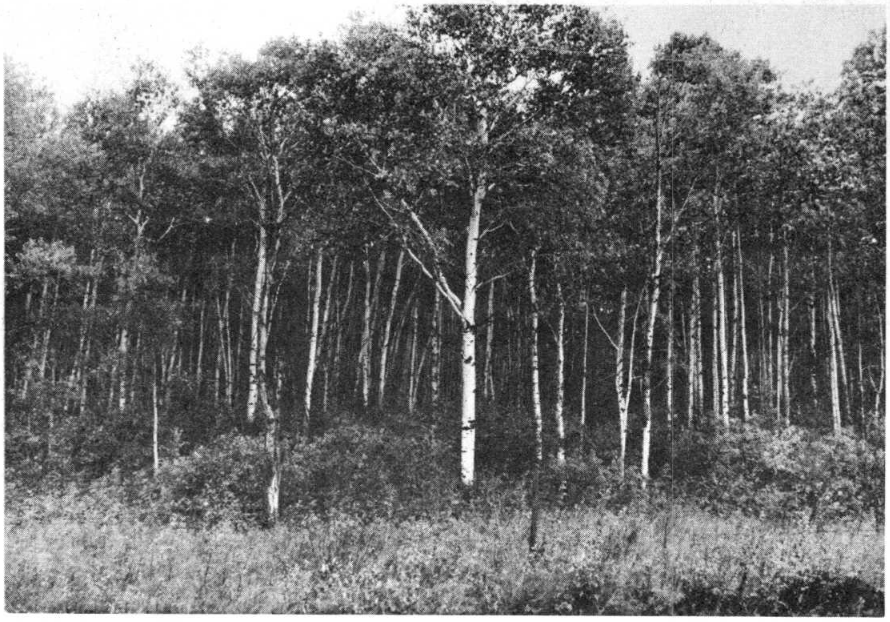


Figure 15.

West Lake Plain. Trembling aspen stand on loamy highly calcareous, imperfectly drained till. Sec. 7, Twp. 19, Rge. 12W.

FOREST HISTORY

Vegetation history since deglaciation has been revealed by palynological analyses and by records of the early explorers and first surveyors and settlers. Intensive forest utilization commenced with settlement and the construction of rail lines across the watershed. Riding Mountain was extensively logged from the late 1800s to 1930. Fires, land clearing, drainage, livestock and tree diseases have drastically changed the landscape.

Post Glacial Tree Cover

Recent pollen analyses by Ritchie[1], relates the regional sequence of vegetation chronology since the last deglaciation of approximately 12,000 B.P. Pollen samples were obtained from drill cores of Holocene limnic sediments from the uplands west of the glacial Lake Agassiz basin. Sites were selected in similar landform regions and cores were taken from small lakes or ponds in hummocky moraine or related glacial deposits.

Variations in tree pollen production, indeterminable source, dispersal range, and preservable qualities pose serious problems to interpretation and collation of pollen spectra. Quantitative studies, therefore, are not as acceptable as a landform - vegetation relationship. Distinctive assemblages are characteristic of landform units.

Vegetation history of the uplands west of the glacial Lake Agassiz basin was correlated by carbon - 14 dates spanning approximately 12,500 years. A relatively high frequency of spruce pollen occurred in the lowest assemblage coincident with 12,500-10,500 B.P. Areas presently occupied by deciduous forest, aspen parkland or mixed deciduous-coniferous forest were dominated by grassland after 10,500 to 4,000 B.P. It is suggested that this marks a climatic amelioration of increased temperatures and reduced precipitation, more conducive to zeric plant communities. A gradual transition from grassland to oak-birch-poplar forest took place between 4,000 and 2,000 B.P.

---

[1] Ritchie, James C. Holocene Vegetation of the Northwestern Precincts of the Glacial Lake Agassiz Basin. Life, Land and Water. Proceedings of the 1966 Conference on Environmental Studies of the Glacial Lake Agassiz Basin. pp. 217-229.

on the areas presently occupied by deciduous forest or aspen parkland. Areas now inhabited by mixed deciduous coniferous forest were transformed from grassland to birch-poplar-oak forest about 4,000 B.P. and eventually to spruce-birch-poplar forest similar to the present conditions. The final invasion of forest originated from northwestern and southern sources.

Radiocarbon dated pollen diagrams prepared by Nichols[1] indicates that spruce forest near Porcupine Mountain more than 100 miles north of the watershed was replaced by grassland about 6700 B.P. and reverted to spruce forest about 4,200 B.P. This climatic sequence is not entirely synchronous with Ritchie's paleoecological succession but there is some approximation to his dates. Glacial recession from Porcupine Mountain occurred about 9,000 B.P. which caused a paleoclimatic lag. This might account for the chronological difference of vegetation history.

A "cool-dry" climate with frozen and wet ground supporting a "marsh-grassland" community during the period 11,500-9,000 B.P. is suggested by Love.[2] This was followed by a riverine spruce parkland with a seed source presumably from the foot of the western Cordillera transported by post-glacial streams.

During a warm climatic period referred to as the "hypsithermal" commencing before 9,000 B.P., a broad-leaved forest invaded from the south. This accounts for the present incidence of bur oak *(Quercus macrocarpa)*, white elm *(Ulmus americana)*, basswood *(Tilia americana)*, green ash *(Fraxinus pennsylvanica* var. *subintegerrima)* and Manitoba maple *(Acer negundo)* along most river channels in south and western Manitoba. The poplars evidently originated from both the west and south. At that time a pine-oak savannah apparently occupied the drier upland sites. Jack pine *(Pinus banksiana)* originated from the west and south.

---

[1] Nichols, Harvey. The Late Quaternary History of Vegetation and Climate at Porcupine Mountain and Clearwater Bog, Manitoba, Arctic and Alpine Research Volume 1, No. 3, 1969. pp. 155-167.

[2] Love, Doris. The Postglacial Development of the Flora of Manitoba: A Discussion. Contribution from the Institute Botanique, Universite de Montreal, Montreal, Quebec. Canadian Journal of Botany, Volume 37 (1959). pp. 547-585.

A period referred to as the "Long Drought" between 7,000 and 4,000 B.P. provided the climatic condition which permitted the advance of western prairie flora with an affinity for "dry-warm" sites.

A cooling trend by 2,000 B.P. caused a consequent shift in vegetation belts. An expansion of spruce ensued which it is believed is still in progress at the rate of 3 miles per 100 years.

The deciduous zone which is invading the prairie sites is being encroached upon by the extension of the spruce range. Aspen which was initially suppressed by fire presently is protected from fire and is expanding its range by root suckering and would gradually diminish the prairie areas if man did not check the spread of trees by cultivation.

Climatic factors may have been the primary influencing force that caused this cyclic change of vegetation. However, the interaction of climate, aboriginal man, large herbivores and the rate of encroachment of tree species may have caused the dynamic vegetative variability.

Tree Cover During Settlement

The diaries, maps and field notes of the explorers and land surveyors who travelled through the area between 1857 and the end of the century together with the written descriptions of the first settlers and travellers give a reasonable account of the occurrence and distribution of tree cover within and surrounding the watershed both prior to, and during settlement.

The southeast part of the Riding Mountain till plain, was depicted by J. B. Tyrell. Sent by the Dominion Government in 1887 to describe the geographical features of northwestern Manitoba he indicated that "the whole land surface is more or less thickly timbered, the woods varying, however, from a few scattered clumps of willows...through groves of poplar severed by open glades...to coniferous forest on the summit and northern and eastern flanks of the mountains".[1] (Riding Mountain and Duck Mountain). This is in contrast to the present forest condition along the flanks that are not cleared for agriculture which are predominantly deciduous forest with almost non-existent coniferous cover. Logging, fires and browsing wildlife may have

[1] Tyrell, J. B. Notes to Accompany a Preliminary Map of the Duck and Riding Mountains in North-Western Manitoba. p. 7E.

WHITEMUD RIVER WATERSHED RESOURCE STUDY AREA

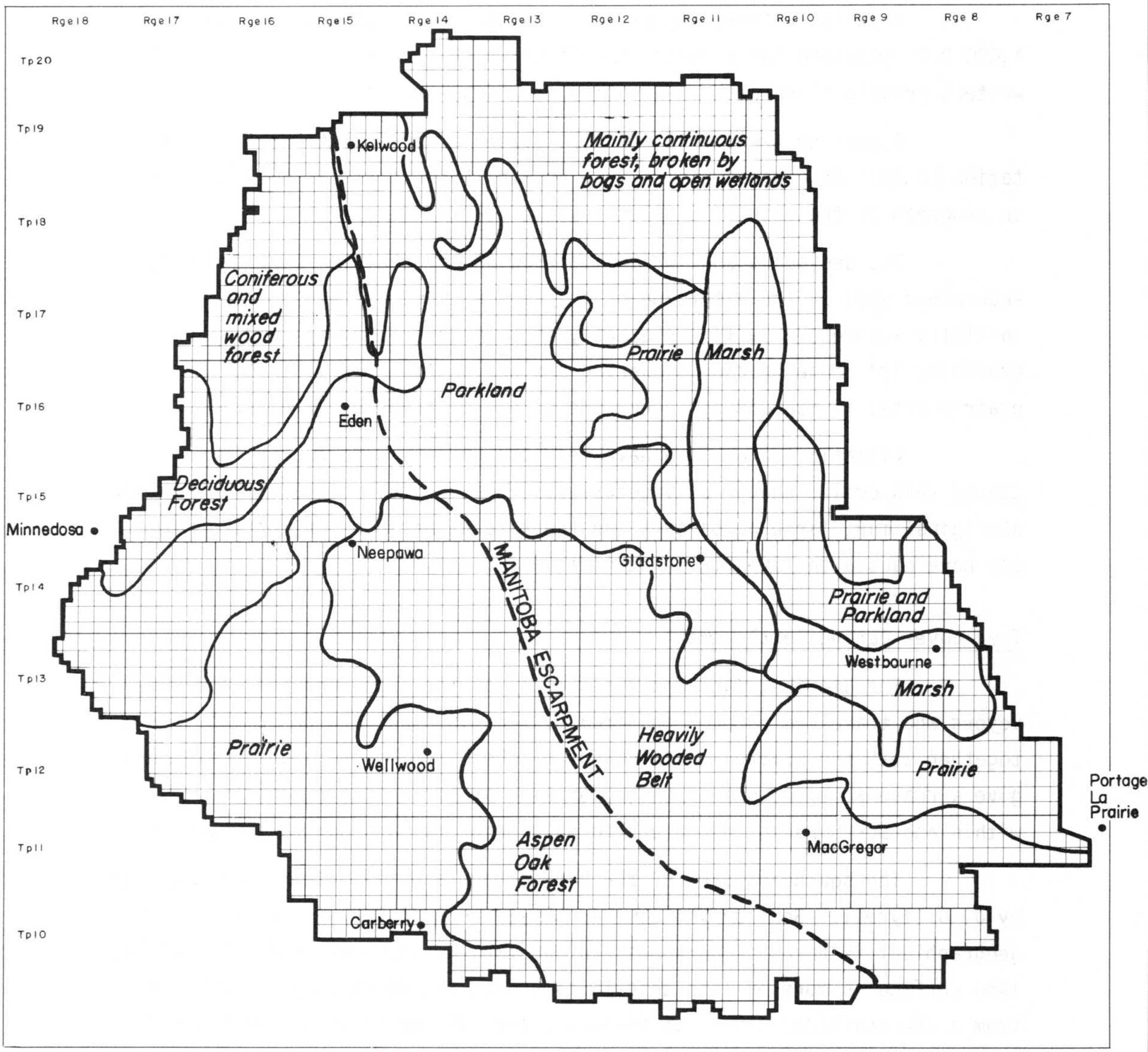


Figure 16. Tree Cover During Settlement (approximates - cover types - Circa 1872).

created the present decadent forest conditions. The summit of Riding Mountain is presently supporting stands of conifers, mixed woods, and hardwoods.

H. Y. Hind[1], in describing his ascent of the escarpment on the northeast side of Riding Mountain (p. 55) said: "The last rise was very abrupt...covered with a fine white spruce, birch, poplar and aspen...". Near their camp on the plateau he recorded diameters of trees of 17" to 19" for aspen, 21" to 28" for white spruce, 12" and 13" for birch and 17" and 18" for balsam poplar.

The West Lake Till Plain, in the north and northeast portion of the Watershed was a more or less continuous canopy of deciduous trees broken by bogs and open wetlands (Fig. 16).

A large parkland expanse, extended from the present town of Gladstone to Kelwood on the Lower Assiniboine Delta and West Lake Plain. Groves and bluffs of aspen, balsam poplar, and willow dotted the landscape around moist depressions. Early travellers described it as a poplar strewn plain. The parkland continued above the escarpment on the Minnedosa-Reston till plain in a wide band from the present town of Eden to Neepawa to the west and south beyond Minnedosa.

Aspen-oak forest extended from south and east of the present town of Neepawa in a wide band above the escarpment and continued beyond the southern boundary of the watershed. There was also a wide heavily wooded belt southwest of Gladstone below the escarpment which continued south of Portage la Prairie in the east.

Large marshes extended north of Gladstone and south of Westbourne. Natural prairie tracts were located south and west of Wellwood, north to Neepawa and northwest of Portage la Prairie, surrounding the large marshes.

Along the course of the Whitemud River, bur oak *(Quercus macrocarpa)*, green ash *(Fraxinus pennsylvanica* var. *subintegerrima)*, white elm *(Ulmus americana)* and Manitoba maple *(Acer negundo)* grew to impressive sizes with

---

[1] Hind, H. Y. 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858, 2 Volumes.

diameters exceeding two feet. H. Y. Hind[1] wrote in 1858 "...The riverbanks are well timbered with oak, elm, ash, maple, aspen and balsam poplar...".

The landscape along the Whitemud River near Gladstone was described during a visit by the Lieutenant Governor, Adams G. Archibald in September, 1871: "The scenery of the Whitemud River is beautiful. Along the margin of the stream the wood is very fine. Forests of oak and maple and poplar stretch away from either side to a considerable distance from the river. The prairie is studded with groves and clumps...Glades of park-like prairie open as the road winds among the trees..."[2]

Channels of creeks and rivers were fringed with trees wherever growing conditions were suitable on the watershed.

Forest Utilization

The Manitoba native people made significant use of wood. Poles for dwellings, fuelwood, spear and arrow shafts, bows, canoes, snowshoes and toboggans were made from species of trees best suited for the specific purpose.

From the inception of settlement an increased use was made of the forest resource. Settlers chose homesteads where wood and water were readily available. The brochures written to promote the area for settlement stressed the advantages of the wooded areas for building material, fuel and fencing. Settlers' dwellings were made of poplar and oak logs and in some locations from spruce and tamarack. Wagons, sleighs, Red River carts, tables, benches, chairs, stools and beds were hewed from wood. Later, barns measuring sixty feed wide by 150 feet long were erected by as many as seventy-five men. Rail fences were common and occasionally fences were made of tree roots and stumps. Before sawmills were built, lumber was whip-sawed and used mainly for flooring at a cost of $60 per thousand foot board measure in 1878.

---

[1] Hind, H. Y. Narrative of the Canadian Red River Expedition, Volume 1 (Toronto, 1859). p. 248.

[2] The Manitoban, 30 September, 1871.

Bridges were initially constructed using logs and eventually replaced with squared timber and heavy planking. There were nine bridges constructed across the Whitemud River after the area had been widely settled. Miles of corduroy road were eventually built of logs across swamps and bogs.

As settlements sprang up, the need arose for lumber. Local sawmills were built in most communities. When timber was not in close proximity to a settlement, portable sawmills were set up in the wooded areas. Settlers also hauled logs, which were cut during land clearing, to local sawmills. Sawmills are mentioned in many local histories and other references, with locations at Bagot, MacGregor, Firdale, Edrans, Carberry, Gladstone, Neepawa, Minnedosa, Arden, Kelwood and McCreary. Riding Mountain was also the site of many portable mills as well as major logging camps and sawmills.

During settlement, homesteaders were allowed to cut timber on Dominion lands up to specified volumes without being charged Crown dues, provided their homesteads had no timber. A regulation enacted in 1906 enabled them to cut 3,000 lineal feet of building timber, 400 roof poles, 500 fence posts and 2,000 rails on Dominion land.

The construction of the Manitoba and North Western railroad to Gladstone in 1882 increased the utilization of wood. Locomotives used wood for fuel and ties were cut for the westward thrust of the railroad. Large volumes of cordwood for heating homes were cut and transported to Winnipeg and Portage la Prairie. When the Canadian Northern (National) Railway was constructed from Neepawa toward Dauphin in the north, a need for fuelwood was satisfied by cutting thousands of cords of white birch from the eastern flanks of Riding Mountain. High quality birch was also cut for furniture stock. In 1905 nine thousand cords of fuelwood were piled at Norgate Siding which is located just outside the watershed boundary to the northwest. All along the rail line were huge stockpiles of fuelwood destined for shipment to Winnipeg and Portage la Prairie. The same year 5,000 cords of fuelwood were shipped from Kelwood.

The establishment of local brick factories in Sidney, Edrans, Brookdale and Minnedosa reduced the need for lumber for exterior finish of buildings. The railroads soon converted to coal burning locomotives. Barbed wire replaced rail fencing. Finally steel, concrete and quarried limestone were used for bridges and large buildings. By 1940 the logging industry, except for local sawmill operations on patent land, was almost non-existent in the watershed.

