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NATIONAL MUSEUM OF CANADA

W. H. COLLINS, ACTING DIRECTOR

BULLETIN No. 74

BIOLOGICAL SERIES, No. 20

# Botanical Investigations in Wood Buffalo Park

BY  
Hugh M. Raup



OTTAWA  
J. O. PATENAUDE, L.S.O.  
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY  
1935

*Price, 50 cents*

## ***ERRATA***

Figure 14. For Cleared hay meadow, *read* Poplar timber, chiefly  
*Populus tacamahacca*.

Page 114. For **C. Vahl**ii, var. **inferalisma**, *read* var. **inferalpina**.





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## BOTANICAL INVESTIGATIONS IN WOOD BUFFALO PARK

### INTRODUCTION AND HISTORICAL SUMMARY<sup>1</sup>

Wood Buffalo park is a tract of nearly virgin wilderness, 17,300 square miles in extent (Figure 1), set aside by the Canadian Government for the preservation of the remnant herds of wild bison and other game and fur-bearing animals that inhabit it. It lies partly in northern Alberta and partly in southern Mackenzie, and has its administrative organization at Fort Smith, on Slave river. Wild life is completely protected within its boundaries, with the exception of certain limited hunting and trapping rights held by treaty Indians through long-standing agreements. As originally designated in 1922 its southern boundary was at Peace river. With the increase of the bison herds it was found necessary, in 1926, to enlarge the area to its present extent.

Investigations directed specifically to the plant cover of the country have been very meagre, and in most of the park area have never been attempted previous to the writer's activities. Some members of geological and topographical survey parties, and a few hunters and travellers have made minor collections or notes on the general aspects of the vegetation. Since the present report involves not only the floristic content of the vegetation, but also its geographic distribution and economic importance, these notes, even though random, have proved valuable in many cases. Most travellers have passed directly through by the main waterways—Athabaska, Peace, and Slave rivers—so their accounts largely duplicate one another. It is to the few who have got away from these routes and have described parts of the inland country that particular attention will be given in the brief sketch that follows.<sup>2</sup>

The earliest white travellers in the region, who have given us written accounts, were probably antedated by Canadian *coureurs des bois* who left no records. According to Petitot (1884), the family of Beaulieu had already become established at Salt river before the first of the traders descended the Slave (47). Samuel Hearne, who was the first to describe Great Slave lake, came to it from the north in the winter of 1771-72, and after crossing it departed eastward to Hudson bay, without having come far enough southward to enter the present park area (30). Peter Pond, a fur trader, descended Athabaska river in 1778 and built a trading post about 30 miles above Athabaska lake. Ten years later a post called Fort Chipewyan was established on Old Fort point, on the south shore of lake Athabaska, by the Northwest Company (4). This was later re-established on its present site at the western end of the north shore of the lake. Although a trading post had already been established on Great Slave lake by one Laurent Leurox in

<sup>1</sup> See References Cited, page 173, for all reference numbers inserted through text.

<sup>2</sup> For a more complete account of the exploration of the region See the writer's "Range Conditions in the Wood Buffalo Park," etc. (54).

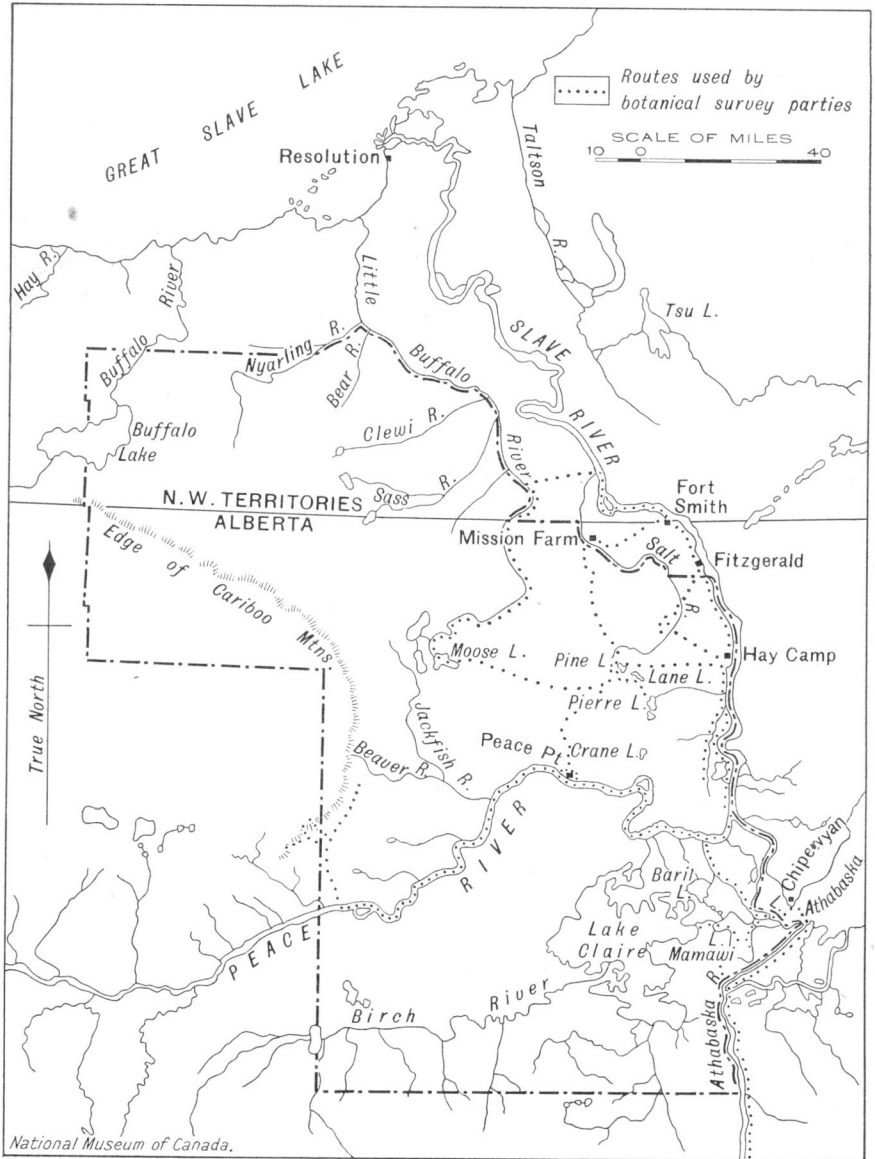


Figure 1. Map of Wood Buffalo park.

1786 (7), Alexander Mackenzie gives the first written description of Slave and lower Peace rivers, which he navigated on his journeys to the Arctic and Pacific oceans (39). The first good map of these waterways was made by Philip Turner (1790-92) (5), but a very inaccurate one had been made in 1785 by Peter Pond (6).