There is one known wood processing industry in the watershed at Neepawa. Morton Timber Preservatives Limited produce treated poles, posts and rails. The wood for the plant is harvested in the Porcupine Mountains, 200 miles north of Neepawa. One million F.B.M.[1] of hardwoods and one million F.B.M. of conifers is utilized annually. Northern hardwoods are preferred because of their higher quality. Southern hardwoods, mainly trembling aspen appear to be more susceptible to disease and poor form which increases the amount of defective wood.

The present volumes of timber cut on Provincially owned land are negligible. Permits are presently issued on Crown lots in the extreme northeast portion of the watershed for poplar and spruce timber, tamarack and willow fence posts, rails and fuelwood. Annual cutting on Provincial Crown land along the east periphery of Riding Mountain National Park usually does not exceed 25,000 F.B.M. No cutting records are available for privately owned land. It appears that the present cutting trends are not contributing noticeably to erosion.

Riding Mountain Logging History. A portion of Riding Mountain was withdrawn from settlement in 1895 and established as a Timber Reserve. The Dominion Forest Reserves Act was passed in 1906 and it became a Forest Reserve. In 1939 the natural resources of Manitoba were transferred to the Province with the exception of Riding Mountain Forest Reserve which became a National Park. The Park covers 1,114 square miles of which less than 30 square miles is in the watershed.

Logging was extensive on the adjacent upland and in the Forest Reserve after 1880. The southeast corner of the Forest Reserve was intensively logged for railroad ties when the railway to Dauphin was being built in the 1890s. Spruce lumber was shipped to settled areas of the province, to other provinces and to the United States. Spruce saw timber in excess

---

[1] Foot Board Measure - 1" x 1" x 12".

of 7,500,000 F.B.M. was cut on the Riding Mountain Forest Reserve in the fiscal year ending March 31, 1906.[1] A combined total of about 80,000,000 F.B.M. was cut under the authority of settlers permits and licenced berths between 1906 and 1926 on the Forest Reserve. It is estimated from old records that 125,000,000 F.B.M. of lumber was sawn by portable and permanent sawmills in and around the Forest Reserve from 1900 to 1960.

Major logging operations were terminated in 1930 when the forest reserve changed status to a National Park. Cutting within Riding Mountain National Park was then restricted to settlers obtaining allotted amounts under the settlers' regulations. With the exception of salvage of beaver flooded or dead material for rails and posts or fuelwood, cutting within Riding Mountain National Park by the rural population has been terminated since 1969. The present National Parks policy emphasizes the wilderness area concept and the preservation of resources in their natural state.

Fires and Other Disturbances

Prairie wild fires and forest fires were a constant threat to early homesteaders and settlements. Accounts of a large fire which ravaged the area east of Minnedosa in 1884 testify to this. Old histories indicate that 1894 was also a particularly severe year for fires. A disastrous wild fire occurred at Bagot in 1897, which burned houses, two elevators, and large amounts of stock piled fuelwood awaiting shipment. Another devastating fire occurred at Edrans in May, 1903, when settlers' homes and thousands of cords of piled cordwood were burned. A cyclone north of Edrans in the summer of 1901 also caused considerable damage to stands of timber.

The use of fire by the early settlers while clearing land caused many uncontrollable fires, particularly along the boundary of the Riding Mountain Forest Reserve. Between 1885 and 1895 large areas were burned over on Riding Mountain. Since 1900, few fires have burned more than 10 acres on the east side of the park. The south half of township 18, range 16 west was burned between 1941 and 1949.

---

[1] Gill, C. B. Manitoba Forest History (Unpublished).

Control of wild fire has contributed to the invasion of tree growth in areas not presently under cultivation which would normally support grass cover. Repeated fires, grazing cattle and tree diseases such as false timber fungus appear to have deteriorated the condition of the present deciduous cover in the settled areas of the watershed.

An invasion of grasshoppers devoured all vegetation on the land in the summer of 1874. The plague was noted at Minnedosa in the west and at Gladstone in the east and presumably affected the area between these points. A larch sawfly infestation wiped out most of the tamarack where it occurred in the upland in the northwest portion of the watershed between 1906 and 1916.

Land Clearing. The landscape was greatly altered and soils made susceptible to wind and water erosion as settlers cleared large tracts of land of wooded vegetation. This and the construction of drainage systems compounded the already natural existing problem of flooding in the lower lying parts of the watershed.

Land clearing along the eastern boundary of Riding Mountain has contributed to the accelerated rate of erosion of the escarpment. Tree covered areas along the slopes that become eroded are undermined and eventually the trees topple into the ravines.

A land acquisition program along the eastern boundary of Riding Mountain National Park is presently being followed by an intensive reforestation program on the newly procured land. Land clearing is, however, still occurring in the lowland area of the watershed.

PRESENT DISTRIBUTION AND CONDITION OF FORESTS

Lands Presently Under Tree Cover

The data for determining the lands presently under tree cover were provided by the Present Land Use Sector 1:50,000 maps (Canada Land Inventory Project). For the area north of the 50th parallel the maps were compiled in 1967 from 1:15,840 scale aerial photography taken in 1962 and 1964. For the southern part 1:80,600 scale LIFT photography (1970) was interpreted in 1971. Units were delineated onto mosaics and field checks were carried out. The information was transferred onto 1:50,000 scale topographic maps and from these maps the units have been traced and classified as U (Non-Productive Woodland) and T (Productive Woodland). The maps compiled in this way have been reduced to the 1:125,000 scale and the units were traced onto a Whitemud Watershed base map. Map #1 indicates the lands presently under some kind of tree cover. This forest cover is broken down into two classes according to the Present Land Use classification system.

The criteria used for separating the lands into two categories (U and T) are described as follows in the C.L.I. Present Land Use Manual:[1]

Productive Woodland (T)

- Land bearing forest of commercial nature. This includes tracts of wooded land on which the crown cover or canopy density exceeds 25 percent and on which the bulk of trees could be used as sawlogs, pulpwood, fence posts or pulpwood of commercial value (at the time of the photography or field work). Most of the trees in this category are over 20-30 feet in height. Some woodland not meeting these requirements is included when it is known that some immediate commercial use was made of it.
- Artificially restocked tracts or plantations regardless of age or height.

Non-Productive Woodland (U)

- Land with a growth of short trees or bushes. This includes tracts of land where bush and tree scrub cover exceeds 25 percent. Tree scrub consists of short (immature or stunted) trees, i.e., less than 20-30 feet in height. (Willows, alder, saskatoon bushes, etc. are commonly occurring in the Non-Productive Woodland category); often it is tree growth found

[1] McClellan, J. B., L. Jersak, C. L. A. Hutton. A Guide to the Classification of Land Use for the Canada Land Inventory (1967).

WHITEMUD RIVER WATERSHED RESOURCE STUDY AREA

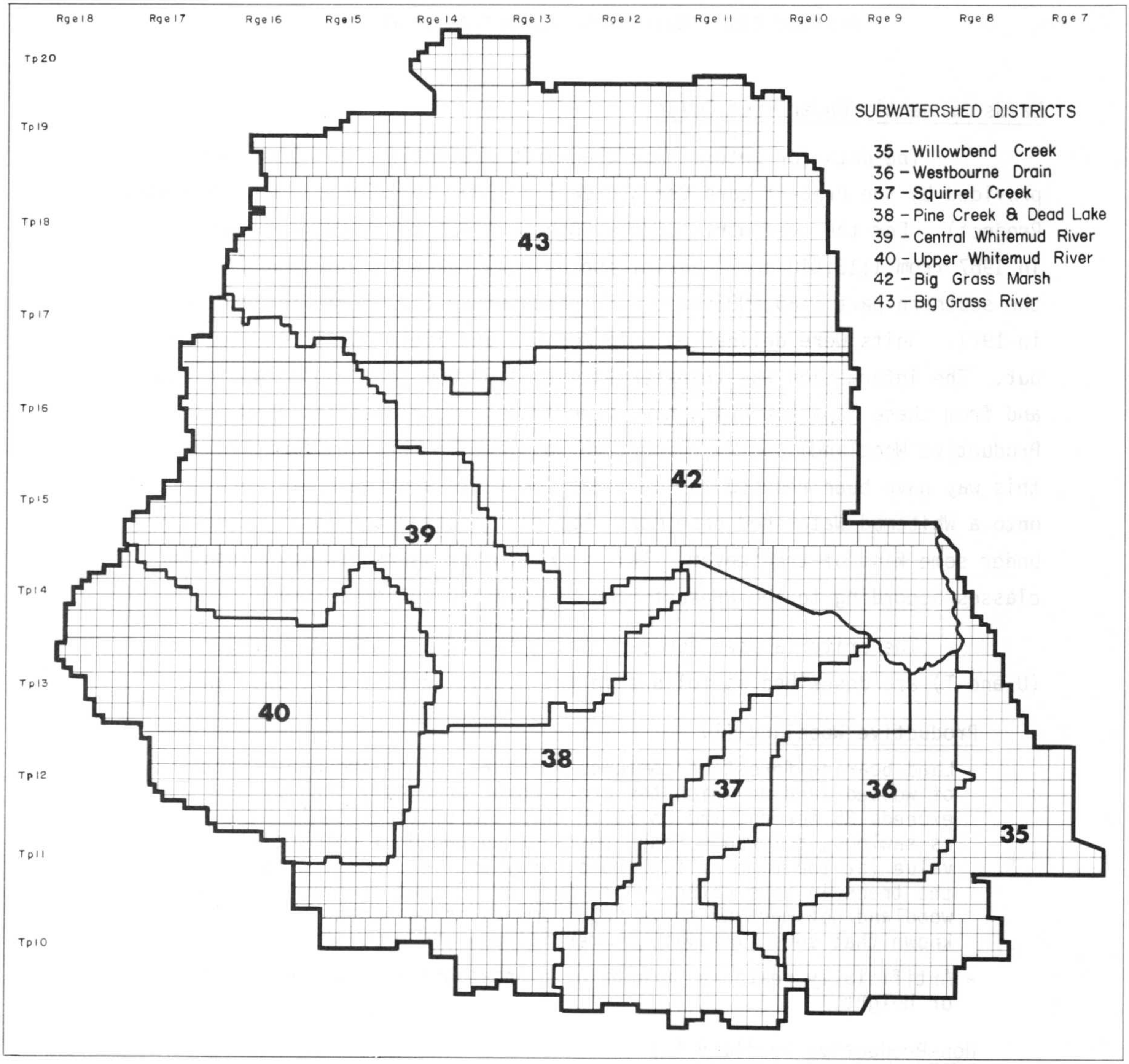


Figure 17. Sub-Watershed Districts.

Table 1.

Woodland categories acreages per subwatershed district (Fig. 17).

Sub-Watershed	Acreage Land Use Category				Percentage		
	Total	T	U	T+U	T	U	T+U
35	124,131	8,924	3,679	12,603	7.2	3	10.2
36	106,835	11,969	2,696	14,665	11.0	2.5	13.7
37	126,019	17,146	18,213	35,359	13.6	14.5	28.1
38	254,567	32,951	44,494	77,445	12.9	17.5	30.4
39	276,256	37,981	26,953	64,934	13.7	9.8	23.5
40	210,583	8,820	16,847	25,667	4.2	8.0	12.2
42	282,161	13,236	21,773	35,009	4.7	7.7	12.4
43	396,739	61,029	55,212	116,241	15.4	13.9	29.3
Total	1,777,291	192,056	189,867	381,923	10.8	10.7	21.5

As the figures indicate a good portion of the Watershed has tree cover of one kind or another. The most extensive tree cover will be found within the boundary of Riding Mountain National Park.

in cut-over or burned-over areas, poorly drained sites or on agricultural land in an advanced stage of reversion to forested land.

- Tracts of land recently logged-off or cut-over, and tracts of forest land recently burned over.

Of the total watershed area 192,056 acres or 10.8% and 189,867 acres or 10.7% fall in land use category T and U, respectively. The breakdown of the acreage per sub-watershed is provided in Table 1.

Forest Composition and Condition

Region 5Sn. The area is distinctly different from the remainder of the Watershed in that the climate is more humid. As stated before the annual precipitation is higher; maximum temperatures are lower during the summer months and the frost-free period is shorter than in lower lying parts of the Watershed.

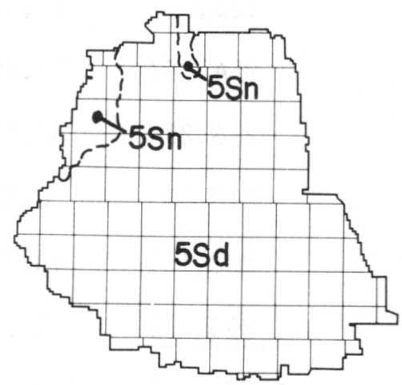


Figure 18. Site Regions.

A large part of this region lies within the Mixed woods Section of the Southern Boreal Forest Zone (Rowe). All tree species characteristic for this section occur in various quantities in the watershed area. The vegetation of the area within the Park's boundary resembles rather closely the natural vegetation of this section before settlement in the past may have altered the composition.

Part of region 5Sn within Riding Mountain National Park[1]. The tree species with the largest areal extent is trembling aspen. Dense, young and mature stands cover many areas, other areas are covered with overmature, decadent stands. The slope is especially heavily wooded with trembling aspen. Hazel *(Corylus cornuta)* forms a dense brush layer in most of the stands. Reproduction of any tree species is very limited as a result of

---

[1] Bailey, R. H. 1968. Notes on the Vegetation in Riding Mountain National Park, Manitoba.

Figure 19.

Riding Mountain Till Plain. Good stand of jack pine (mixed with younger white spruce) on well drained loamy till.

Figure 20.

Riding Mountain Till Plain. Trembling aspen stands on alluvium and alluvial terraces. Sec. 34, Twp. 17, Rge. 16W.

Figure 21.

Upper Assiniboine Delta. Trembling aspen stand on imperfectly drained medium textured lacustrine deposits. Sec. 13, Twp. 15, Rge. 15W. Note the invasion of the wetter area by trembling aspen suckers.

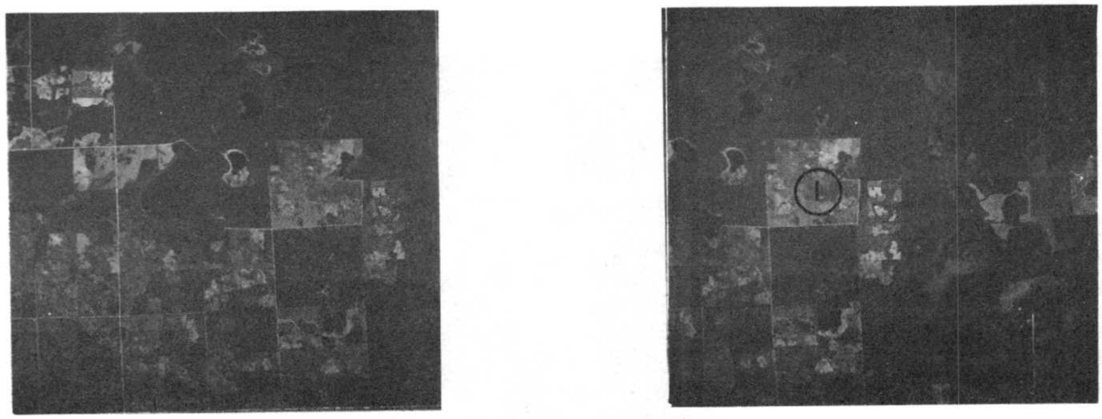


Figure 22. *Color Infrared. Scale 1:128,000. Twp. 17-18, Rge. 16-17W. Riding Mountain Till Plain. (1) Eroded fields.*

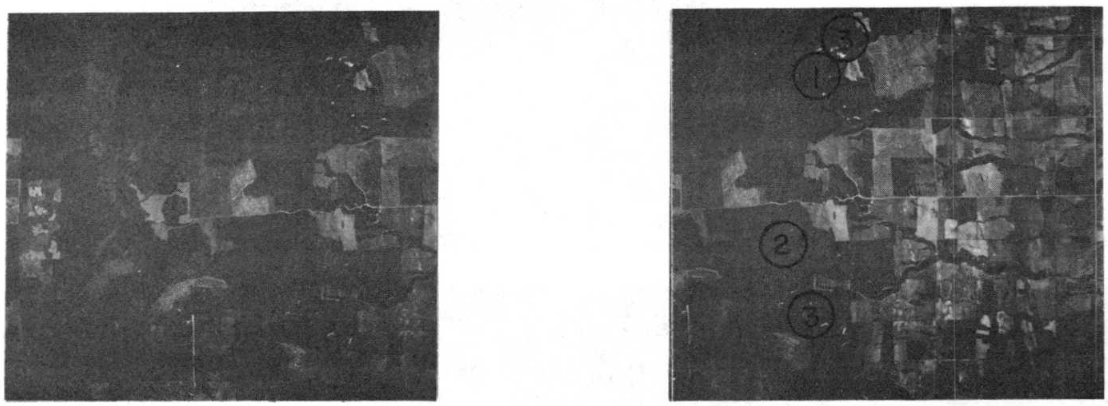


Figure 23. *Color Infrared. Scale 1:128,000. Twp. 17-18, Rge. 15-16W. Riding Mountain Till Plain. (1) Coniferous tree cover (white spruce). (2) Deciduous tree cover (trembling aspen). (3) Active eroding areas in gullies.*

Figure 24.