The earliest notable records upon natural history were made during the two expeditions commanded by Sir John Franklin, a British naval officer. Sir John Richardson was surgeon and naturalist to these, and accumulated an immense collection of notes and specimens which later became the basis for two classic works on the fauna and flora of North America (59, 31). In addition to carrying out the major purpose of the expeditions, geographical exploration in the Arctic, a vast amount of information was gathered relating to the topography, geology, and inhabitants of Mackenzie basin. The narrative of the first of these journeys (25) gives the first description of the Salt Plain country along Salt river. The traders had already been getting salt to supply their posts by ascending Salt river (Figure 1), which enters the Slave about 20 miles below the present site of Fort Smith, to some brine springs. The salt is evaporated out at the orifices of the springs, and may be gathered and used without alteration. In July, 1820, Franklin's party ascended the river about 22 miles to the Salt Plain, a semi-open prairie area, part of which is barren salt flat. On their way downstream next day they killed a buffalo which attempted to swim the river.

Although many of the plant specimens collected by Richardson must have come from Athabaska and Slave Rivers areas, the annotations found in *Flora Boreali-Americana* are of little value in forming a flora of this region, since they are not sufficiently specific as to the locality. From what is now known of the flora of the Salt Plains, it is evident that no accurate records were made there.

Other expeditions to the north followed much the same course through the country as the one just described. Franklin in his second journey (26), George Back (2), Thomas Simpson (66), and Sir John Richardson (60) visited the Salt Plains, but added little to the knowledge already gained. Back, a clever artist, published a good picture of the plains and springs. Thomas Simpson entered the country in winter, and instead of following the regular boat channels through the delta of the Athabaska, took a route via Embarras channel and a portage to a creek leading into lake Mamawi. No detailed description is presented.

In 1875, John Macoun made a canoe and boat journey down Peace river to Athabaska lake, thence up Athabaska and Clearwater rivers (40, 41). His account of the vegetation at the western end of the lake and in the Athabaska and Peace deltas is excellent, and the first that was ever made. He gives a list of plants collected on the trip, but no specific collection localities. Emile Petitot, a Roman Catholic Missionary well known for his works on the geography of Mackenzie basin, also gives an early account of this delta region (47). He has several interesting notes upon the effects of high and low water conditions in the vicinity.

In the winters of 1889-90 Warburton Pike (48), an explorer and hunter, made an overland journey southwest from Resolution in search of the wood bison. He described roughly a semi-open prairie country west of Little Buffalo river, in what is now the northern section of the park.



R. G. McConnell, of the Geological Survey, Canada, visited the Salt Plains in 1887 (38). He made a careful examination of the geological features of the region.

Frank Russell (61), a naturalist from the University of Iowa, entered the country in the spring of 1893 to collect birds, mammals, and ethnological materials. He spent a month in the early summer collecting in the Quatre Fourches delta west of Chipewyan, the account of which gives a few notes on the topography and vegetation of that area. In January of 1894 he made a trip southwest from Resolution, reaching, apparently, the same district that Pike visited. He gives the locality and the nature of the country in somewhat more detail.

In the summer of 1892 Miss Elizabeth Taylor made the trip down the main rivers to the Mackenzie delta and back. She made minor plant collections along the way, and those gathered at Fort Smith are of some interest in connexion with the flora of Wood Buffalo park.

Caspar Whitney (71), a hunter and sportsman, made a winter journey through the area in 1895. In February of that year, with Indian guides and a companion named Munn, he set out from Fitzgerald (Smith Landing) in a southwesterly direction to hunt buffalo. The party crossed Salt river and a wide stretch of semi-open prairie country, and entered a wooded area in which there were many sink-holes and muskegs. From the brief description given, they must have passed close to Heart lake and Pine lake, and gone on westward and southwestward toward Moose Lake basin. Near the end of their hunt they had a close view of Caribou mountains from a ridge. So far as the writer can find, this is the first published description of the upland country between the upper Slave river and Caribou mountains. It is all too brief, taking into account only casual notes as to openness, ridge, timber, muskeg, etc.

Although E. A. Preble (49) did not enter the park area on his two journeys (1901 and 1903-4), his account of the condition of the wood bison is the most complete up to that time. A list of trees and shrubs collected along his routes of travel is of considerable interest.

In 1902, Charles Camsell (13) of the Geological Survey, Canada, made three journeys into the country southwest of Fort Smith. The first of these was a canoe trip up Salt river, far into the Salt Plain district. The second was an overland trip by pack-horse to the shore of Moose lake, via Salt mountain, Flatgrass lake, and Ninishith hills. On the third trip he ascended the Little Buffalo to its headwaters and portaged to the headwaters of the Jackfish, which he descended to Peace river. His narrative is filled with excellent notes on the topography and vegetation of the country he traversed.

E. T. Seton (65), in 1907, made one trip from Fitzgerald and two from Fort Smith, in company with Major A. M. Jarvis, of the Royal Canadian Mounted Police, in search of the wood buffalo. The first two of these trips were overland to the upland semi-open country west of the Salt Mountain escarpment, and to Little Buffalo river. The third consisted of a canoe journey down Slave river as far as Grande Detour portage to the Little Buffalo, then down the latter stream and up its principal western tributary, the Nyarling, which is now the northern boundary of the park. Seton's description has many valuable notes on the arrangement of the vegetation.

He drew the first map of Nyarling river. A list of plants appears in an appendix to his book, prepared by E. A. Preble, his companion on most of the journey, and annotated by the author himself. The determinations of species are by J. M. Macoun.

Various parts of the present park area were patrolled by the Northwest Mounted Police between 1908 and 1911. Their reports(44) contain much valuable information on topography, and on the distribution of the major types of vegetation.

Charles Camsell examined the Salt Plain and upland country between Fort Smith and Peace river in the summer of 1916, and wrote a report on its topography, geology, and natural resources (20). A collection of the principal forage plants, determined by J. M. Macoun, and published with the report, appears to be the first authentic material brought from the Salt Plains. There are also a few notes upon the success of the Roman Catholic Mission Farm, which was located on Salt river about 20 miles from Fort Smith.

The physiographic history of the lowlands of Athabaska, Peace, and Slave rivers is well outlined in a paper by E. M. Kindle (33, 34), who was for a time engaged in geological survey operations in Mackenzie basin. The most comprehensive treatment of the post-Glacial geology of the park area is that of A. E. Cameron (8). In this the principal topographic features are outlined, and their origin and development traced to the present condition. The paper has been most valuable in a study of the distribution of vegetation. F. V. Seibert made a series of journeys in the park north of Peace river, and in 1922 published a map containing many notes on the vegetation (63). He also wrote a brief account of the region as an appendix to a description of the summer range of the wood buffalo by Maxwell Graham (29, 64).