True Color. Scale 1:110,000. Twp. 18-17, Rge. 16-15W. Riding Mountain Till Plain, Manitoba Escarpment. (1) Active eroding spots in gullies.

Figure 25.

True Color. Scale 1:110,000. Twp. 17, Rge. 16-15W. Riding Mountain Till Plain. (1) Active eroding spots in gullies.

brush competition. Pure extensive white spruce stands are not found in this part of the Park. Trembling aspen and white spruce, in various mixtures, occur on the upland. Other species such as balsam fir and white birch occur in small quantities. On fresh to moist sites hazel forms an extensive shrub layer that is continuous except immediately beneath individual white spruce where its development is hindered by subdued light.

On the drier upland sites some jack pine can often be found in a mixture with black spruce and/or white spruce (Fig. 19). The occurrence of jack pine is very sparse; this may be the result of soil conditions but fire history might be the most important reason. Jack pine regenerates abundantly after fire. The jack pine cones need the heat generated by a fire to open up and release the seeds.

The limited occurrence of fires in this part during the last 70 years may be the reason for the limited occurrence of jack pine.

Black spruce is confined mainly to the poorly drained peat filled basins on the mountain plateau; however, it is also found in association with jack pine or dry sites, especially on sites adjacent to bogs. Tamarack is often associated with black spruce in the wet to very wet areas.

Balsam fir is more abundant in this portion of the park (the higher slope) than anywhere else. This may be a result of the higher precipitation in this part of the Park especially on the rim of the escarpment. Bur oak occurs primarily under droughty conditions in the Park; in this part it is found on the upper slopes of deeply incised stream valleys in the escarpment. The condition of the forest varies very strongly within the Park. Young and overmature stands are plentiful. Forest cover is generally good with some high quality timber.

Part of region 5Sn Outside Riding Mountain National Park. Most land in this section is cleared for agricultural purposes. Stands and remnants of former stands can be found in this area. Further from the Park, tree cover is confined to sites not suitable for agriculture, that are too wet or too dry. The occurrence of white spruce is even more limited in comparison to that of trembling aspen. The occurrence of jack pine is limited to the area close to the park. Black spruce is replaced by white spruce in the depressions where the latter grows in association with tamarack. Bur oak is more abundant on the drier sites than in the Park.

Figure 26.

Duned medium sand in Lower Assiniboine Delta. Vegetation of trembling aspen and bur oak and grasses.

Figure 27.

Bank of Whitemud River. Vegetation of hardwoods such as bur oak, elm and ash.

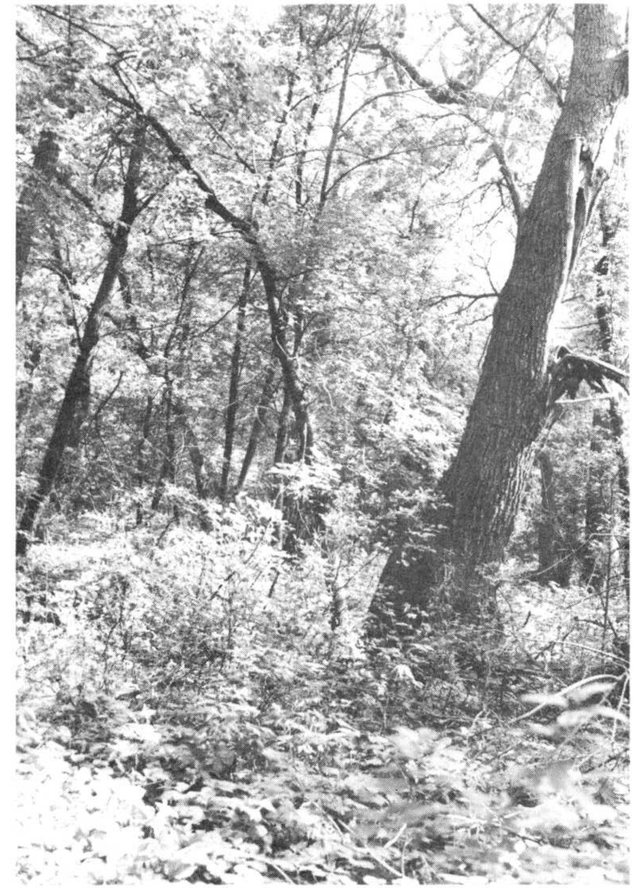


Figure 28.

Bank of Whitemud River. Vegetation of elm, ash and maple.

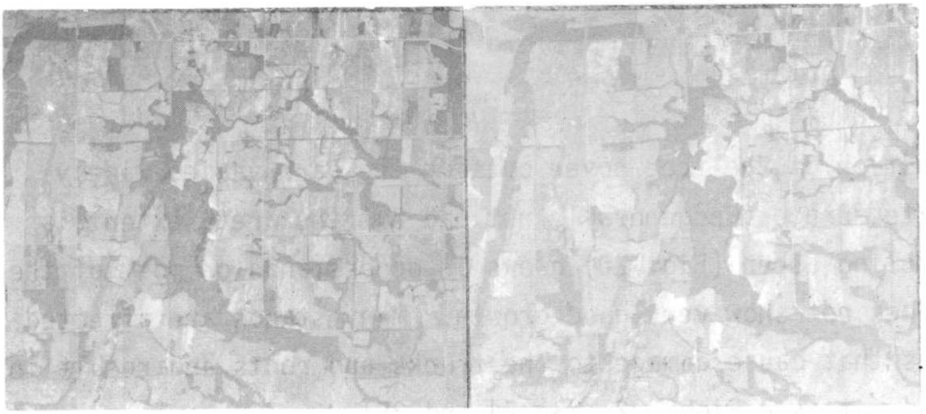


Figure 29.

True color. Scale 1:110,000. Minnedosa-Reston Till Plain. Note the erosion of the cleared lands and the confinement of tree cover to the non-arable areas.

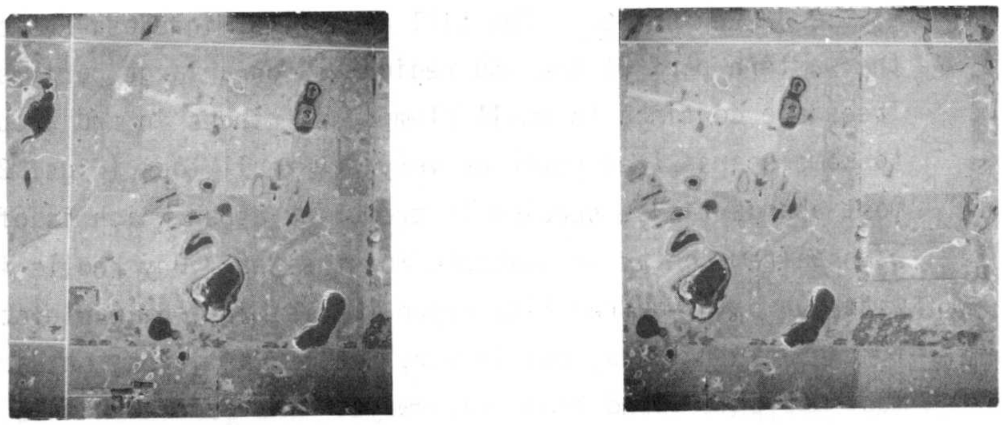


Figure 30.

True color. Scale 1:40,000. Minnedosa-Reston Till Plain. Note the numerous depressions and the lack of trees.

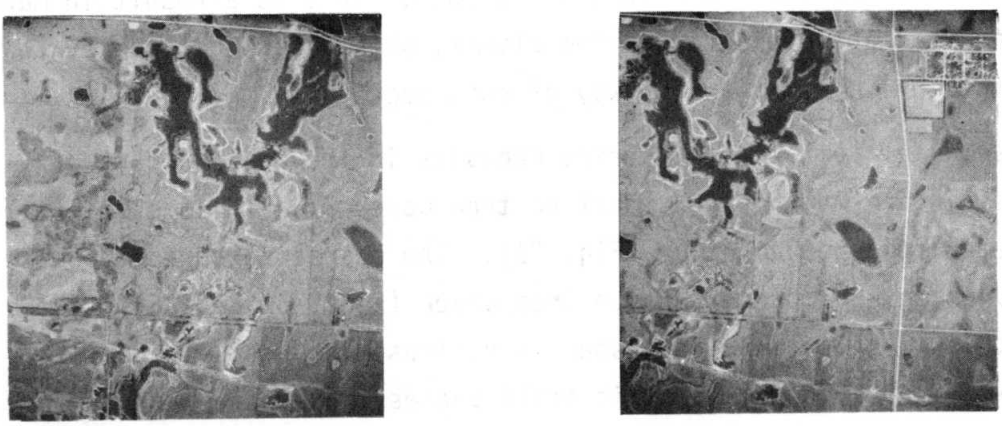


Figure 31.

True color. Scale 1:44,000. Twp. 12, Rge. 16W. Minnedosa-Reston Till Plain. Note numerous depressions and the lack of tree cover.

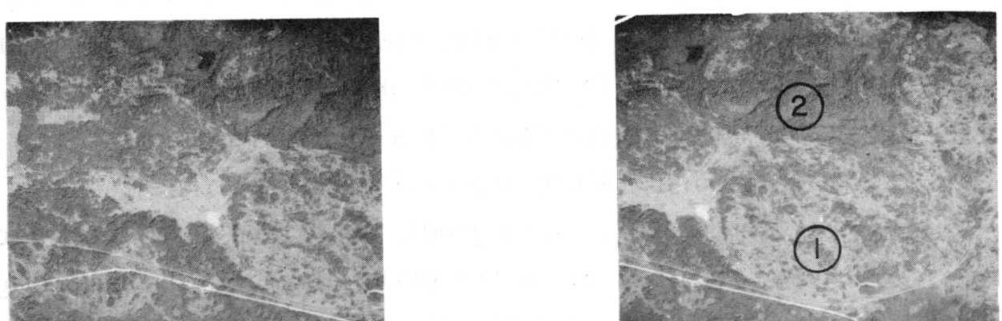


Figure 32.

True color. Scale 1:44,000. Twp. 12, Rge. 13W. Upper Assiniboine Delta. (1) Dunes. Note the vegetation on north facing slopes and the almost barren south facing slopes. (2) Trembling aspen in moister locations and sedge type vegetation in the very wet depressions.

The condition of the tree cover outside the Park varies widely. The patches of white spruce are generally not bad but the areal extent is quite small. Trembling aspen (Fig. 20) grows in good stands on most of the soils, jack pine does not show very good growth. Many stands are affected by cattle and fires that cause damage to the trunks and roots and result in hampered growth and rot (see Figs. 22, 23, 24 and 25).

Region 5Sd. The till area (The Minnedosa-Reston Till Plain) in the western part of the 5Sd region is for a large part used for agriculture. Trees are confined to small clumps or fringes in and around depressions, and to some sparse tree cover on very dry knoll tops (Figs. 29, 30 and 31). The most abundant tree species is trembling aspen which is often in a mixture with balsam poplar on suitable moist sites. Dry knolls if wooded are covered with bur oak and trembling aspen. Some Manitoba maple occurs scattered throughout the area, but in very small quantities, on various sites; however, most maple is found along waterways. The forest in this area is often poorly stocked and exhibits mediocre and inferior growth. This is a result in many cases of damage by cattle and fire. The clumps, show a strong tendency to expand into the agriculture land by way of root suckering.

The medium textured lacustrine deposits in the western part of the Upper Assiniboine Delta have almost no tree cover at all; some small clumps of trembling aspen do occur (Fig. 21). The coarse textured deposits blown into dunes have a more extensive tree cover (Figs. 32 and 36). The most abundant species is trembling aspen in various mixtures with bur oak. The tree growth is very poor except in small depressions where water supply is more adequate (Fig. 33). The south and west facing slopes and the tops of knolls are in most cases covered with grass. The trees found in this area are mainly poor in shape and growth and are often affected by ranging cattle. The medium textured deposits along the escarpment are also in agriculture use (Fig. 37). Along the ravines and on the steeper slopes the forest cover is still present. Tree growth is rather good in the forest remnants of this heavily wooded area in the past. Trembling aspen is again the species that occurs most, but good balsam poplar and bur oak are also present. Stands are affected by man's activities (burning, ranging, logging) and show deterioration as a result. In the southern part of the Upper Assiniboine Delta on the coarse textured deposits some white spruce can be found and in some very poorly drained depressions tamarack occurs.

Figure 33.

Tree cover along river in Upper Assiniboine Delta.

Figure 34.

Trembling aspen stand in West Lake Plain.

Figure 35.

Trembling aspen stand in West Lake Plain. Note the damage by fire and cattle.

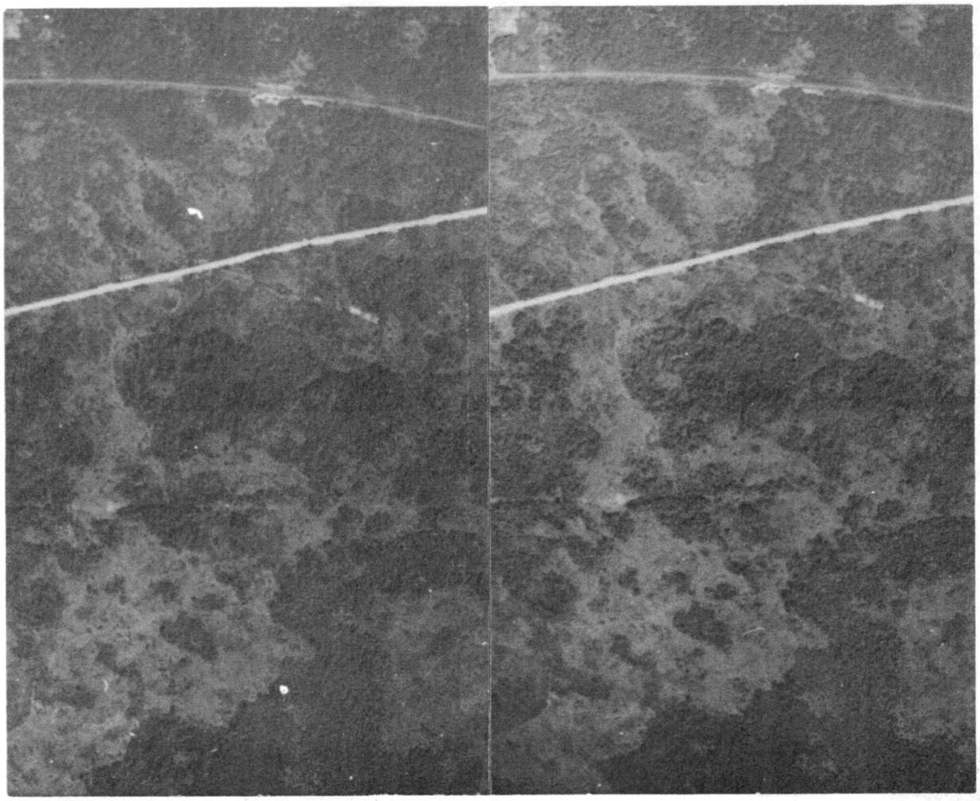


Figure 36.

True color.
Scale 1:11,000.
Twp. 12, Rge. 13W.
Enlargement of picture 32.

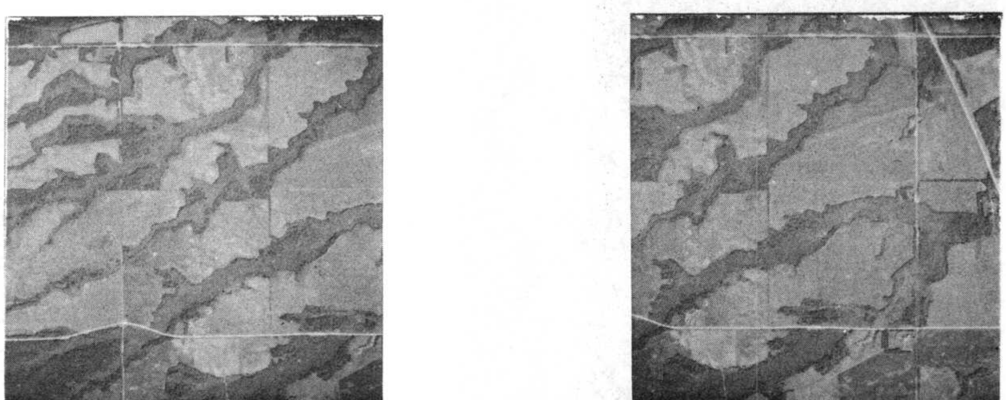


Figure 37.

True color.
Scale 1:44,000.
Twp. 12, Rge. 13W.
Upper Assiniboine Delta. Peat filled gullies. Acting as sponge for runoff.