John Russell, D.L.S., engaged in field work for the Topographical Survey, made a small collection of plants in the northern area of the park in the summer of 1926. The specimens came chiefly from along Sass, Clewi, and Nyarling rivers, and are well annotated as to locality and habitat. They were determined by the late Dr. M. O. Malte, Chief Botanist of the National Museum of Canada, and nearly all of them have been examined by the writer. This is the only material available from the northern area. The activities of the Topographical Survey between 1927 and 1929 have yielded an immense amount of information regarding the interior of the park. G. H. Blanchet, D.L.S., drew a map, published in blueprint form in 1927, on which a rough outline of the topography was attempted. Since that time most of the southern half of the park has been mapped by aerial photography (68). The photographs are particularly useful in mapping the vegetation.

The writer, assisted by his wife, carried on field work in the southern part of the park during the summers of 1928-29-30, for the National Museum of Canada, and under the general direction of Dr. Malte. Considerable material gathered in Athabaska-Peace delta, along upper Slave river, and in Fort Smith district in the summers of 1926 and 1927 will also be incorporated in the present report. The general plan of operations has included the systematic collecting of the flora and the making of more or less detailed local studies of distribution in certain areas. These areas

were selected so as to give a representative view of the chief types of vegetation, and to make possible a study of the development of the entire flora. The first set of specimens will be found in the National Museum at Ottawa, and the second at the Gray Herbarium of Harvard University. Mrs. Raup looked after the lichens and mosses, while the writer collected the ferns and flowering plants. Reference to the map (Figure 1) and itinerary<sup>1</sup> will show the general outline of the work. A short paper describing some of the major geographic problems involved has already been published (53), but is summarized in the following pages.

It has been extremely difficult to form a comprehensive idea of the country by the ordinary means of travel in the past, for there are but few places of sufficient elevation to afford a view, and it is only with the advent of aerial photography and mapping that the true nature of the complex system of land and water relations can be seen. This holds true also for a study of the distribution of types of vegetation and the historical development of the same. The recently published maps above mentioned form the basis for a far more detailed analysis than has been possible heretofore, and the photographs themselves, loaned to the writer through the courtesy of the Director of Surveys, Department of National Defence, have been used to compile a series of local maps of vegetation which would have been possible in no other way. Simple diagrammatic sections, or transects, will be used to supplement the maps. The contours of the land surfaces thus indicated are not accurately drawn, but although they may be slightly exaggerated to bring out certain features, they show relative arrangement sufficiently well. The vegetation is classified into plant associations, each of which is designated by the species (one or more) that predominate in it and give it its general cast or appearance.<sup>2</sup> The width of these associations as shown by the diagrams is, of course, extremely variable, but their relative size, which is the most important consideration, is fairly clear. Where the transects represent actual sections, as they do in most cases, the places are indicated by lines on the maps.

<sup>1</sup> The following is an abbreviated itinerary of the writer's travels in Wood Buffalo park. (C) indicates that collections and studies of local distribution problems were made at the places where it appears in the list. Modes of conveyance are indicated by: (St)-steamer or motor tug, (Ca)-canoe or skiff, (H)-pack-horse, (W)-wagon or buckboard, (P)-back packing.

1926: Mouth of Embarras channel, Athabasca delta, July 11 (C).

1927: Left Chipewyan (Ca) June 6; Quatre Fourches channel, Peace delta, June 7 and 9 (C); 30th base line, Slave river, June 10-20 (C).

1928: Left Waterways (St) June 6 (C); left Fort Smith, June 14 (W); Smith to Pine lake, June 14-17 (C); Pine lake and vicinity, June 17-July 12 (C); trip to Lane lake (Ca), June 26 (C); Pine lake to Peace point (H), July 12-15 (C-Round lake, July 14); Peace point, July 15-22 (C); Peace point to slough country along upper Murdock creek, July 22-26 (Ca); Murdock creek, July 26-29 (C); Government Hay Camp, Slave river, July 29-Aug. 16 (C); Hay Camp to Fitzgerald via prairies along Salt river (H), Aug. 16-22 (C-prairies, Aug. 19-20); arrived Waterways, Aug. 30.

1929: Left Waterways (St), June 5; left Fort Smith (Ca), June 12; portage, Salt River village to Little Buffalo river (W), June 13; started up Little Buffalo (Ca), June 15; falls of Little Buffalo, June 18-24; passed winter trail to Sucker creek July 2, and Ninisith hills July 7-8; Moose lake, July 12-17 (C); Moose lake to Pine lake (P), July 17-20; Pine lake, July 20-Aug. 1 (C); Pine lake to Moose lake, Aug. 1-4 (H); Moose lake, Aug. 4-19 (C); Moose lake to Government Hay Camp (H-W), Aug. 19-26; arrived Fort Smith, Aug. 27, and Waterways, Sept. 4.

1930: Left Waterways (St), June 4; left Fitzgerald (St), June 10; left Peace river at Indian graveyard (H), June 16; camp at base of Caribou mountains, long. 113° 55', June 21-July 8 (C) and long. 113° 57', lat. 58° 52', July 8-28 (C); reconnaissance trips into Caribou mountains (H), June 23, July 11-12 (C), July 23 (C); Indian graveyard, Peace river, July 28-Aug. 2 (C); arrived Government Dog Camp, lake Mamawi (St), Aug. 4; stop at Peace point (C), Aug. 2-3; trip to Reed portage, Embarras channel (Ca) (C), Aug. 14-15; trip to Hay (Prairie) river (Ca) (C), Aug. 18; Government Dog Camp, Aug. 4-21 (C); left Dog Camp, Aug. 21; left Fitzgerald (St), Aug. 25; arrived Waterways, Aug. 27.

<sup>2</sup> The word *association* will be used in a broad sense to mean any aggregation of plants that is readily seen to be different from its neighbours on account of the preponderance of one or more species that reach their best development in it. No attempt will be made to define smaller or larger units of vegetation other than the major "types," such as prairie, timber, muskeg, etc.

The account of the vegetation will be preceded by general descriptions of the topography, soils, and geological history of the region. Detailed descriptions of these features in local areas, however, will be relegated to discussions of plant distribution.

The investigation would be incomplete without acknowledgment of the many kindnesses and the assistance rendered the field parties. It would be impossible to enumerate all those who have helped to forward the work, but the writer wishes to express his thanks especially to Mr. J. A. MacDougal, District Agent at Fort Smith, whose organization in the park supplied the necessary transportation, and to the officers of the Hudson's Bay Company, who have been most helpful in outfitting. Many persons have assisted in the systematic work on the flora, and will be mentioned as the occasion arises. Especial thanks are due to the Carnegie Museum of Pittsburgh, Pennsylvania, and to the Gray Herbarium of Harvard University, for the use of their collections and libraries in working up the material. The present report has been prepared during the writer's tenure of a National Research Council Fellowship in the Biological Sciences.

### TOPOGRAPHY AND SOILS

The highest land in Wood Buffalo park is in Caribou Mountain plateau, only a part of which lies inside the western boundary. This plateau reaches an elevation of about 3,500 feet above sea-level, and appears to be a part of an ancient, much dissected upland. Very little of it has ever been described, but judging from a few scattered references and the writer's observations, it is rather flat-topped, with margins deeply dissected by rapid streams. The eastern slope is of morainic materials and is gradual up to about 1,400 feet, where a noticeable steepening occurs, and there are what may be classed as terminal morainic deposits, modified to form what appear to be shore terraces. At higher levels there are long, gradual slopes which have no rolling character.

In a few places, at an altitude of about 2,000 feet, the writer has found bluish clay soils, part of which are known to have weathered, in situ, from shales that outcrop at this elevation. A discussion of these and their distribution will be found in a discussion of the forest types that appear on the upland.

The only other elevation of note is the northern margin of Birch mountain, which comes into the park along the southern boundary. This highland rises about 2,300 feet above the sea (21). Stretching north and east from these uplands is a gently rolling plain known as the Alberta plateau (22). A considerable part of its northern margin lies within the park, and is marked by a well-defined escarpment reaching from a region southwest of Fort Smith, northwestward and northward across Little Buffalo river, and finally westward toward Buffalo lake. Its position is marked by falls and rapids on the upper Little Buffalo and on the western tributaries of this stream, such as Clewi, Sass, Bear, and Nyarling rivers. The Little Buffalo has cut a gorge about 6 miles long below the falls. In the area southwest of Fort Smith it is known as the Salt Mountain escarpment, and forms the southwestern border of the plain of Salt river. The southward extension of the escarpment has not been clearly defined.



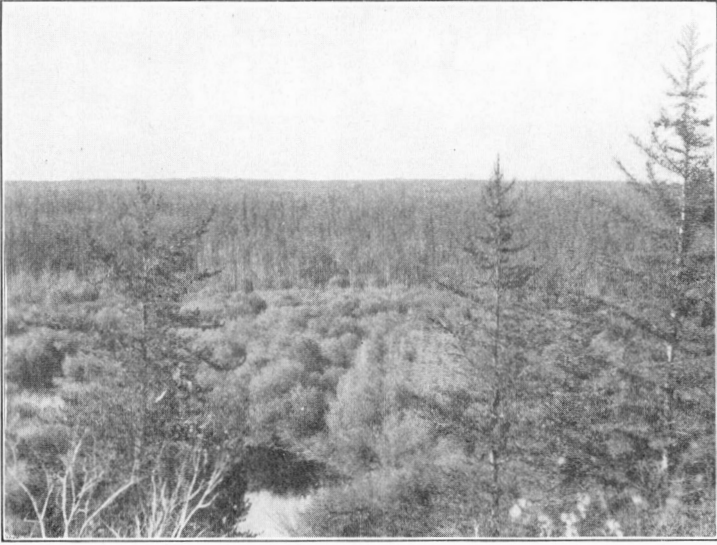


A. View of Caribou mountains from prairies at their eastern base.

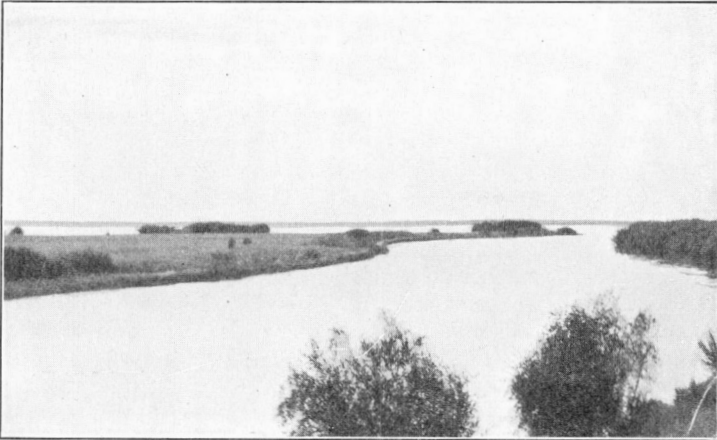


B. Eastern edge of Caribou Mountain plateau (longitude  $114^{\circ} 9' W.$ , latitude  $58^{\circ} 51' N.$ ; elevation about 2,300 feet).

## PLATE II



A. View northwest from summit of Ninishith hills at the point where Little Buffalo river cuts through them.



B. Hay (Prairie) River district, Athabaska-Peace delta.

This part of Alberta plateau is a poorly drained area, except for the valleys of the larger streams, such as Peace and Athabaska rivers, which are graded and occupy deep, broad valleys. The soils are sands, clays, and tills of lacustrine and morainic origin.

The topography between the Salt Mountain escarpment and the base of Caribou mountains has been adequately described by Camsell (14), along the routes which he travelled. It is a very gently rolling plain broken only by a range of hills extending in a northwest-southeast direction between the Moosehorn slough district and the Ninishith hill country north of Little Buffalo river. The entire extent of the range cannot be defined with the present state of knowledge but its general position is sufficiently well known to make its physiographic significance clear. The hills appear to be of morainic origin and consist largely of sand with a variety of rounded granite boulders. They are up to 100 feet above the general level, and are usually along fairly straight lines, often extending as nearly straight ridges for several miles. Camsell has observed, and the writer's own notes bear out the fact, that the ridges tend to converge northwestward, forming, for the most part, one main ridge north of the point where the Little Buffalo cuts through the Ninishith. Between Pine and Moose lakes and southward, the hills cover most of the country.

Throughout the upland there are numerous sink-holes of varying sizes, some being a mile or more in length or diameter. Some have lakes in them, whereas others are completely dry. At two places along the Pine Lake-Moose Lake trail there are sinks into which sizeable streams flow, but from which there is no surface outlet. The holes are not evenly distributed over the country, but tend to be localized.

Lying between the ridge country and Caribou mountains is a broad, shallow depression, containing many lakes and wide muskegs. This depression, called the Moose Lake basin, is bounded on the south by ridges lying north of Peace river, through which Jackfish river has cut channels. Camsell describes the first hills met with in his descent of the Jackfish as being about 20 miles below Jackfish lake (19), indicating that this area was approximately on the margin of the basin. The northern extension of the lake country has not been defined, but probably continues northwestward around the base of the Caribou plateau nearly to Buffalo lake. The only elevations within the basin are low boulder and sand ridges such as appear on the shore of Moose lake.

Although the section lying north of the 60th parallel has not been extensively described, the notations on Seibert's map (63) indicate that it is similar in topography to that about Pine lake.