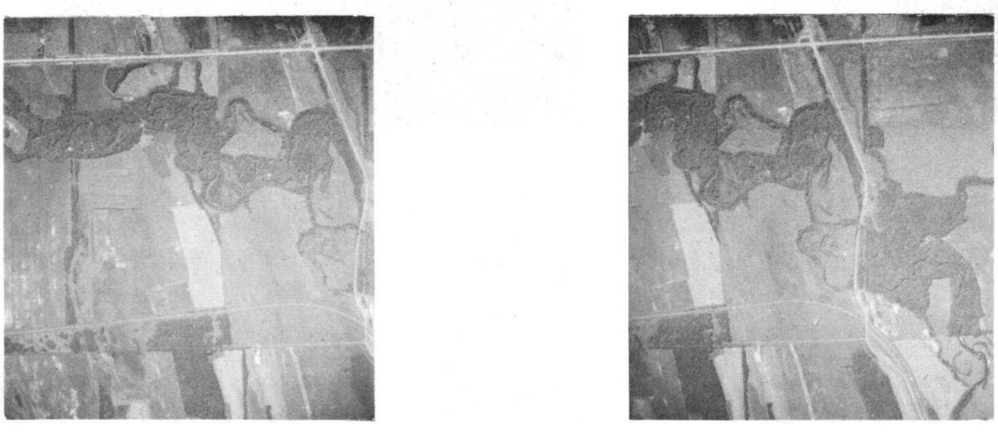


Figure 38.

True color.
Scale 1:44,000.
Twp. 14-15, Rge. 13W. Lower Assiniboine Delta. Note the dense tree cover along Whitemud River.

The Lower Assiniboine Delta is mostly imperfectly to poorly drained. Trembling aspen again forms the most extensive species on land not cleared for agriculture. The occurrence of balsam poplar is more widespread than in other parts of the region and shows excellent growth on suitable moist sites. On the northern calcareous fine textured deposits, and more to the east on the finer textured materials tree growth is very limited (Figs. 27, 28 and 38).

The West Lake Till Plain is partly cleared for agricultural purposes although large areas are still tree covered. Stand appearances are not very good (Figs. 34 and 35). As a result of high lime content of the parent materials, soil profiles are very shallow, hampering tree growth. The well to slightly imperfectly drained sites show the best growth of aspen. Bur oak occurs on drier ridges and balsam poplar on suitable wetter sites. The depressions are large in extent and covered by willow and sedges. A small area, indicated 5Sn, is covered by sandy deposits. A few scattered stands or clumps of jack pine may be encountered and some white spruce, tamarack and white birch occur. Along streams in the watershed Manitoba maple, white elm and green ash are common species. Some very good growth can be found. Trembling aspen, balsam poplar and fairly good bur oak, on the drier banks, are found in mixtures with these hardwood species. The beaches show tree growth of bur oak and trembling aspen. The very dry tops are sparsely wooded but the slopes show denser tree cover and the lower slopes support rather good trembling aspen and balsam poplar growth.

Regeneration

The regeneration of trembling aspen is mainly by means of suckering. Suckering occurs as well on healthy as on almost dead trees. Suckers arise from lateral roots especially after disturbances such as fire and windfall. Regeneration is generally very good after fire, but severe fires and especially frequent fires can eliminate trembling aspen. As a result of the way in which trembling aspen regenerates, aspen stands are composed of a limited number of clones[1]. Differences in clones often result in variation of leafing

---

[1] Clone: Group of trees having the same genetic characteristics as a result of vegetative regeneration.

out and shedding dates in the same stand. The differences may also account for diversity of the rates of growth, susceptibility to diseases, rot, etc.

In the Riding Mountain area the regeneration of aspen is hampered by the dense shrub layer (hazel) found in most stands. The shrubs are severe competitors for light and suckers do not survive for more than a few years as a result of shade.

In the 5Sd region the regeneration of aspen is very prolific. Many aspen clumps tend to expand into the lands in use for agriculture. In wet years the drier slopes may be invaded by regeneration but in years with less precipitation regeneration may die off whereas in depressions the opposite takes place.

Balsam poplar acts quite similar to trembling aspen but is not as prolific in regenerating compared to trembling aspen. Regeneration may be, for a large part, the result of seed germination.

The reproduction of white spruce (in pure stands and mixtures) is rather poor on all sites. This is probably a result of unfavorable germination conditions and/or competition of the shrub and herb layer in the different forest communities. Regeneration is often confined to rotten white spruce logs and stumps. Logging will result in a decline in regeneration as a result of the removal of the seed source and germination sites. In aspen-white spruce communities the reproduction of white spruce is light in comparison to that of the trembling aspen.

The occurrence of white spruce is very limited outside the Riding Mountain area. Some white spruce is found in the southern part of the watershed in the vicinity of the Spruce Woods Forest Reserve. It also occurs in the 5Sn region in the north central part of the Watershed area, where it is mainly found on moist sites. The lack of white spruce in the 5Sd region may have been caused by frequent fires that eliminated the seed source. It is also possible that the conditions for germination are unfavorable in general throughout this region; i.e., soil, climate. There are, however, some indications that once white spruce is established, natural regeneration can occur. This was noticed on two occasions. Planted white spruce had in both cases regenerated on north facing slopes of a road ditch where grass competition was not severe and mineral soil was exposed in many places.

The occurrence of jack pine is limited in regions 5Sn and 5Sd. In region 5Sn some pure stands can be found but more often the jack pine occurs in a mixture with other conifers. Jack pine needs fire to germinate but frequent fires can eliminate the seed source and consequently the jack pine. Upland sites covered with jack pine along black spruce bogs will be invaded by species such as black spruce, if no fires occur.

Black spruce will regenerate by seed on the upland sites, but is in most places confined to peat filled basins where regeneration may be either by seed or layering.

Balsam fir regenerates very well where it occurs. Bur oak regenerates mainly by seed but regeneration will occur on old stumps after cutting. Species such as elm, ash and maple regenerate generally well, at least sufficiently enough to maintain the kind of community in which they are found.

Species such as white birch and tamarack regenerate generally well on particular sites, where competition of other species is limited because of site conditions such as moisture (tamarack) or because of fire or soil disturbance (white birch).

Volumes

A forest survey was undertaken in 1960 to determine the areal distribution of forest types, the volume of timber, and an allowable annual cut for the commercially important species in Riding Mountain National Park.[1] This report provides information about gross merchantable timber volumes per species and per cutting class for working circles. The working circles do not coincide with the Riding Mountain National Park area encompassed by the watershed, therefore, only a general statement can be made in regard to volumes. Some additional information is available from Canada Land Inventory sample data. Most of these samples were taken north and west of that part of Riding Mountain National Park, that lies within the watershed, but may be considered indicative of volumes to be found in the watershed portion.

[1] Bailey, R. H. Report on the Forestry Survey of the Riding Mountain National Park, Province of Manitoba, 1960.

No inventory has been undertaken to determine volumes and forest types for the remainder of the watershed area. The information, available for this area, is data collected by the Canada Land Inventory. Samples were taken in the best parts of stands close to rotation age (rotation age is defined in this case as the age corresponding with the culmination point of the mean annual increment). Dominant and co-dominant trees were measured to obtain data about age, height and diameter and basal area counts were made.

Honer's formula:

$$\frac{\text{Basal Area Count}}{\left(a + \dfrac{b}{\Sigma H/\text{no. of trees}}\right) \quad .005454} = \text{Volume/Acre}$$

a = conversion factor } depending on species
b = conversion factor } depending on species
ΣH = sum of tree heights

was used to calculate gross total volume per acre. A deduction was made to arrive at gross merchantable volume per acre. The deduction factors varied for species and sites and were rather subjective.

Region 5Sn. *Riding Mountain Till Plain - Park Section.* The average gross merchantable volume per acre for all species within cutting class 5 (mature, thrifty stands) without regard for differences in site and stocking is about 1950 cubic feet.

As indicated by the Canada Land Inventory data white spruce can produce up to 4500 gross total cubic feet (about 4000 gross merchantable cubic feet) in 75 years on fresh to moist loamy sites. Jack pine produces from 2000 to 4500 gross total cubic feet (1500 to 3800 gross merchantable cubic feet) on dry to fresh sites respectively, in 80 years. Black spruce produces 1000 to 2500 gross merchantable cubic feet in 60-70 years on peat to 4000 gross merchantable cubic feet in mixed stands on moist mineral soils. The production of trembling aspen is comparable to that of white spruce on favourable sites.

Riding Mountain Till Plain - Section Outside the Park. In this area white spruce produces generally the same volume on comparable sites as in the park. The volume production of trembling aspen is usually lower but this is a result of poorer stocking caused by logging and grazing. The production on coarse outwash is about 1000 gross merchantable cubic feet in 50 years.

Region 5Sd. *Minnedosa-Reston Till Plain.* The best volumes are produced by trembling aspen or mixtures of trembling aspen and balsam poplar on slightly dry to slightly wet loamy sites. The soils have a moisture deficiency or moisture excess respectively, during parts of the growing season, but moisture supply is adequate for most of the season. Measurements on these sites are between 1700 and 2400 gross merchantable cubic feet per acre in about 50 years. Sites that have more severe moisture problems produce as low as 1000 cubic feet on very dry sites.

Upper Assiniboine Delta. The best stands are produced on loamy medium fine sands that have only slight moisture problems; either too dry or too wet during parts of the growing season. Areas with a surplus of moisture during part of the growing season are the better of the two. Gross merchantable volumes can range from 1500 to 2000 cubic feet for stands of 45-65 years old. The volumes on slightly dry sites range from 1500 to 2400 cubic feet for stands 45-55 years old. The duned areas support timber of low quality and low volume. Height growth is very limited and because of tree form, the gross merchantable volume is in general not much more than 1000 cubic feet per acre for 40-50 year old stands.

Lower Assiniboine Delta. A large part of this area is imperfectly drained. The best growth is found on sites that have minor problems in regard to moisture excess during a part of the growing season and have adequate moisture supply throughout most of the season. These sites produce between 2000 and 3200 cubic feet (gross merchantable) per acre in 40-50 years. Very good sites produce up to 5000 cubic feet per acre but these micro sites are very scarce. Sites that have a slight moisture deficiency problem produce around 2000 to 2500 cubic feet in 40-50 years. Sites with more severe moisture problems, either excess or deficiency, produce much less.

West Lake Plain. In this area not only moisture supply is a critical factor affecting tree growth but the high level of calcium carbonates in the soil also deters growth. Soil profile development is usually not very deep and very high levels of calcium carbonates are found close to the surface. Sites which are too wet for a part of the growing season show the best growth. Volumes up to 2700 gross merchantable cubic feet are found in stands 45-55 years of age. The dry sites show considerably less volume production. A production of 1000-1500 cubic feet in 40-50 years is common.

Tree Planting

A brief history of tree planting in the province is necessary to appreciate the progress made in establishing shelterbelts, plantations and tree farms in the watershed.

Pioneering Mennonites were the first known settlers to plant trees in Manitoba. Cottonwood *(Populus deltoides)* cuttings obtained from the Pembina River valley in North Dakota were planted in Blumenort, Manitoba in 1877. A greater variety of trees were planted extensively in 1886. Plantings included currant *(Ribes* spp.*)*, wild plum *(Prunus americana* Marsh*)*, chokecherry *(Prunus virginiana* L.*)*, trembling aspen *(Populus tremuloides)*, green ash and Manitoba maple. These were obtained from the foothills of the Pembina Mountains and Pembina River Valley. Probably other indigenous species of trees were also planted.

Seeds of domestic fruit trees were brought from Europe by the settlers, however, the attempts to grow these were unsuccessful. Settlers within the watershed transplanted trees from the surrounding rivers and creeks and conifers were obtained from the eastern flank and plateau of Riding Mountain.

Experimental Forestry Stations. The need to establish experimental forestry stations in Manitoba was recognized in 1885 by the Forestry Commission. A preliminary report stated that, "From these stations could be learned what trees could be grown; their adaptability to the soil; a study could be made of the animal and vegetable foes of trees, and of the means to combat them...They could also be used as nurseries for raising and supplying young trees to settlers..."[1]

The Canada Department of Agriculture, Experimental Farm at Morden has carried out over 40 years of experimentation on hedge plants. Trees and shrubs of 130 different species and varieties have been tested. The climate differs between Morden and the watershed but experience gained with certain species may be useful in future planting proposals.

---

[1] Sessional Papers, Vol. XVIII, No. 7, 1885, Forestry Commission. Summary of Preliminary Report of Mr. J. H. Morgan, Commissioner.

Dr. F. L. Skinner (deceased) had carried out over 50 years of plant research since 1911 at his private nursery at Dropmore, Manitoba. Although he never received formal horticultural training he introduced more than 200 species of plants, shrubs and trees to Manitoba from all over the world. Plant breeding by cross-pollenation and grafting scions was his specialty. By these methods he developed and improved 144 varieties of horticultural plants. Records of his past experiments may also benefit future planting projects.

In conclusion there are presently more than 25 private tree and shrub nurseries in Manitoba which provide stock for urban and rural planting.

Field and Farmstead Shelterbelt Planting. Tree seedlings were distributed from the Central Experimental Farm, Ottawa, to Canadian Pacific Railway Stations in western Canada in 1889. Twenty-five stations each received 175 trees of which about one-third were several species of deciduous trees.

Distribution of tree seed and seedlings from the Dominion Experimental Farm at Brandon, also commenced in 1889. Because of the close proximity of this source, many of the trees produced would have been planted on the watershed. The reports of 1889 to 1903 show the acceleration in production of tree nursery stock and the increase of interest by the early settlers to establish shelterbelts.

About 1,670,000 trees were distributed from the Brandon Dominion Experimental Farm from 1889 to 1903. Production increased from 15,000 in 1889 to 872,000 in 1903. One million and a half trees were grown in 1903 in anticipation of the planting demands for the spring of 1904. The species grown for distribution were Manitoba maple, white elm, white spruce, buffalo berry *(Shepherdia argentea)*, green ash, white birch, willow *(Salix* spp.*)*, Russian poplar *(Populus siberica)*, cottonwood *(Populus deltoides)*, Caragana *(Caragana brevifolia)*.

Shelterbelt nursery stock has been shipped to Manitoba from the Tree Nursery at Indian Head, Saskatchewan since 1901. Table 2 lists the species and numbers of trees and shrubs which were shipped from 1901 to 1944, for field shelterbelt and farmstead planting. More than half of the 28,000,000 trees and shrubs were Manitoba maple and caragana.

Table 2.

Shelterbelt Trees and Shrubs planted in Manitoba (Indian Head Planting Stock).

		Number	
1901-1944	DECIDUOUS SPECIES:		
	Manitoba Maple	7,473,995	
	Green Ash	4,242,705	
	White Elm	1,161,175	
	Cottonwood	426,595	
	Russian Poplar	1,714,050	
	Acute Willow	2,167,425	
	Poplar Hybrids	283,700	
	Laurel Willow	696,675	
	Red Willow	278,750	
	Birch	2,650	
	Caragana	8,982,080	
		27,429,800	27,429,800
	CONIFEROUS SPECIES:		
	Siberian Larch	1,860	
	Tamarack	14,950	
	Scotch Pine	159,724	
	Jack Pine	50,100	
	Lodgepole Pine	23,850	
	White Spruce	337,195	
	Colorado Spruce	73,136	
	Norway Spruce	8,400	
		669,215	669,215
			28,099,015
1945-1953	ESTIMATED TOTAL		7,500,000
1954-1971	SPECIES:		
	Willow	2,250,925	
	American Elm	2,818,252	
	Siberian Elm	1,618,750	
	Ash	3,119,905	
	Poplar	370,440	
	Maple	652,675	
	Caragana	8,399,445	
	Other Species (Coniferous and Deciduous)	555,685	
		19,786,077	19,786,077
Total number of trees planted from 1901-1971 (Indian Head Planting Stock)			55,385,092

It is estimated that 7,500,000 trees and shrubs were shipped from Indian Head and planted in farmstead and field shelterbelts in Manitoba during 1945 to 1953. It is difficult to surmize how many trees and shrubs were planted on the watershed commencing from the first shipment in 1901. Probably one-tenth of the approximate 35,000,000 trees and shrubs were planted on the watershed from 1901 to 1953.

The most recent figures show that 20,000,000 trees and shrubs were received from Indian Head from 1954 to 1971. About 4,000 miles of shelterbelt have been planted in this eighteen year period in the province. Table 2 lists the species and numbers of trees and shrubs planted. During this period about 2,250,000 trees were planted along 500 miles of field shelterbelts, within and immediately surrounding the watershed. The estimated total trees planted on the watershed is 5,750,000 which is about ten percent of the total trees received from Indian Head.

The main problems encountered with shelterbelts are unseasonably dry weather after planting, livestock browsing and trampling trees, rodents girdling and browsing trees, grass competition, saline soils and inundation. The soil and moisture requirements of tree species varies, therefore, careful choice of species must be made to ensure successful planting.

A combined total of about one million trees were provided by the Provincial tree nurseries at Marchand since 1952 and at Hadashville since 1956 for shelterbelts. In addition, 1,250,000 trees have been planted since 1958 by individuals interested in the Christmas tree farm industry. Of these amounts 36,000 trees were planted on the watershed by residents mainly as farmstead shelterbelts and 150,000 trees were planted for tree farms. Scotch pine *(Pinus sylvestris)* is planted principally for Christmas tree production. Lesser amounts of white spruce, jack pine and red pine *(Pinus resinosa)* are planted for both shelterbelts and tree farms.