Three streams drain the region: Jackfish, Little Buffalo, and Salt rivers. Western tributaries of the Little Buffalo—the Sass, Bear, Clewi, and Nyarling—form the drainage of the northern area. Salt river rises in McNeil lake, southwest of Pine lake, and the other two streams rise in Moose Lake basin. The height of land between the headwaters of these two was crossed by Camsell in 1902 (18), the portage trail being only  $4\frac{1}{2}$  miles long, and the elevations low boulder ridges. Within the basin, and in the upper part of their course in the upland, neither of these streams receives any large tributary, but they are connected by small creeks with the larger bodies of water, such as Moose and Bog lakes. They are much ponded, but in many places

are full of rapids, which are composed almost entirely of granite boulders of glacial origin. The rivers are further obstructed by beaver dams and log jams, both of which are very numerous.

There appear to be certain well-defined soil types in the Alberta plateau district. Present knowledge permits only their division into those with a preponderance of sand and gravel, and heavier ones with a large admixture of clay. These types appear to occupy rather definite areas, the heavy soils being found mainly in two regions. The first is a strip of country lying between the Pine Lake-Lane Lake district and the area about Flatgrass lake, which is near Little Buffalo river on the summer trail between Sucker creek and Fort Smith (15). The second is a band of country west of Jackfish river, south of Jackfish lake, and along the base of Caribou mountains. It is rather level, with a gentle slope away from the mountains. Both of these areas of clay soils have many dry watercourses in them. A hole made by the writer in a prairie opening near the base of Caribou mountains showed a sandy loam to a depth of 24 inches. Below this is a layer about 13 inches thick in which there is almost pure sand crossbedded with clay. Frost was struck at 37 inches on June 26. Boulders and gravel are completely absent, and where creeks from the mountains have cut deep ravines the only larger materials are those brought down by the streams themselves.

The morainic hills are notable for the large amount of sand and rounded boulders, forming extremely dry soils. Any representative of Alberta plateau that may occur between Peace river and Birch mountain has not yet been examined. The contour map of northern Alberta shows no indication of it except on the northern slope of the mountain (67).

Between the Alberta plateau escarpment and the present lowlands of Slave river is a plain that stands at about the 800-foot contour line. The northern and southern extensions of it are not well defined, but it is known along Little Buffalo river in the latitude of Salt River settlement, and extends southeastward well beyond the latitude of the Government Hay Camp. The inadequate descriptions of the country farther northward seem to indicate that there are representatives of it beyond the Little Buffalo. The small prairie at Peace point, on Peace river, is probably a southern extension, but its occurrence south of the Peace is uncertain. The plain is nearly level, except for some gently rolling areas and a few morainic hills or ridges. Drainage is by the streams above described as flowing from far back in Alberta plateau, and by such smaller ones as Salt and Darrough creeks in the southern sections.

Over large areas there are poorly drained, clayey soils, with many shallow ponds on the surface. Outwash from brine springs at the base of the escarpment to the west has left a thin deposit of salt in many of the depressions, and caused most of the streams to be brackish. The section southwest of Fort Smith has long been known as the Salt Plain, and the nearby escarpment as Salt mountain. Most of the early travellers ascended Salt river from the Slave to procure supplies of salt at the springs.

The present level of Athabaska, Claire, and other, smaller lakes in the vicinity is about 700 feet above the sea, and most of the lowland bordering them in the park area stands only a few feet above this. Extensions of the lowlands reach down Slave river nearly to Fort Smith, up Peace river nearly



to Peace point, and far up the valley of the Athabaska. The rivers meander through broad flood-plains with many islands, bars, and abandoned channels separated by low levees. Lake Claire basin contains wide, marshy deltas, formed of silt and debris brought down by Peace, Birch, and Athabaska rivers and divided by a complicated system of interlocking waterways.

The only notable relief features in the lowlands are formed by granite hills appearing like islands in the eastern parts. These are glacially scoured and grooved, and contain only small patches of thin soils.

## GEOLOGY AND PHYSIOGRAPHY

Nearly all of the surface of the park area is covered by morainic, fluvial, or lacustrine deposits of recent geologic time, but the position and nature of the underlying rocks have so influenced the development of present conditions that a brief discussion of them is necessary.

The eastern boundary of the park is roughly coincident with the contact zone between the Precambrian granites and gneisses to the east, and the Palæozoic sediments to the west. Outliers of the former are the rounded knolls rising above the delta plains of Peace and Athabaska rivers. The latter, sedimentary rocks, are represented along Peace and Slave rivers by cliffs of limestone and gypsum, which appear above Peace point, at La Butte, below the Government Hay Camp, and at Caribou island. Athabaska and Claire lakes lie in a depression crossing this contact from east to west. The inland districts show very few exposures, the most notable being the Salt Mountain escarpment and its northwestward extension, all of which is composed of Palæozoic limestones (21). At the falls of the Little Buffalo there is one sheer drop of about 40 feet, with the lower, under-cut rock layers showing softer strata.

The Palæozoic sediments are very little disturbed. Extensive sink-hole development in the Alberta plateau district, particularly toward its eastern parts, is indicative of the gypsiferous nature of the underlying rocks (23), and the presence of an elaborate system of underground drainage. Many of the sinks have sizeable streams running into them, but have no outlets. Soundings made in Pine lake by the writer, resulting in a rough contour map of its bottom (See Figure 2), show clearly its origin in a series of sink-holes which have a definite alinement. Air photographs show that the holes have some sort of definite arrangement, the cause of which is not known. In some the water-level is constant, but in others there is evidence of very recent change too great to be caused by evaporation. In one hole along the Pine Lake-Moose Lake trail the writer observed shells of aquatic snails 50 to 75 feet above the present pond. The vegetation on the slopes indicates that the water has fallen within the past few years. In a small lake about 6 miles south of Moosehorn slough, known locally as Round lake, the water has been observed to change several feet in level within a year. Whether the change is a cyclic one and will repeat itself is unknown. There are well-defined ancient shore-lines on Pine lake which are at least 10 feet above the present water-line.

Caribou and Birch Mountain areas are known or thought to be Cretaceous, and are looked upon as erosion plateaux formed through the long-continued dissection of the uplifted bottom of the Cretaceous sea

that covered the whole region (8, 32). It is thought that the present main drainage lines, such as those of Athabaska, Peace, and Slave rivers, have maintained themselves with modifications from late Cretaceous or early Tertiary time, and have persisted through the Pleistocene. The Cretaceous plateaux of Birch and Caribou mountains have, according to Cameron (8), had a large influence upon the position and character of the Glacial deposits.

The plateaux of Watt mountains, Caribou mountains, Birch mountain, Eagle mountain, and Buffalo Head hills are considered to be remains of the above-mentioned continuous plain which was dissected in pre-Glacial times. The remaining uplands were high enough to greatly affect the course of glacial movement during Pleistocene time. "At least three definite glacial lobes are apparent in the area. One extended up the valley of Hay river; a second swung west, south of the Caribou mountains, and probably sent tongues up the valleys of the Peace and Wabiskaw rivers; while a third lay in the basin of Athabaska lake with its tongue pointing up the valley of Athabaska river" (10).

As the fronts of these lobes receded, the waters from the upper basins of the Hay, Peace, and Athabaska were impounded against them to form large post-Glacial lakes. From studies of terraces in the valleys of the main rivers, of elevated shore-lines on Great Slave lake, and from the results of topographic surveys, Cameron has designated four of these ancient lake levels, formed successively at 1,600 feet, 1,100 feet, 800 feet, and 700 feet above sea-level. The 1,600-foot level appears in the park area only along the southern border, on the margins of the Birch Mountain upland. The remainder was completely covered by the glacier with the exception of the higher parts of Caribou mountains. At the 1,100-foot level the shore was formed on the north, east, and south fronts of Caribou mountains. This lake extended far up the valleys of Hay, Peace, and Athabaska rivers, while the ice front had taken such a position that about half of Athabaska lake was exposed, and the remnants of the Peace and Hay River lobes were still apparent. The Peace lobe reached across the present valley of the Slave and over the upland nearly to Moose lake. The Hay River lobe stopped a short distance north of Buffalo lake.

What appears to be the terminal morainic system formed at this ice front in the region west and southwest of Fort Smith has been located with a fair degree of accuracy by the writer and by Camsell (13). The Ninishith hills, converging to the northward near the place where they are crossed by Little Buffalo river, appear to be on the southern side of a re-entrant angle that lay between the remnants of the Hay and Peace River lobes. South of the Ninishith the system is expanded over many miles of territory lying between Pine lake and Moose Lake basin. Hills having a northwest and southeast trend between Moosehorn slough and Peace point are probably further extensions of this system. The terminal moraine mentioned by Cameron as occurring north of Buffalo lake, and making the dam that holds the latter, is the probable western limb from the angle.

At the 800-foot level the ice had receded off Athabaska lake and covered only a portion of the eastern arm of Great Slave lake. The shore of the lake within the park area followed, in general, the margin of the Alberta plateau. The Buffalo Lake region was probably covered, as were

also the basin of the Peace below the site of Vermilion, and the lower Athabaska flood-plain. The entire basins of Athabaska and Claire lakes were submerged, and the eastern shore was the margin of the Laurentian highland. The flat-lying country of the Salt Plains southwest of Fort Smith probably originated as the bottom of this lake.

As the general water level lowered to form the 800-foot lake, a part of it seems to have been maintained in the present Moose Lake basin, at the foot of Caribou mountains, by the damming of Jackfish and Little Buffalo rivers. The morainic system above described served to pond the Little Buffalo, and morainic ridges of uncertain origin, across the Jackfish, held back the waters of the latter stream. The drainage of the basin has gone on until very recent times and seems to be still in progress (13, 56). Its rate has been determined by the rate at which the streams have been able to cut through the barriers.

The 700-foot level is practically that of Athabaska lake. The basins of Athabaska and Great Slave lakes were then separated, the former having a northern arm extending down Slave river about half-way to Smith rapids, and the latter having a great southern arm occupying the site of the lower Slave and Little Buffalo river flood-plains. In subsequent post-Glacial time the extensions of the two lakes have been silted full to form wide flood-plains in which the streams take sluggish, meandering courses. The manner in which these plains were formed has been well summarized by E. M. Kindle of the Geological Survey, Canada (33). Mr. Kindle notes particularly the immense amount of drift timber and silt brought down by Athabaska and Peace rivers, with the localization of the deposits of this material in the western end of lake Athabaska and on the south shore of Great Slave lake. A more detailed description of the lowlands will be found with the discussion of their vegetation.

Although no precise lines can be drawn, the distribution of the clayey and sandy soils on the Alberta plateau seems to be correlated with the main morainic systems. In the retreat of the ice eastward from Caribou mountains, moraines were left on the slopes of the mountains and in the hill country described between the Ninishith and Moosehorn Slough districts. Outwash from the latter front would tend to deposit its finer materials farther to the westward than the coarser ones. The clayey deposits at the base of the mountains may have originated in this way. To the eastward they disappear in the sand and gravel country south of Moose Lake basin. Similar soils found from the Pine Lake-Lane Lake district to Flat-grass lake may have had a similar origin in some lake stage that existed immediately after the retreat of the ice eastward from the moraines that lie just west of them.

## CLIMATE

Insufficient data are available for the interpretation, except in a general way, of climatic factors in their relation to the vegetation. For many years records of precipitation and temperature have been kept at various settlements, but as there are very few evaporation or frost data it is difficult to turn these figures into anything that might correlate with local differences in vegetation. The most important considerations that can be discussed with present knowledge are the relative shortness of the season for plant growth,

and the effect of the short season upon the development of soils and topography. These have already been brought out in part by E. M. Kindle (33, 34) and by the present writer (53).

The predominating vegetation which gives the distinguishing character to the landscapes of the region is the coniferous evergreen forest. The determining factor in its distribution appears to be the physiological dryness of the soils, which is brought about in this case by low temperatures over much of the year, resulting in the rendering of existing water unavailable to plants, and in the production of a high degree of acidity (70).

The period between the final thawing of the soils in spring and the time of their freezing in the autumn is not recorded, nor have any data been compiled as to an average frostless season, if the latter can actually be said to exist. Absolute minimum temperatures during July commonly reach 32 degrees<sup>1</sup> or fall below it, and killing frosts are likely to occur at any time during the summers<sup>2</sup>. Such low July minima were recorded at Chipewyan nine times during the forty-five years between 1884 and 1928, five times at Vermilion between 1905 and 1928, six times at Fort Smith between 1913 and 1928, only once at Hay river between 1893 and 1928, and not at all at Resolution between 1914 and 1928. The first dates just given are the earliest from which there are consecutive records. Low temperatures are much more common in June and August. In forty-five years' records at Chipewyan they are found twenty-eight times in June and twenty-four times in August. At Resolution, where July minima are relatively high, the June minima fell to 32 degrees or below thirteen times in the fifteen years recorded, but only twice in August. The sudden change from June to July is probably due to the fact that the Great Slave Lake ice holds through June. From these few data it is evident that the season that is quite free of frost is very short and exceedingly hazardous. It centres in July and is probably more certain on the south shore of Great Slave lake than in other localities under consideration.

A seasonal indicator that has been recorded for many years throughout the north is in the times of opening and closing of the lakes and rivers. The lower reaches of the Peace and Athabaska where they approach Athabaska Lake area usually open about the first of May (50), but the western part of the lake is not free of ice until about May 10. The lake ice usually sets again during November. The large degree of variation in these times is shown by the records of E. M. Kindle (35). In the autumn of 1919, he found ice set in Quatre Fourches channel on October 9, and much floating ice in Rocher river. Protected bays in Athabaska lake had an inch of ice on them. His party, ascending the Athabaska, found it necessary, at McKay, on October 13, to abandon a scow that had been nearly cut through by floating ice. The usual time for the freeze-up of the Slave, according to his notes, is in the latter part of October. The ground was frozen, in 1919, on October 4. Great Slave lake freezes up between the latter part of October and the middle of November.