Provincial tree nurseries which have since been abandoned were located at Birch River southeast of Porcupine Mountain; Lake Max on Turtle Mountain; Shilo and Carberry on the Upper Assiniboine Delta and Marchand in the sandilands of southeastern Manitoba. Since 1904 the main purpose of the nurseries was to provide planting stock for reforestation on cut over or burned over areas and for afforestation of duned areas and natural grassland.

Plantations in Spruce Woods Provincial Forest Reserve. Coniferous plantations were established in the Spruce Woods Provincial Forest Reserve near Shilo, from 1904 to 1929 by the Forestry Branch, Northern Affairs and National Resources. During this period 772,923 trees and shrubs were planted.

Since the plantations are located inside and outside the watershed boundary southwest of Carberry it is worthwhile to describe them in relation to similar soils and topography located on the watershed. The plantations were mainly experimental to determine the degree of survival, cause of mortality and the rate of growth of several species. By assessing the results the best species, site preparation and planting method could be determined for future planting projects.

The plantations are located on the Upper Assiniboine Delta on fairly level coarse sandy outwash, and on duned deltaic loamy sand deposits. These deposits are well drained and are often 200 feet deep. The representative soil under grass cover of the two soil textures is a weakly developed Black profile although Dark Gray profiles occur under pockets of natural spruce on north and east facing slopes. Regosolic profiles prevail in the duned areas. The local average annual precipitation of 16 inches is insufficient for optimum tree growth.

Jack pine *(Pinus banksiana* Lamb.*)*, lodgepole pine *(Pinus contorta* Dougl. var. *latifolia* Engelmann*)*, Scotch pine *(Pinus sylvestris* L.*)*, white spruce *(Picea glauca* Moench Voss*)* and Norway spruce *(Picea abies* Dietr.*)* were planted in 62 experimental blocks covering 204 acres.

Table 3.

Trees Planted in Spruce Woods Forest Reserve, 1904-1929.

Species	Number of Trees
Scotch pine	289,265
Jack pine	210,312
Lodgepole pine	27,263
White spruce	233,783
Norway spruce	2,300
TOTAL	772,923

Planting stock was obtained mainly from the Indian Head tree nursery although a Manitoba Forestry Branch nursery at Shilo provided some planting stock. Jack pine and white spruce seed was collected locally. Scotch pine seed was obtained from Sweden, Finland, Germany and Scotland. Lodgepole pine seed was acquired from Nicolo, British Columbia.

The main causes of mortality were drought, high temperatures and drying winds immediately after planting. Planting site, vegetative competition, method of planting, stock age and seed provenance undoubtedly had an effect on survival. In 1952 a thorough assessment was made of all plantations. Mortality rates averaged 80% in Scotch pine, 65% in Lodgepole pine and 60% in Jack pine. Norway and white spruce were complete failures which may possibly be attributed to the shallow rooting habit of the species and high permeability of the coarse to medium textured soils.

Winter kill caused by winter drying in young plantations was high in years of light snowfall. Heavy snowfall and drifting snow often caused poorly formed trees by breaking branches and leaders. Trees planted under aspen succumbed to browsing rabbits but appeared to have more protection from drought. Pocket gophers buried young trees or exposed the roots. Fires also wiped out isolated plantations.

Scotch pine reflects the best height and diameter growth but stocking and volume per acre is less than that of jack pine. Lodgepole pine shows the poorest growth. Almost one-half of the 62 plantations were complete failures and many of the remaining plantations are understocked. The most favourable planting sites were in patches of ground cedar *(Lycopodium complanatum* L.*)* and in furrows.

Judging from the overall condition and appearance of these plantations Scotch pine appears to be a favourable coniferous species to plant on similar soils to establish tree cover. Refill planting may be necessary for several years if full stocking is desired. Natural regeneration of pine can be expected but because of intolerance to shade the young seedlings will require partial release from the overstory. White spruce regenerates satisfactorily on the north side of both mature plantations and natural clumps in the duned areas.

An additional 4,427,910 trees were planted by the Provincial Forestry Branch on 4,257 acres, in and adjacent to the Spruce Woods Forest Reserve during 1945 to 1971. The plantations are located in the same general area as the original experimental plantings of 1904 to 1929. The species and number of trees planted are:

Table 4.

Jack pine	2,356,200
Scotch pine	1,701,110
Lodgepole pine	100,150
Red pine	12,000
White spruce	254,450
Colorado blue spruce *(Picea pungens* Engelm)	2,000
White spruce *(Picea glauca* var. *albertiana* S. Brown Sarg.) Black Hills, N.D.	18,000
	4,427,910

Spring planting was mainly carried out by hand and machine in furrows but trees were occasionally planted in the fall. Planting assessments five years after planting indicate that survival rates range from ninety percent to complete failures. Jack pine tublings were planted recently but survival rates appear to be poor.

Tree Planting for Erosion Control. During 1957 to 1959 about 20,000 trees were planted on four farms. The farms are situated along the escarpment in the Rural Municipality of Rosedale. The plantations range in size from 5 to 15 acres on areas where soil erosion has been a problem. Scotch pine, jack pine and white spruce were planted to stabilize eroding knolls and to provide added income from the sale of Christmas trees. The survival rate was surprisingly high.

Three quarter sections of severely eroded land were purchased by the Department of Agriculture, Manitoba, along the eastern escarpment of Riding Mountain. This land on Section 23, Township 16, Range 16 west, was developed as a demonstration farm. More than 200,000 trees have been planted from 1967 to 1971. Many species both coniferous and deciduous have been planted with relatively good survival. The plantings are an example of what could be accomplished to help alleviate soil erosion by wind and water along the escarpment.

The Department of Mines, Resources and Environmental Management has recently acquired several parcels of land along a one-mile buffer zone, adjacent to Riding Mountain National Park. The objectives are to re-establish vegetative cover and reduce the rate of precipitation runoff. This will reduce severe soil erosion and also provide more habitat for wildlife. Of the 4,100 acres acquired 200 acres were planted with 230,000 white spruce in the fall of 1971.

Tree Planting Riding Mountain National Park. Tree nurseries in Riding Mountain were located at Lake Audy and later at Wasagaming. Since 1925 about 1,000,000 trees have been planted in the Park. Natural openings have been planted in the past with little success as a result of heavy grass competition and coarse textured soils. This also tends to reduce the area of natural meadows used by the estimated 7,000 elk in the Park. No planting has occurred on eroded areas along the east boundary near the escarpment. Planting is presently confined to replacing damaged trees in campsites and underplanting in aspen stands used for picnicking.

Wilson Creek Study Area. In 1957 the Committee on Headwater Flood and Erosion Control chose the Wilson Creek watershed as a representative erosion problem study area on the eastern slopes of Riding Mountain within the National Park boundary. The decadent forests along the escarpment appeared to create a potential contribution to rapid runoff. Interception of runoff and increased evapotranspiration would be accomplished by a restoration of a more vigorous forest cover. Studies by Ritchie* suggest that if the watershed were completely protected from wildlife browsing the mass of aerial plant parts would increase and the capacity of the cover to intercept and transpire precipitation would be maximized. Natural succession to a more continuous canopy would be ensured. Plots in decadent stands were cut and a significant increase in suckering occurred. However, the shoots were heavily browsed and the vigorous growth decreased.

White spruce were planted on spot scalped and unprepared control plots in mixed brush and open decadent forest in 1962. Four year old, 6- to 8-inch trees and five year old 12- to 14-inch trees were planted. Both

---

* Cited by G. H. MacKay and C. R. Stanton in Wilson Creek Study, Erosion and Sedimentation Control, 1965.

ages grew better on scalped plots although the older stock had a higher survival rate. Ten-foot strips were bulldozed across slopes and two rows of trees were planted in the spring of 1963. A planting assessment in 1966 indicated an 86 percent survival rate.

Experiments with tree and shrub seed were carried out in the fall of 1960 on a steep faced shale bank. Seeding was repeated the following fall but in both instances no response was observed. Shrub transplants were also unsuccessful.

Contour trenches planted with willow wands and seeded with grass initially were encouraging but recent assessments show that wind-borne shale particles have damaged the shoots and high mortality was incurred. Snow fencing was installed to protect the newly planted vegetation from flying shale.

Vegetative bank protection methods were employed along a creek. Willow poles were dug into the stream bed and secured together. After two years, sixty-five percent of these poles were growing. As an alternate method, willow wands were tacked to a plank and buried in a trench in a stream bed parallel to the bank. The purpose of these trials was to induce sedimentation buildup. The deposits of sediment will eventually be planted with willows.

Initial vegetative experiments offer some encouragement to continue similar studies with a wider variety of species and site conditions. White spruce and willow appear to be the most successful species.

The 1:125,000 forest capability map for the Watershed is compiled from 1:50,000 maps provided by the Forestry Sector of the Canada Land Inventory Project. These maps were reduced to the 1:125,000 scale and traced onto a 1:125,000 scale base map. All information contained on the 1:50,000 maps is provided on this forest capability map for the watershed area.

Classification System*

All mineral and organic soils are classified into one of seven classes based upon their inherent ability to grow commercial timber. Class one being the highest and class seven being the lowest. The highest class encountered in the watershed area is class three.

The classification system consists of three categories:

- the capability class
- the capability subclass (limiting factor)
- the indicator species

When assigning land to a given class the environment of subsoil, soil, relief, regional, local and microclimate as well as the characteristic tree species are all taken into account. The capability class then is an expression of all environmental factors as they apply to tree growth.

The factors which limit tree growth are shown as subclasses for all except class three, the highest class in region 5Sn and class four being highest in region 5Sd.

The tree species which can be expected to yield the volume associated with each class are shown as part of the symbol. Only indigenous species adapted to the region and land are shown.

Basis of Classification.

(1) The separation of the land into homogenous units (sites or complexes of sites) is on the basis of physical characteristics.

---

* R. J. McCormack, Land Capability for Forestry. 1970. Report #4.

(2) Assignment of each unit to a class is on the basis of all known or inferred information about the unit including subsoil, soil profile, depth, moisture, fertility, landform, climate and vegetation.

(3) When the highest class in a region has no subclass associated with it, regional climate may be assumed to be the overall limiting factor. A wide variety of land may have the same capability rating but for different reasons. The type of limitations are shown in the subclass.

(4) Associated with each capability class is a productivity range based on the mean annual increment of the best species or group of species adapted to the site(s) at or near rotation age. Productivity classes are expressed in gross merchantable cubic foot volume to a minimum diameter of four inches. The productivity is expressed as that of "normal" that is fully stocked stands. Thinnings, bark and branch wood are not included.

(5) To the extent that only well-stocked stands are measured to indicate capability it may be assumed that only good management would have produced stands of this nature.

(6) Classification is based on the natural state of the land without improvements such as fertilization, drainage or amelioration practices. It is realized that with improved forest management the productivity may change. To the extent that the limitations shown in a symbol may be altered, class change may also take place. However, since the classes are based on relatively permanent features, significant changes will only be achieved through costly and continuing practices.

Capability Classes

Classes 1 and 2 do not occur in the area, therefore, no description is included.

Class 3 - Lands have moderate limitations to the growth of commercial forests.

Soils may be imperfectly drained, of medium to fine texture with moderate to good water holding capacity. They may suffer from periods of moisture imbalance.

Productivity will usually be from 71-90 cubic feet per acre per year.*

Class 4 - Lands have moderately severe limitations to the growth of commercial forests.

Soils may be well to imperfectly drained, from medium to fine texture with good to medium moisture holding capacity. They may have from good to fair structure and from good to fair natural fertility.

Productivity will usually be from 51-70 cubic feet per acre per year.

Class 5 - Lands have severe limitations to the growth of commercial forests.

Soils are frequently excessively or somewhat poorly drained, of coarse or fine texture. They may have poor moisture holding capacities and may have fertility problems.

Productivity will usually be from 31-50 cubic feet per acre per year.

Class 6 - Lands have very severe limitations to the growth of commercial forests.

The mineral soils are excessively and poorly drained, of coarse to fine texture. They may have low natural fertility or contain high levels of toxic elements. They may have fertility problems associated with high levels of calcium and magnesium carbonates.

A small percentage of the land in this class is comprised of poorly drained organic soils.

Productivity will usually be from 11-30 cubic feet per acre per year.

Class 7 - Lands will have limitations of such a severe nature as to preclude the growth of commercial forests.

Mineral soils are excessively or very poorly drained or subject to regular flooding. They may contain toxic levels of soluble salts.

---

* Gross merchantable cubic feet.

A small percentage of the land is very poorly drained organic soils. Productivity will usually be less than 10 cubic feet per acre per year.

Capability Subclasses

Subclass symbols when shown always represent a limitation to growth and are used only when the limitations they represent affect the class level. In the circumstances in which they may be advantageous or present, but not severe enough to affect the class level, they are not shown.

Only those subclasses which appear in this map sheet are mentioned.

(1) Climate

U - exposure (usually south and west facing slopes).

(2) Soil Moisture

M - soil moisture deficiency
W - soil moisture excess
X - a pattern of M and W too intimately associated to map separately.

(3) Permeability and Depth of Rooting Zone

D - physical restriction to rooting by dense illuviated Bt horizons.
P - weathered and fragmented shale bedrock which affects forest density or growth.
R - restriction of rooting zone by bedrock.

(4) Other Soil Factors

F - low fertility
L - fertility problems associated with high levels of calcium and magnesium carbonates
N - excessive levels of toxic elements such as soluble salts
E - actively eroding soils or soils which are potentially extremely susceptible to erosion
I - soils periodically inundated by streams or lakes

(5) Indicator Species

The tree species which can be expected to yield the volume associated with each class are shown as part of the symbol. Only indigenous species adapted to the region and land shown.

(6) Coniferous Species

wS - white spruce *(Picea glauca)*
bS - black spruce *(Picea mariana)*
jP - jack pine *(Pinus banksiana)*
tL - tamarack *(Larix laricina)*

(7) Deciduous Species

tA - trembling aspen *(Populus tremuloides)*
bPo - balsam poplar *(Populus balsamifera)*
bO - bur oak *(Quercus macrocarpa)*
Mm - Manitoba maple *(Acer negundo)*
gAs - green ash *(Fraxinus pennsylvanica* var. *subintegerrima)*
wE - white elm *(Ulmus americana)*

Classification Methodology

In order to obtain the necessary data for classifying the lands a field survey was conducted in the summer of 1970. On the basis of an air photo reconnaissance sites were selected for field sampling.

Field samples provided information about landform, parent material, relief and external drainage. The soil profile was described and classified. Compact layers, stoniness, gleyzation features, internal drainage and depth of the ground water table were noted. Characteristics of the soil and landform which would limit tree growth were recorded. The forest stand was described in relation to tree cover, species composition, crown closure, age distribution and history and stage of succession. A brief notation on vegetation other than tree cover was made as was a description of tree regeneration. A few trees were measured in the stand to determine height, age and diameter. A basal area count provided the additional information to enable a volume per acre calculation. The stand was briefly described as to appearance, overall quality and the affects that fire and/or grazing may have had on the stand. A preliminary classification was given to the site.

The data was reviewed in the office and the sites were more accurately classified, based on the ecosystem concept.

The 1970 LIFT aerial photos (scale 1:80,600) were interpreted and units delineated. With the aid of the data collected in the field, soils reports, topographic maps, etc. these units were assigned to a class or a complex of classes. This information was transferred to 1:50,000 scale topographic maps which were used for compiling the 1:125,000 map for the watershed area.

Capability Ratings

The forest capability in the watershed is mainly limited by climate. The short growing season, low precipitation and relatively high evapotranspiration make class 4 the highest rating in site region 5Sd and class 3 the highest in site region 5Sn. Very small units of higher class than 4 for 5Sd and 3 for 5Sn may occur, but are too small to map.

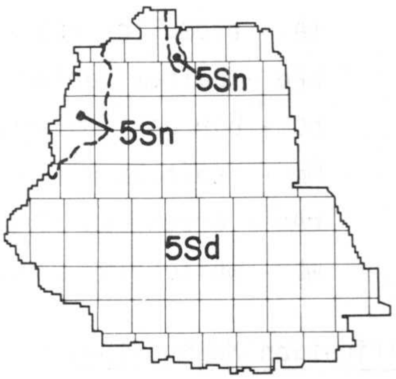


Figure 39. Site Regions.

Region 5Sn. In site region 5Sn (Figure 48) the main limiting factors other than climate are an excess or deficiency of soil moisture and to a lesser extent shallowness of deposits over shale bedrock and restricted root development as a result of compact layers in the profile. Class 3 occurs on loamy sites where water supply throughout the growing season is adequate. These sites can produce very good stands of a variety of tree species (deciduous and coniferous). The indicator species used on this map is white spruce. Most class 3 sites are currently under some kind of mixed tree cover. Indications are that the climax may be a kind of shrub forest rather than a tree forest. Hazel forms a very dense shrub layer in many stands preventing tree species from regenerating. Tree seedlings and suckers are very sparse and growth and survival rate are very low. Class 4 and 5 sites show the same problems.

Class 4 sites (Fig. 40) are drier (4M) and wetter (4W) than class 3 sites. The profile often exhibits a very heavy, well developed Bt horizon restricting root development (4D). The alluvial sediments deposited along the edge of the escarpment show weak profile development but D is used as a limiting factor due to the very heavy texture. On the east slope of the Riding Mountain, class 4 and 5 sites are classified for white spruce and trembling aspen. The occurrence of white spruce is, however, limited; this may be the result of fire, logging or adverse soil conditions for regeneration or a combination of all these factors. The alluvial soils have a tree cover consisting mainly of hardwood species such as trembling aspen, balsam poplar, white elm, maple and green ash. Trembling aspen will probably produce the best volume and is used as the indicator species. The drier sites within the Park could produce good jack pine stands but the extent of natural stands is very limited. These sites are also suitable for the growth of white spruce and trembling aspen and hence the use of both indicator species.

The class 5 lands have more restrictions to tree growth than the class 3 and 4 lands. The lands are too dry for a large part of the growing season (5M) or too wet (5W). Shallow deposits over shale bedrock are classified as (5P) and those soils with compact layers in the profile as (5D). The drier sites are capable of producing good stands of white spruce, trembling aspen and jack pine. The wetter sites are suitable for the growth of white spruce, trembling aspen and balsam poplar either as pure or mixed stands. The 5P sites are probably best suited for the production of trembling aspen. Along ravines some lands are classified 5E, indicating a distinct possibility of erosion.

The wet (6W) and very dry sites (6M) are very much limited by adverse soil conditions. The 6W lands are mostly peat lands with a fair growth of black spruce and tamarack. The 6M sites are very dry, sandy and gravelly lands with a natural tree cover of trembling aspen and bur oak. The very shallow soils over shale bedrock are classified 6P for trembling aspen and bur oak.

The very poorly drained lands (7W) support either poor growth of black spruce and tamarack or willow and alder. In the latter case no indicator species is used with the class.

Region 5Sd. This site region is characterized by the lack of any significant stands of conifers. Class 4 is the highest class encountered and is mostly found along rivers and streams. The classification for this site region will be described on the basis of the physiographic areas.

Minnedosa-Reston Till Plain (Figure 49)

The moderate and steep north and east facing slopes and the very moderate west and south facing slopes have a capability of class 5 (Fig. 41) for trembling aspen. During a part of the growing season lack of moisture is a definite restriction to tree growth (5M). The lower part of the slopes have, during a part of the growing season an excess of moisture (5W) but may be too dry during the rest of the season. Drought is not as important a restriction as on the upper part of the slopes. These lower lands can support good stands of trembling aspen and balsam poplar. The tops of knolls, south and west facing slopes and banks of gullies are very dry during a very large part of the growing season. Lack of moisture is such a severe limitation that only fair to poor growth of trembling aspen and bur oak can be expected (6M). Class 6W is found in a small fringe around sloughs where excess of moisture during the growing season prevails. Class 7W is found in very wet depressions where no other tree growth other than willow and alder exists. Some sloughs may have water at the surface all year but are too small to show up on the map and are, therefore, included with the 7W.

Upper Assiniboine Delta (Figures 49 and 50)

The area can be divided into two textural groups: the medium textured deposits (medium fine loamy sands and loamy sands) and coarse textured deposits (coarse sands). The deposits are deep and coarse in the subsoil resulting in a rapid percolation of rainfall in most of the area.

The medium textured deposits can support a fair to good growth of trembling aspen and bur oak. These soils are generally rather poor in natural fertility which restricts growth to some extent (5M and 5F). Some lands are drier than the average and do not support a better class than 6. Poorly drained depressions are classified as 7W (Figs. 42 and 43).

The coarse textured deposits are blown into dunes over a large area resulting in a variety of sites. The main limiting factor is moisture deficiency (M). The east and north facing slopes of the dunes can support forests of trembling aspen and bur oak which meet the requirements of class 6. The south and west facing slopes and the dune tops are very arid and as a result of that and exposure (U) have very scarce tree growth or no tree growth at all (6^{M}_{U}, 7^{M}_{U}). The lack of natural fertility also restricts tree growth (6F). Some depressions have a more favourable moisture regime and are capable of supporting class 5 forest. The class 7 sites are mainly peat filled ravines with an excess of moisture (7W). The area in the very south of the watershed contains some natural white spruce and some class 5 sites are classified for this tree species.

The Lower Assiniboine Delta (Figure 50)

The surface deposits of this area range from coarse to fine lacustrine. The area is generally imperfectly to poorly drained. The moisture regime in some sites is very favourable to tree growth having a rating of class 4 for poplar. Most of the area can support fair to good trembling aspen and balsam poplar growth (Fig. 44). Depending on moisture regime they are classified as 5W and 5M. Areas too wet to support better growth than fair to poor are rated 6W. The class 7 lands are too wet (W) to support any tree growth other than willow and alder. The medium textured soils south of Westbourne have excessive levels of toxic elements such as soluble salts (6N, 7N). On the fine textured deposits some lands are too wet in spring and too dry in summer (5^{W}_{M}) or have a very heavy compact layer in the soil profile (5D). Poorly drained sites (6W) have often also high levels of toxic elements (6N). The very poorly drained lands are classified as 7W and 7^{W}_{N}.

The medium textured flat lying deposits in the central part of the watershed have the same limitation to tree growth as most of the area (M, W) but are also very calcareous. A limitation related to calcareousness (L) is added to the ratings where applicable.

West Lake Till Plain (Fig. 48)

The area shows the ridge and swale microrelief resulting in an abundance of microsites (Figs. 45, 46 and 47). The better drained ridges are classified as class 5 for trembling aspen with M as the limiting factor. The moister lands are rated 5W for trembling aspen and balsam poplar. The poorly drained sites range in ratings from 6W to 7W. Some of the higher ground is classified as 6M as a result of a more severe limitation by moisture deficiency. The lime content of the soils is very high, therefore L is added as a limiting factor to classes 5 and 6.

The small 5Sn region in the West Lake Plain is, therefore, significant in that some coniferous stands are found. Areas which contain natural stands of conifers are rated for trembling aspen, which is the dominant tree species, and the coniferous species. The sandy deposits are very low in natural fertility resulting in the subclass F.

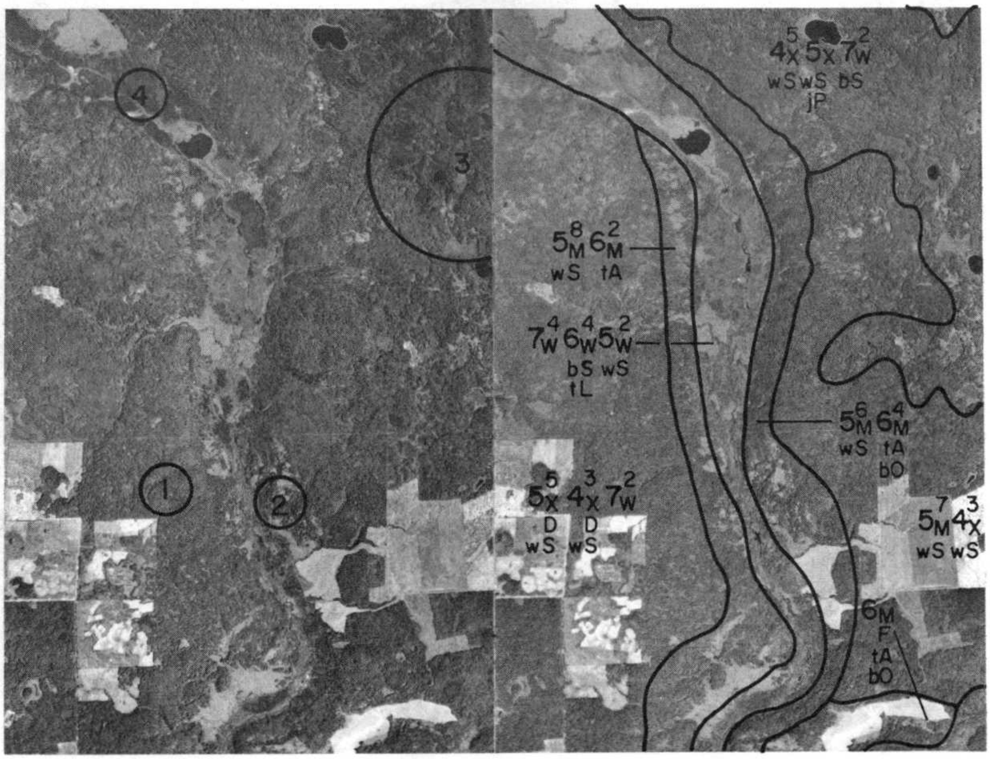


Figure 40.

Riding Mountain Till Plain - Twp. 17, Rge. 16W.
This area can and does support good tree growth of both coniferous and deciduous nature. Outside the park, land has been cleared and tree cover is confined to the steep slopes. Trembling aspen (1) is the most abundant tree species; on the dry sites it is mixed with bur oak (2). Trembling aspen and white spruce mixtures (3) are most abundant in the park. In the poorly drained areas (4) black spruce is found.

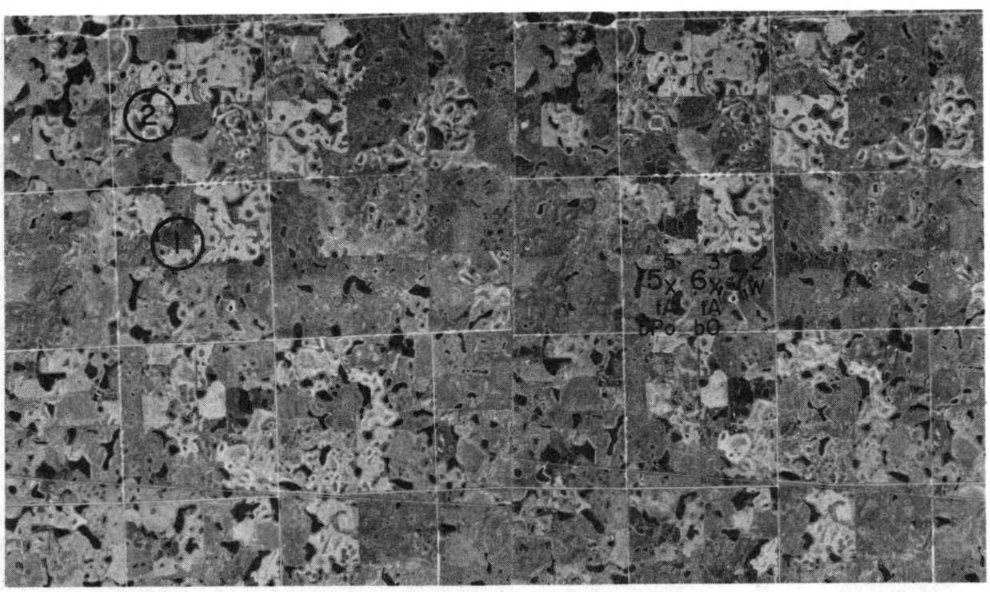


Figure 41.

Minnedosa-Reston Till Plain - Twp. 13-14, Rge. 17-18W.

1) Trembling aspen and balsam poplar occupy the moist and fresh sites. Most of these sites are, however, cleared of vegetation.

2) Tops of knolls and steeper slopes are in many cases more or less eroded. Note the numerous depressions and knolls characteristic for this physiographic area.

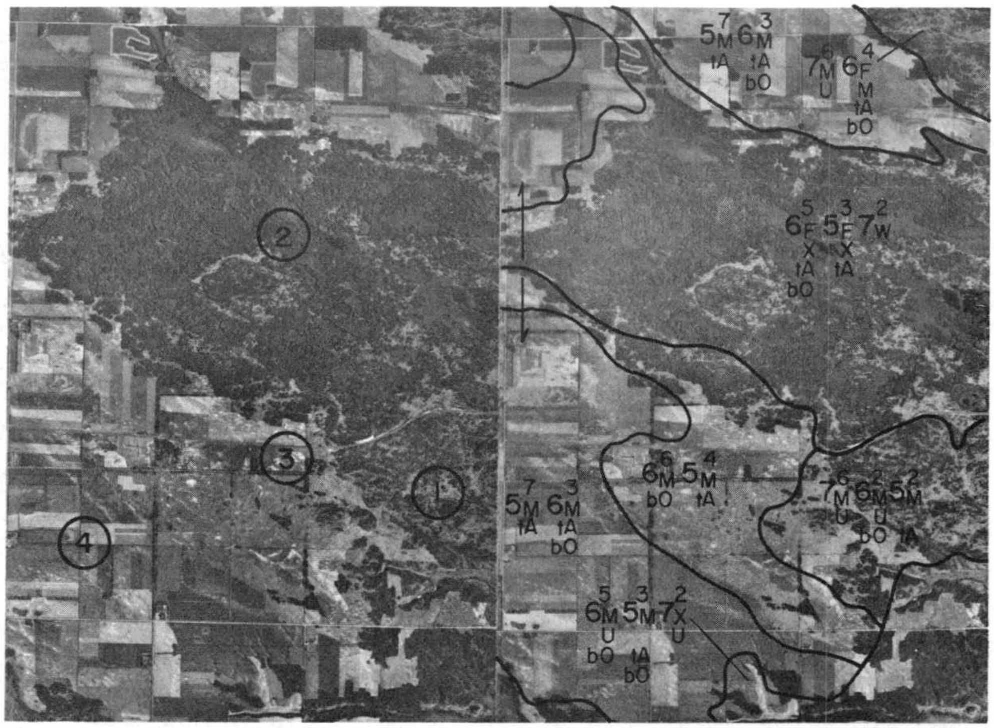


Figure 42.

Upper Assiniboine Delta - Twp. 12, Rge. 14W.

1) *Duned area. The south and west facing slopes are too dry to support tree growth. The north and east facing slopes have a more favorable microclimate, resulting in a tree cover of aspen and bur oak.*
2) *Slightly duned area with many very wet depressions. The tree cover is more extensive as a result of a better moisture supply.*
3) *Slightly duned area, but very dry as a result of rapid percolation.*
4) *Medium sands. This results in a better moisture retention capability. These lands can support fair to rather good tree growth.*

Figure 43.

Upper Assiniboine Delta - Twp. 12, Rge. 13W.

1) *Peat filled basins. The peat acts as a sponge. Runoff is released in a slower and more gradual pace.*
2) *These lands had a rather extensive tree cover (trembling aspen and bur oak) in the past. Most of these lands have been cleared and are now in use for agriculture. The tops of knolls and slopes show signs of erosion.*

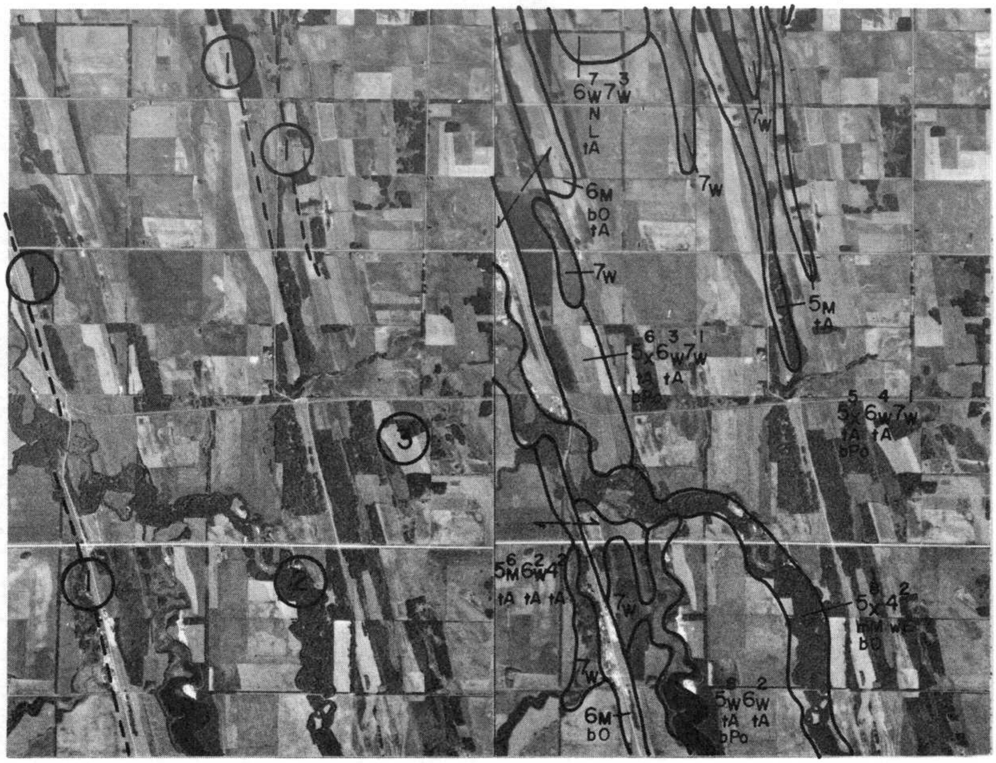


Figure 44.

Lower Assiniboine Delta - Twp. 15, Rge. 13W.
1) Former beaches of glacial Lake Agassiz.
2) Whitemud River. Note the good growth of tree species such as Manitoba maple, white elm, green ash and balsam poplar.
3) Sandy deltaic deposits with a fairly high groundwater table. Most of this land has been cleared. Sites, where the moisture balance is right for most of the growing season, can support very good balsam poplar and trembling aspen growth.