The six to six and a half months of open water in Athabaska Lake area is undoubtedly a longer period than that in which the upper layers of

<sup>1</sup> Temperatures given in this paper are Fahrenheit.

<sup>2</sup> Detailed meteorological data given here and in the tables below have been supplied to the writer through the courtesy of the Director of the Meteorological Service, Toronto, Ontario.

soil are not frozen. The vegetation in Wood Buffalo park usually has its spring aspect well developed during the first week of June. Birches and poplars are yet in a small-leaved state on June 1, whereas *Pulsatilla ludoviciana* is rather past the height of its flowering and *Calypso borealis* is in its best development. In the spring of 1928, the writer found the Pine Lake region to be several days later in the development of its spring flora than the districts nearer the river. The autumn is usually reckoned as beginning about the middle of August. The writer experienced freezing temperatures on the Salt Plain southwest of Fitzgerald on August 17, 1928, and this was not looked upon as an unusual year. The autumn flora, typified by the goldenrods and asters, and by the ripening of the fruits of raspberries, dogwoods, roses, moose-berries, and blueberries, is well advanced by the third week in August. Throughout the summer there is a notable "telescoping" of the seasonal aspects of the flora. *Calypso* has been found in flower as late as June 26, and goldenrods as early as July 19.

Records of rainfall are scanty, but indicate that during June, July, and August there are from 4 to 6 inches (Table 2). Snowfall for the whole year averages between 34 and 53 inches in different localities (Table 3).

As suggested above, the presence of the larger lakes has a slight ameliorating influence upon neighbouring climatic conditions. Monthly mean and absolute minimum and maximum temperatures for January and July, recorded at Chipewyan, Vermilion, Fort Smith, Hay River, and Resolution, when averaged over a period of ten years (1917-26) (Table 1), indicate that in winter lower temperatures are experienced at Fort Smith and Vermilion than at settlements on the lakes. Cool periods in summer reach lower temperatures inland than on the lakes, whereas warm periods in summer tend to be warmer inland. Of the two inland districts, Fort Smith consistently shows less fluctuation than does Vermilion, probably due

TABLE 1

*Table of Temperatures Averaged over a Period of Ten Years, 1917-1926*

—	Chipewyan	Vermilion	Fort Smith	Hay River	Resolution
Monthly mean minimum...{Jan. July	-19.6 51.1	-24.5 46.1	-24.0 46.7	-22.4 50.0	-22.4 <sup>1</sup> 51.2
Absolute minimum.....{Jan. July	-49.0 35.3	-56.1 33.2	-53.9 33.3	-49.4 38.4	-47.9 <sup>1</sup> 40.0
Monthly mean maximum..{Jan. July	-2.1 72.8	0.3 74.9	-7.5 72.8	-4.3 <sup>2</sup> 68.1	-8.6 <sup>1</sup> 68.6
Absolute maximum.....{Jan. July	26.2 86.4	29.8 88.3	19.2 88.1	25.1 <sup>2</sup> 86.8	15.5 <sup>1</sup> 83.4

<sup>1</sup> Averaged over seven years (1920-26) due to lack of records.

<sup>2</sup> Averaged over nine years, records for 1918 being absent.

TABLE 2

*Total Rainfall (in Inches) During June, July, and August, 1917-1926*

—	Chipewyan	Vermilion	Fort Smith	Hay River	Resolution
1917.....	4.07	4.95	6.31	3.69	3.52
1918.....	5.44	5.24	3.92	4.24	1.63
1919.....	6.32	10.26	6.88	5.39	5.92
1920.....	2.60	5.86	<sup>1</sup>	5.00	5.25
1921.....	5.14	8.19	10.52	9.12	4.79
1922.....	5.19	6.44	5.07	6.73	4.82
1923.....	1.91	5.99	5.22	2.92	0.80
1924.....	5.09	3.32	3.66	3.45	5.54
1925.....	2.11	6.87	3.55	3.56	4.10
1926.....	<sup>1</sup>	5.64	3.29	4.98	4.77
Average.....	4.21	6.27	5.36	4.90	4.11

<sup>1</sup> Incomplete records.

TABLE 3

*Total Snowfall (in Inches) During Each Year, 1917-1926*

—	Chipewyan	Vermilion	Fort Smith	Hay River	Resolution
1917.....	82.4	36.0	22.3	40.5	38.0
1918.....	105.9	54.7	60.2	50.1	57.0
1919.....	32.3	27.6	50.2	37.6	38.7
1920.....	25.0	23.9	34.6	41.6	49.8
1921.....	33.5	31.1	24.3	47.3	40.7
1922.....	85.5	33.9	31.3	30.6	38.8
1923.....	24.5	24.4	40.0	57.8	38.8
1924.....	52.0	42.6	31.5	74.0	54.0
1925.....	46.5	39.3	37.0	42.3	72.0
1926.....	45.3	29.3	41.9	32.0	78.1
Average.....	53.29	34.28	37.33	45.38	50.59

to its position between two great lake basins. In its winter maxima it shows a close relationship with lake shore conditions. The highest temperatures ever recorded were at Vermilion in 1912, when the thermometer reached 101 degrees. Ninety degrees is not an uncommon temperature throughout the region. The rainfall tables indicate greater precipitation in the summer months inland than on the lakes, whereas the snowfall during the rest of the year is greater on the lakes than inland. July and August are the only two months of the year in which snow has never been recorded.

The permanent frozen condition of the soil at comparatively shallow depths and the short season during which the surface is thawed influence the development and distribution of the vegetation by limiting root development, affecting the position of the water table and the nature of the drainage, slowing down the process of humus development, and by allowing only a short period of the year when physiographic changes can take place. Open prairies were found frozen at a depth of 37 inches on June 26, and in the early part of August frost was found at about 5 feet on the cleared bank

of Slave river at the Government Hay Camp. On July 12, frost was found at about one foot on a hillside exposed to the noonday sun, high on the eastern slope of Caribou mountains. No deeply rooted plants may enter such situations unless they can adapt themselves.

The effect of a constantly frozen surface below the ground-level would tend to lessen the amount of seepage through the soil and increase the run-off. In relatively undrained regions this condition assists in the the extensive development of muskegs (bogs), with their typical vegetation of plants that are suitable to acid soils. The cold or cool weather, in which bacterial decay and humus formation are greatly retarded, has a strong tendency to render very slow the successive movements in the development of the vegetation which are dependent upon chemical changes in the soil. Such movements, also, which are dependent upon topographic change and the formation of new barren areas for colonization by plants, are greatly retarded because of the shortness of the season available for erosion and deposit. These retarding results are especially significant in a study of young vegetations just beginning their development on the recently exposed land surfaces in the Athabaska-Great Slave Lake region.