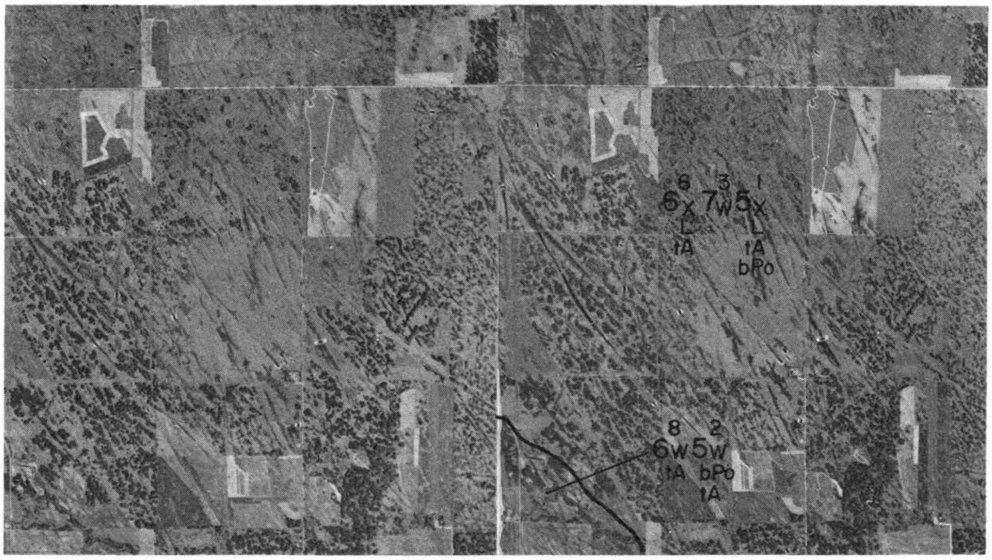


Figure 45.

West Lake Plain - Twp. 15, Rge. 10W.
Highly calcareous soils.
Note the sparse and stunted tree growth in this area. The ridge and swale topography is caused by ice movements scraping elongated depressions in the surface deposits.

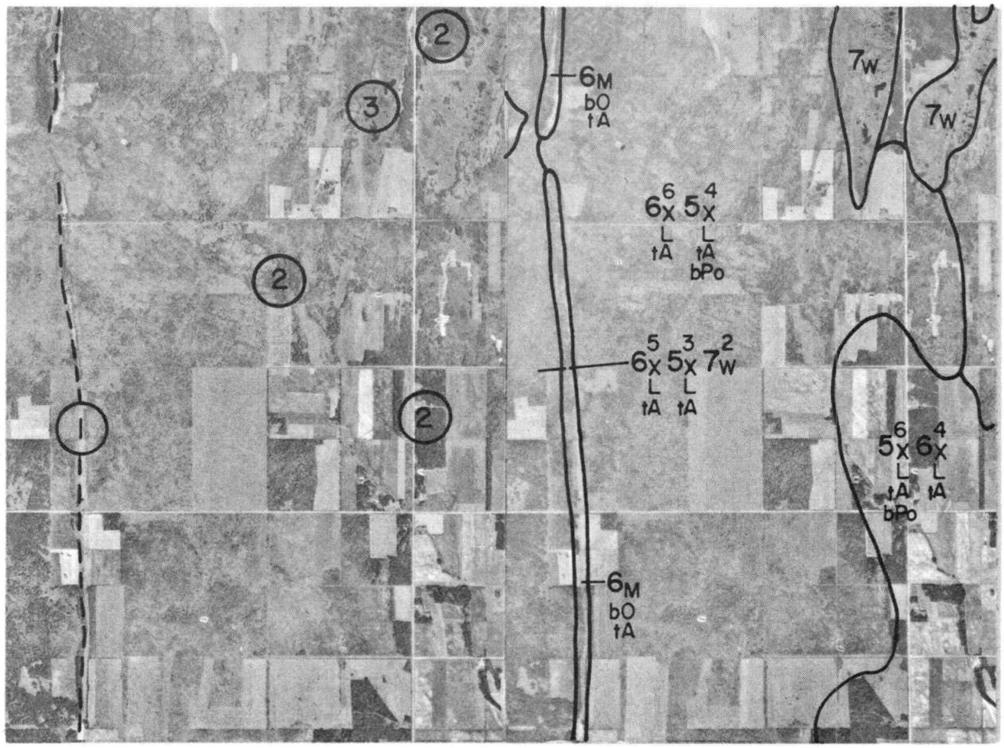


Figure 46.

West Lake Plain - Twp. 19, Rge. 12W.
1) Former beach of glacial Lake Agassiz.
2) Trembling aspen stand and grove; note the better growth on the somewhat better drained sites.
3) Depression with a sedge vegetation.
The soils in this area are very calcareous.

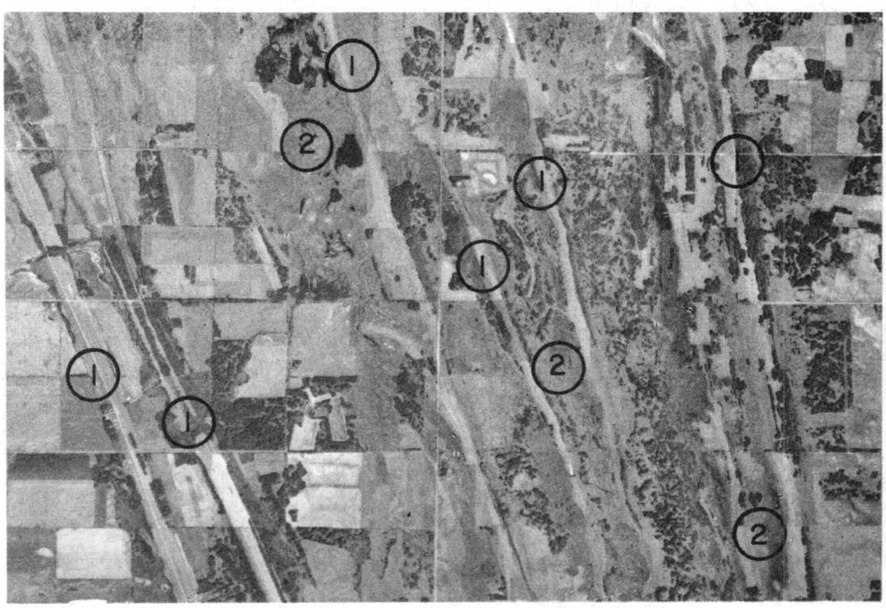


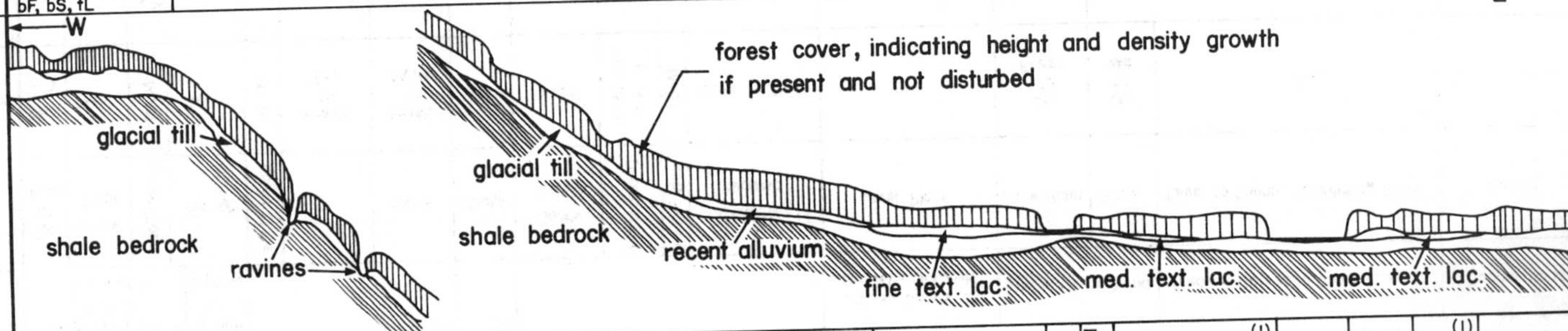
Figure 47.

West Lake Plain - Lower Assiniboine Delta - Twp. 16, Rge. 14W.
1) Former beaches of glacial Lake Agassiz.
2) Depressions (very wet). Runoff is hampered by the direction of the beaches which is across that of the landfall. Water accumulates against the west side of the beaches.

Figure 48.
Hypothetical crosscut showing relation of site to capability for forestry.

Riding Mountain Till Plain, Riding Mountain Escarpment and West Lake Plain

Capability Rating: Class	3 – 7	5 4	4	5	7 6	5 6 (1)	7	6	(1)	5 6
Capability Rating: Limiting Factor	M, W, D	MD D	XD	XD	W M	XL WL	W	M		XL ML
Capability Rating: Indicator Tree Species	wS, jP, bS, tL	wS wS	wS/tA/bPo	tA/bPo	tA/bO	tA/bPo tA		tA/bO		tA/bPo tA
Present tree cover (if any)	wS, jP, tA, bPo, wB, bF, bS, tL	tA bPo	tA, bPo, mM, wE, gAs	tA/bPo/Wi	Wi tA/bO	tA/bPo	Wi	tA/bO		tA/bPo tA

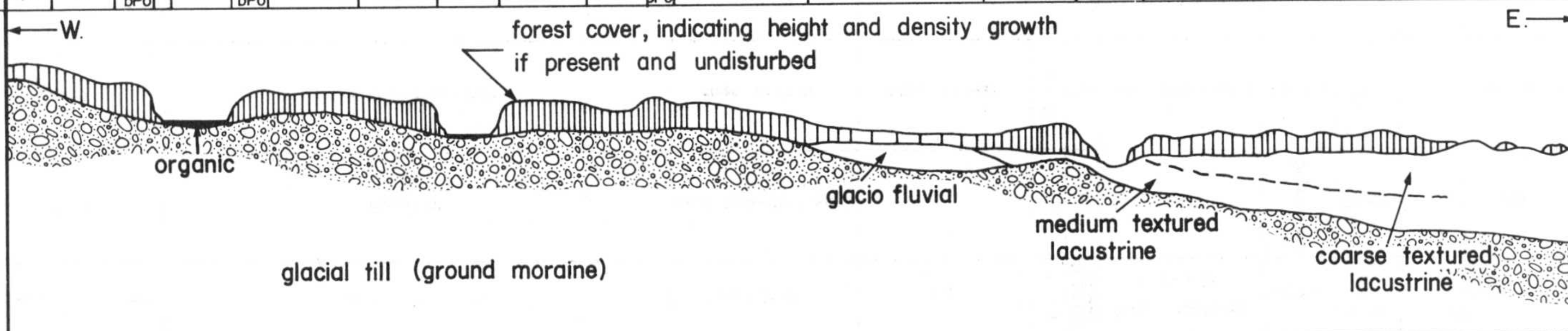


Parent Material	Sand to Clay Loam	Loam to Clay Loam	Loam to Clay	Clay	Organic	Sand and Gravel	Fine Sandy Loam to Silty Clay (1)	Organic	Sand and Gravel	(1)	Sandy Loam
Topographic Location	Plateau	Escarpment	Level to Gently Sloping			Beach	Level	Depressional	Beach		Level
Moisture Conditions	Dry to Wet	Dry to Slightly Moist	Fresh to Moist	Moist to Wet	Very Wet	Dry	Fresh to Very Moist	Very Wet	Dry		Fresh to Moist
Soil	Grey Wooded Dark Grey Wooded and Organic	Grey Wooded	Regosol	Black and Gleysol	Organic	Black	Black	Organic	Black		Black and Regosol
Surface Texture	Sand to Clay Loam	Clay Loam	Clay Loam to Clay	Clay		Sand	Loam to Clay		Sand		Loam

Figure 49.

Hypothetical crosscut showing relation of site to capability for forestry.

		Minnedosa - Reston Till Plain and Upper Assiniboine Delta																		
Capability Rating	Class	6	5	5	6	7	5	5/6	5	7	5	6	5	6/5	6	6/5	6	7	6/5	6/7	
	Limiting Factor	M	M	W	W	W	X	M	X	W	X	W	W	M	M/F	M	M	W	M	MFU	MU
	Indicator Tree Species	tA/bO	tA	tA/bPo	tA		tA/bPo	tA	tA/bPo		tA/bPo	tA	tA/bPo	tA/bO	tA/bO	tA/bO	tA/bO		tA/bO	tA/bO	
Present tree cover (if any)		tA/bO	tA	tA/bPo	tA	Wi	tA/bPo	tA/bO	tA/bPo	Wi	tA/bPo	tA	tA/bPo	tA/bO	tA/bO	tA/bO	tA/bO	Wi	tA/bO	tA/bO	bO

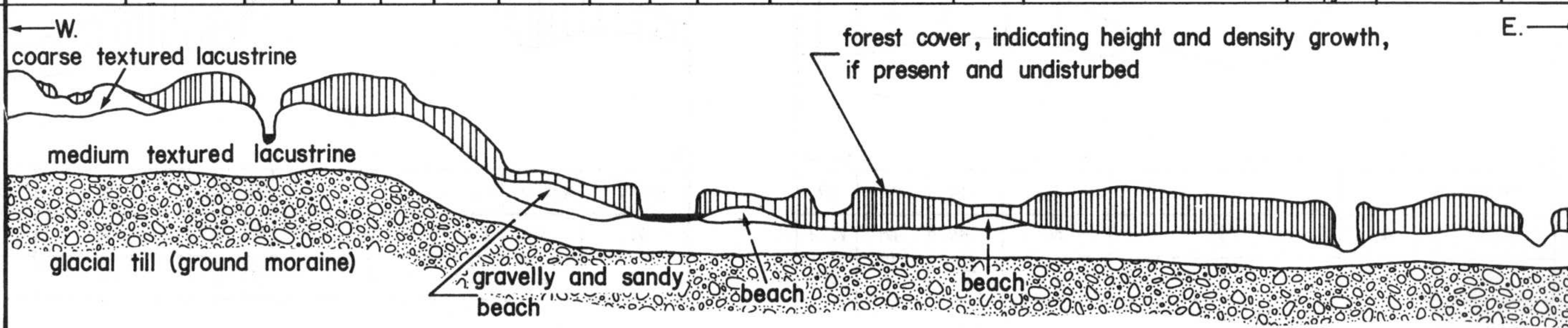


Parent Material	Moderately Cal. Loam to Clay Loam (1)			Marsh or Organic (2)			(1)	(2)					Coarse, Sandy & Gravelly Outwash	Medium Fine Sand		Medium Coarse to Coarse Sand	Coarse Sand
Topographic Location	Top of knoll	Upper Slope	Lower Slope	Slough	Lower Slope		Slope	Slough	Gently Sloping	Depressional	Gently Sloping	Gently Sloping	Level Plain	Level Plain	Gully	Level to Slightly Undulating Plain	Duned
Moisture Conditions	Very Dry	Fresh	Moist	Wet	Moist	Fresh to Dry	Fresh to Moist	Wet	Fresh	Very Moist to Wet	Moist	Fresh to Dry	Dry	Dry to Fresh	Dry to Wet	Dry	Dry to Very Dry
Soil	Black	Black	Black and Dark Grey	Gleysol and Organic	Black and Dark Grey	Black	Black to Dark Grey	Organic	Black	Gleysol and Organic	Dark Grey	Black	Black	Black	Black and Gleysol	Black	Regosol
Surface Texture	Loam	Clay Loam	Clay Loam		Clay Loam	Clay Loam	Clay Loam		Clay Loam		C. Loam	Clay Loam	Coarse Sand to Loamy Coarse Sand	Loamy Medium Fine Sand	Medium Fine Sand	Loamy Medium Fine to Coarse Sand	Coarse Sand

Figure 50.

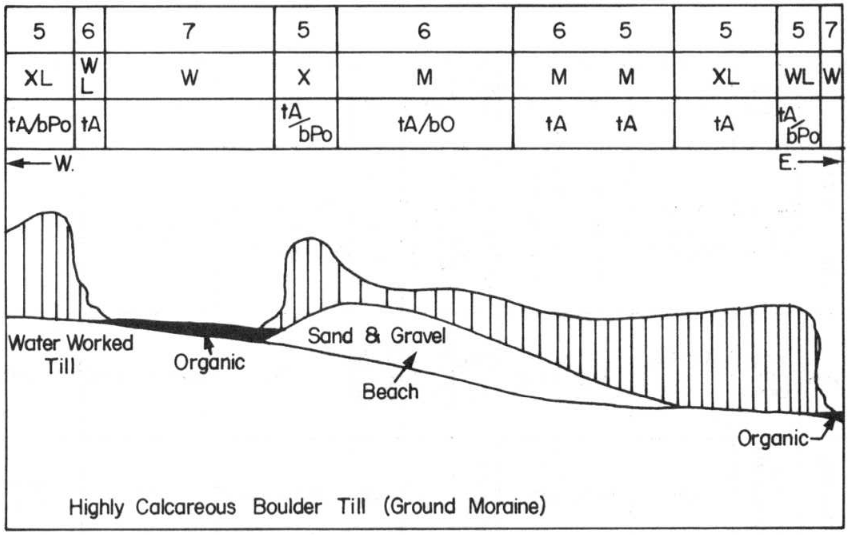
Hypothetical crosscut showing relation of site to capability for forestry.

		Upper Assiniboine Delta, Manitoba Escarpment and Lower Assiniboine Delta																		
Capability Rating	Class	7	6	5	6	6/7	6/5	5	5	5/6	6	5	7	5 6	5 6	6	5(4)	5 4	5	5
	Limiting Factors	MU	MFU	M		MW	M	X	M	M	M	X	W	X M	X W	M	X	X	X	M
	Indicator Tree Species		bO/tA	tA/bO		tA/bO	tA	tA	tA/bO	tA/bO	tA/bO	tA/bPo		tA bO	tA/bPo tA	tA/bO	tA/bPo	mM/bO wE	tA/bPo	tA/bO
Present tree cover (if any)		bO	bO/tA	tA/bO		tA/bO Wi	tA/bO	tA	tA/bO	tA/bO	tA/bO	tA/bPo	Wi	tA bO	tA/bPo tA	tA/bO	tA/bPo	mM, tA, wE, bPo, gAs	tA/bPo	tA/bO

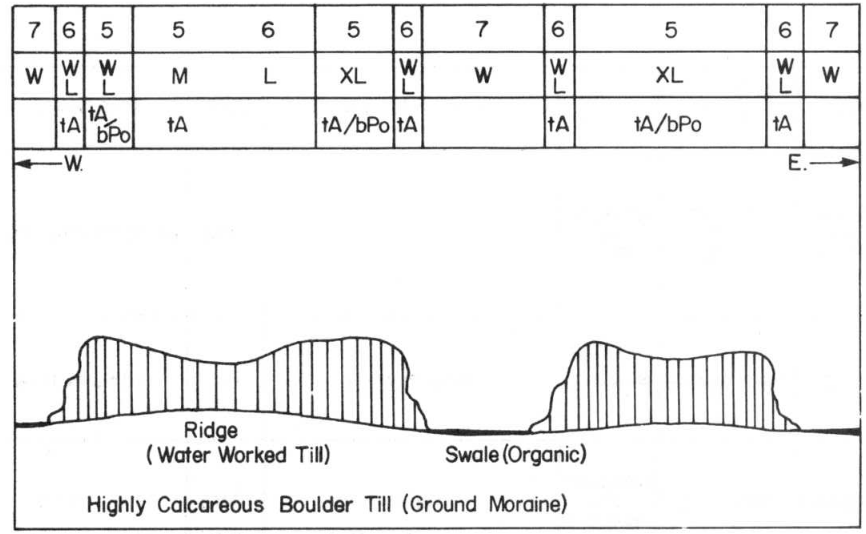


Parent Material	Coarse Sand		Sand to Fine Sand							Gravel and Sand		Organic	Gravel and Sand	Sand to Fine Sand	Gravel and Sand	Sand to Fine Sand	Sand to Clay	Sand to Fine Sand	
Topographic Location	Duned		Gently Sloping	Ravine	Hilly	Depressional	Slope	Slope	Beach	Lower Slope of Beach	Depressional	Beach	Level Plain	Beach	Level Plain	River Banks and Flood Plains	Level Plain	River Banks
Moisture Conditions	Dry to Very Wet		Dry	Very Dry to Wet	Dry to Very Dry	Dry to Fresh	Dry	Dry	Dry to Very Dry	Fresh to Moist	Wet	Moist to Dry	Moist to Fresh	Dry	Moist to Fresh	Dry to Moist	Fresh to Moist	Dry
Soil	Regosol		Black, Dark Grey and Grey Wooded	Black Gleysol	Black and Dark Grey	Dark Grey and Grey Wooded	Grey Wooded	Grey Wooded	Dark Grey and Black	Black and Dark Grey	Organic and Gleysol	Black and Dark Grey	Dark Grey and Gleysol	Black	Black	Black to Grey Wooded	Black and Dark Grey	Black to Dark Grey
Surface Texture	Coarse Sand		Loam	Loam	Loam	Clay Loam	Clay Loam	Loam	Sand	Loamy Sand		Sand	Loamy Sand	Sand	Loam to Sandy Loam	Clay Loam	Loam to Sandy Loam	Loam

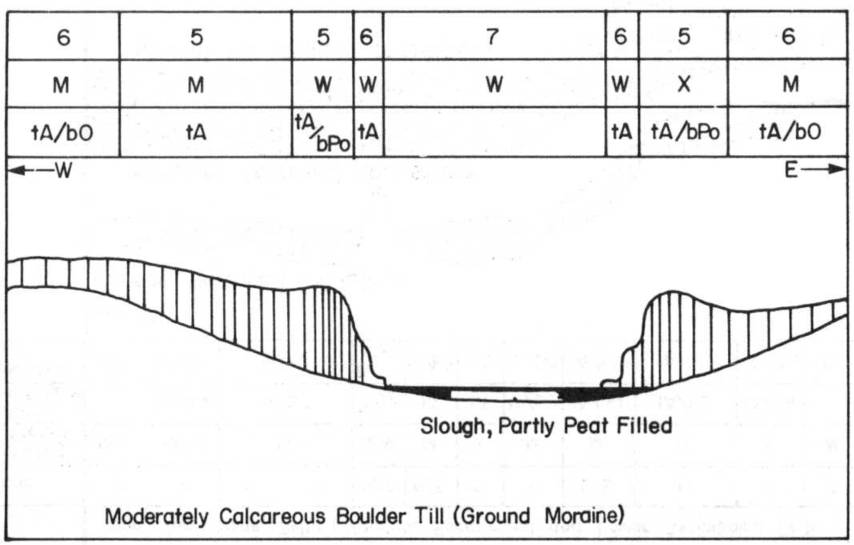
Figure 51.



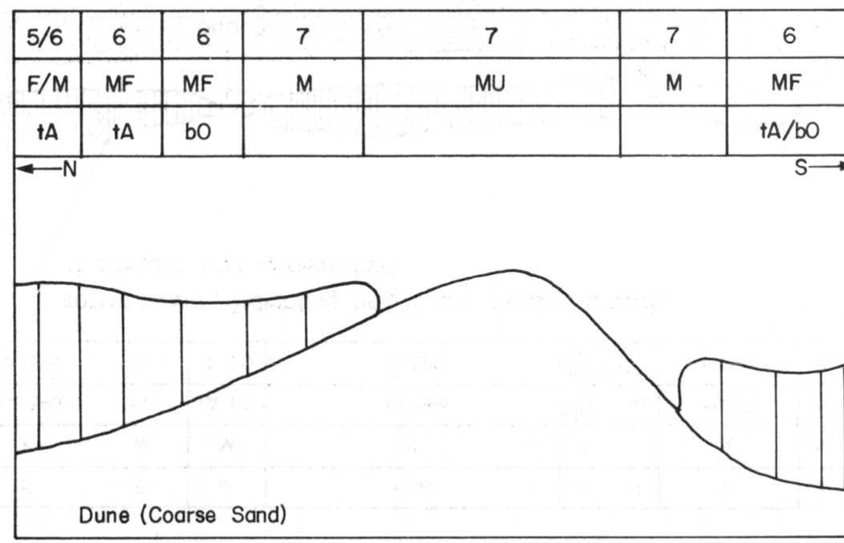
Crosscut of beach ridge.



Crosscut of ridge and Swale.



Crosscut of undulating till.



Crosscut of Dune.

SUMMARY AND CONCLUSION

Of the total watershed area slightly more than one-fifth is classified as woodland. One-half is productive woodland, the other half is non-productive. The best and most extensive stands are found in and close to Riding Mountain National Park. In the remainder of the area most stands are smaller, and poorer in quality as a result of abuses like burning and grazing. In the Riding Mountain area conifers are important components of the forest communities, but trembling aspen is the dominant species in areal extent. In the remainder of the watershed, tree cover is almost exclusively deciduous, with trembling aspen and to a lesser extent balsam poplar as the dominant species. In dry areas bur oak is an integral member of the species composition.

In recent times the use of the forest resource has been limited; timber is cut for household and farm use, but no cutting or logging operations of any importance are carried out currently. At the time of early settlement the forest resource played an important role in providing timber and lumber for construction and fuel. Later timber was cut for use as railroad ties and fuel wood. Logs and lumber were also exported to markets outside the watershed. Several saw mills were operated in the area at the turn of the century. The economic importance of the resource has all but disappeared.

No significant use of the forest resource, in the conventional sense, can be expected for the future. That does not mean that forest and trees in this area should be considered as unimportant. Cultural or Environmental Forestry practices and management which recognize forest ecosystems, environmental and biotic interactions within these, and emphasis of the social or cultural and environmental functions of a forest, could greatly assist in alleviating apparent environmental problems like erosion and inundation. It could also assist in the shaping of a more harmonious association between the rural and urban user practices (i.e. landscape, wildlife, fish production, recreation) and thereby create a well balanced environment.

The use of natural forest cover and plantations as a means to modify watershed regimes and to reduce erosion has been demonstrated in many parts of the world. In this watershed it appears to be feasible environmentally as well as in an economical sense. Selection of methods and species for reforestation and afforestation should, however, not be based on the principles of timber and fiber production but on that of ecosystem productivity, which includes trees, wildlife, lesser vegetation, and on the social and economic needs of the population.

From the early days of settlement tree planting projects have been carried out throughout the province. In the early years tree planting was an individual effort but from the late 1880s programmes have been undertaken to provide farmers with planting stock for shelterbelts. Many hundreds of miles of shelterbelts have been planted over the years with native and exotic species. In 1945 strong recommendations were made to establish extensive shelterbelts as a measure of erosion control; to plant woodlots and to manage existing ones properly to provide timber for local use and to provide additional income to farmers. This advice has not been followed generally, and as a result the erosion problem is severe and most woodlots contain timber of inferior quality. Plantations and shelterbelts in the watershed or just outside the boundary show that some species both native and exotic will do surprisingly well in many cases.

While most of the area is presently covered by hardwoods and grassland and a small portion on the Riding Mountain by southern boreal forest, it should be pointed out that this species distribution is not necessarily in accord with the present environmental conditions. Present vegetation should not be the only criterion to be used when species for planting or seeding are selected on an ecological basis. Climate has been changing in the past and vegetation reacts slowly to those changes. It is believed that as a result of the cooling trends in the last 2000 years which culminated about 400 years ago (Little Ice Age) that boreal forest could (and finally would) form relatively stable communities on most sites. Introduction of boreal species like *picea* and *pinus* could, therefore, be considered environmentally justified.

The capability of the lands to produce commercial timber is not very high, but in general, better than indicated by the present forest cover. About 40-50% of the lands can support class 5 forest, indicating severe limitations for timber production. About 45% of the lands have even more severe limitations for forest growth and are classified as class 6 and 7. Five percent of the area is land with moderate to moderately severe limitations to the growth of commercial forests (class 3 and 4). The main limiting factor affecting tree growth is climate. Besides that, the most important factors limiting tree growth are excess and deficiency of moisture during the growing season.

The potential value of forests to check and modify erosion and inundation is accentuated by the coincidence that the upper parts of the watershed tend to be areas with superior forest capability. This is especially true for the Riding Mountain Upland and escarpment area. Many of the steeply sloping and eroding lands with limited agricultural value, would lend themselves for successful reforestation with commercially and ecologically attractive species.

RECOMMENDATIONS

1. For watershed studies, surveys and management in areas in Southern Manitoba, where the forest resource is not of considerable importance to the economy, a Cultural or Environmental Forestry approach should be used. In such an approach the environmental and social or cultural functions of a forest will be emphasized over economical considerations.

2. In the second phase of the Whitemud Watershed study the cultural forestry approach should be implemented in more detailed studies.

3. A detailed study is desirable to define the relationship of present (both natural and planted) vegetation and hydrological regime and soil problems.

4. Coinciding with No. 3, studies should be carried out to assess the magnitude of modification of the hydrological regime by conceivable cultural or conventional reforestation and afforestation practices.

5. A study should be carried out to evaluate existing shelterbelts in regard to windbreaking, snow accumulation, landscape and in conjunction an evaluation of the species composing the shelterbelts.

6. A literature study should be carried out to evaluate the potentialities of multi-disciplinary use and management of ecosystems in this area.

REFERENCES

Bailey, R. H. 1967. Report on the Forest Survey of the Riding Mountain National Park, Province of Manitoba, 1960. Dept. of Forestry and Rural Development, National Park Forest Survey. Report No. 1.

________. 1968. Notes on the Vegetation in Riding Mountain National Park, Manitoba. Dept. of Forestry and Rural Development, National Park Forest Survey. Report No. 2.

Dominion Experimental Farm Reports. 1889-1903.

Ellis, J. H., C. B. Gill and F. W. Brodrick. 1945. Farm Forestry and Tree Culture Projects for the Non-Forested Region of Manitoba.

Ehrlich, W. A., E. A. Poyser and L. E. Pratt. 1957. Report of Reconnaissance Soil Survey of Carberry Map Sheet Area. Manitoba Soil Survey, Canada Dept. of Agriculture, Manitoba Dept. of Agr. and Immigration and Soils Dept., The University of Manitoba Soils Report No. 7.

________, L. E. Pratt, E. A. Poyser and F. P. Leclaire. 1958. Report of Reconnaissance Soil Survey of West-Lake Map Sheet Area. Manitoba Soil Survey, Canada Dept. of Agriculture, Manitoba Dept. of Agriculture and Immigration and Soils Dept., The University of Manitoba Soils Report No. 8.

Forest Resources Inventory. 1956. Report No. 4. Mountain Forest Section. Forest Service, Dept. of Mines and Natural Resources, Province of Manitoba.

Forrester, D. B. 1972. Soil Capability for Forestry, Brandon 62 G. Canada Land Inventory (not yet published).

Gill, C. B. Manitoba Forest History (Unpublished).

Hind, H. Y. 1860. Narrative of the Canadian Red River Exploring Expedition of 1857 and of the Assiniboine and Saskatchewan Exploring Expedition of 1858. 2 volumes.

Hodgson, J. A., I. G. Hiller and A. N. McCaughan. 1967. Present Land Use Map for Neepawa, 62 J. (Unpublished).

Honer, T. G. 1965. A New Total Cubic Foot Volume Function.

Jameson, J. S. 1956. Planting of Conifers in the Spruce Woods Forest Reserve, Manitoba, 1904-1929. Dept. of Northern Affairs and National Resources, Ottawa.

Love, Doris. The Postglacial Development of the Flora of Manitoba: A discussion. Contribution from the Institute Botanique, Universite de Montreal, Quebec. Canadian Journal of Botany, Volume 37 (1959). pp. 547-585.

McClellan, J. B., L. Jersak, C. L. A. Hutton. 1967. A Guide to the Classification of Land Use for the Canada Land Inventory. Geographical Branch, Dept. of Energy, Mines and Resources, Ottawa.

McCormack, R. J. 1970. Land Capability Classification for Forestry. The Canada Land Inventory Report No. 4, second edition. Dept. of Regional Economic Expansion, Ottawa.

MacKay, G. H. and C. R. Stanton. Wilson Creek Study, Erosion and Sedimentation Control.

Manitoban, The. September 30, 1871.

Morgan, J. H. 1885. Sessional Papers, Vol. XVIII, No. 7. Forestry Commission. Summary of Preliminary Report of Mr. J. H. Morgan, Commissioner.

Morton-Fahrni, Margaret and W. L. Morton. 1946. Third Crossing. A history of the First Quarter Century of the Town and District of Gladstone in the Province of Manitoba.

Nichols, Harvey. 1969. The Late Quaternary History of Vegetation and Climate of Porcupine Mountain and Clearwater Bog, Manitoba, Arctic and Alpine Research, Volume 1, No. 3. pp. 155-167.

Ritchie, James C. Holocene Vegetation of the Northwestern Precincts of the Glacial Lake Agassiz Basin. Life, Land and Water Proceedings of the 1966 Conference on Environmental Studies of the Glacial Lake Agassiz Basin. pp. 217-229.

Rowe, J. S. 1959. Forest Regions of Canada, Canada Dept. of Northern Affairs and National Resources, Forestry Branch, Bulletin No. 123.

________. 1962. Soil, Site and Land Classification. Canada Dept. of Forestry, Forest Research Branch.

Tyrell, J. B. Notes to Accompany a Preliminary Map of the Duck and Riding Mountains in Northwestern Manitoba. p. 7E.

Veldhuis, H. and J. Thie. 1972. Soil Capability for Forestry, Neepawa 62 J. Canada Land Inventory. (Not yet published).

Waldron, R. M. 1966. Factors Affecting Natural White Spruce Regeneration on Prepared Seedbeds at the Riding Mountain Forest Experimental Area, Manitoba. Canada Dept. of Forestry and Rural Development, Forestry Branch, Ottawa. Dept. Pub. No. 1169.

Report Prepared by:

H. Veldhuis,
Resource Projects,
Manitoba Dept. of Mines, Resources
and Environmental Management.

D. Forrester,
Resource Projects,
Manitoba Dept. of Mines, Resources
and Environmental Management.

R. Bukowsky,
Resource Projects,
Manitoba Dept. of Mines, Resources
and Environmental Management.

J. Thie,
Resource Projects,
Manitoba Dept. of Mines, Resources
and Environmental Management.

Approved by:

A. E. Borys,
Asst. Director, Resource Projects,
Manitoba Dept. of Mines, Resources
and Environmental Management.