A fruitful field for investigation that may be mentioned in this connexion is the degree to which the plants naturally selected to enter the region are drawn from those that are able to live with a minimum amount of available nitrogen in the soil. Prevaillingly cold, acid soils, containing much raw humus, are poor in available nitrogen, and plants that inhabit them must either get along with this small amount or have some means of utilizing atmospheric nitrogen that has been fixed by other plants.

## TYPES OF VEGETATION IN WOOD BUFFALO PARK

Coniferous forest is the predominating vegetation in Wood Buffalo park. Although floristically different in some respects from that in other regions, this forest is a part of the extensive belt of conifers that extends from the St. Lawrence basin to Alaska and sends its representatives southward on the mountain chains of the continent. Canada spruce *Picea glauca*, and jackpine *Pinus Banksiana*, are by far the commonest species in the timber, the former occurring mostly upon the better soils of the uplands and along the major streams, and the latter being confined to semi-barren rocky hills, and to dry, sandy knolls and plains.

The casual traveller along the rivers gets an erroneous idea, however, of the actual extent of the forest, since the banks are usually clothed with a rather heavy growth of it. Journeys inland, together with examination of aerial photographs and the maps that have been made from them, dispel this idea, and it is soon found that river flood-plain timber is largely confined to the banks of the present rivers. The largest continuous stands are to be found on the rolling country of the uplands which are bounded on the south by Peace river, on the east and northeast by Salt Mountain escarpment and the Salt Plains, and on the west by Moose Lake basin; and which extend northward and northwestward across Little Buffalo river. Other extensively forested areas are on the eastern slopes of Caribou Mountain plateau. The timber is confined largely to sandy and gravelly, well-drained soils.

The drier areas, such as the upper slopes and summits of sandy ridges, have a nearly pure forest of jackpine with a light undergrowth, making a rather open woods. On lower slopes and well-drained hollows, where the water table is nearer the surface and the soils have a somewhat greater water-holding capacity, Canada spruce forms dense forests, often of trees 3 to 4 feet in diameter and over 100 feet in height.

The main variations of these forest types occur over extensive areas that have been burned, and in such lesser areas as muskeg margins, districts that reach a considerable elevation above the general level of the surrounding country, and marginal situations subject to the influx of other species. The outstanding effect of fires has been the introduction of large quantities of aspen and poplar timber, *Populus tremuloides* and *P. tacamahacca*. These occur in nearly pure stands or in all sorts of combinations with the conifers, depending upon the nature of the fire and upon local soil and seed conditions. At muskeg margins black spruce *Picea mariana*, and larch *Larix laricina*, become predominant over the other trees. The jackpine, which is not far from its northern limit in this region, disappears upon the highest morainic ridges, where its place is taken by a park-like growth of Canada spruce such as occurs on sand-plains about the eastern arm of Great Slave lake (52). In Caribou mountains the jackpine is also absent. The higher levels in the mountains maintain an outlier of the Cordilleran forest, which involves the lodge-pole pine *Pinus contorta* (55). This tree occupies open slopes in company with black spruce *Picea mariana*. At the southern margin of the park, in the upper delta of Athabaska river, is to be found the balsam fir *Abies balsamea*, a representative of the fir-spruce forests to the southeast.

Muskegs<sup>1</sup>, with or without accompanying lakes, are regularly formed in undrained depressions throughout the region. They are characterized by very wet, bog-moss associations, grading off into the aquatic associations of open water, sedge marshes, or shrubby growths of willows *Salix* spp., and dwarf birch *Betula glandulosa*. Although common throughout the region, they have their greatest development in Wood Buffalo park, in the recently drained basin of Moose (Eight) and Bog (Thultue) lakes, between the Pine Lake upland and Caribou mountains.

Semi-open prairies are to be found on clayey soils which are more or less localized in three districts: around the eastern base of Caribou Mountain plateau; in a strip of country extending from Grassy Slough district, north of Pine lake, northwestward to Little Buffalo river; and on the Salt Plain areas south and west of Fort Smith. These districts have a characteristic cover of herbaceous vegetation, chiefly grasses, dotted or separated by clumps of willows and the trees of the vicinity. Common grasses are the blue-joint *Calamagrostis canadensis* var. *robusta*, blue-grass *Poa pratensis*, vanilla-grass *Hierochloë odorata*, brome-grass *Bromus* spp., wheat-grass *Agropyron* spp., prairie June-grass *Koeleria cristata*, and purple oat-grass *Schizachne purpurascens*. A wealth of other perennial herbs such as larkspur *Delphinium scopulorum* var. *glaucum*, mustard *Erysimum cheiranthoides*, cowslip *Mertensia paniculata*, and many others, accompany the grasses, giving the prairies a blaze of colour which changes with the

<sup>1</sup> The term "muskeg" is universally applied to peat bogs in northern Canada.



seasons. Much of the Salt Plain has barren or semi-barren flats which are the bottoms of shallow ponds in the spring and early summer. The water in these ponds is somewhat saline due to the outwash from the salt springs of the region, so that vegetation on the flats has a distinctly halophytic character. Glasswort *Salicornia europaea*, sea milkwort *Glaux maritima*, and various other salt marsh plants are common in the more saline areas. The baltic rush *Juncus balticus*, and the blue-joint grass *Calamagrostis inexpansa* var. *brevior*, cover large areas of semi-saline land. The widest expanse of semi-open prairies is on the Salt Plains. Small local areas are to be found in certain types of sink-holes.

The flood-plain and delta lands of the lower Peace and Athabaska rivers and the Lake Claire-Lake Mamawi basin have extensive marshes ranging from very wet or aquatic shore associations to grasslands. The sloughs and wet meadows are separated by natural levees and other alluvial deposits formed by the meandering channels of the rivers. These slightly higher, better-drained soils have willow clumps or timber on them. Two of the most widespread species are the blue-joint grass *Calamagrostis canadensis*, and the meadow sedge *Carex trichocarpa* var. *aristata*. These form extensive "hay-meadows" throughout the lowlands. Minor flood-plain areas are to be found on the lesser streams that drain the uplands, such as Salt and Little Buffalo rivers. The vegetation on these is similar to that of the main lowlands.

From the above brief discussion it is evident that the most extensive timbered areas are on the uplands that have been exposed since the lowering of the post-Glacial lake that stood at about the 1,100-foot level. They do not cover all of this upland, but are broken by the wide muskeg district of the Moose Lake-Bog Lake basin and by the semi-open prairies on the clay soils that lie northwest of Pine lake and at the base of Caribou Mountain plateau. The prairies have their widest spread in the country south and west of Fort Smith, which was formerly under the lake that stood at about the 800-foot level. The slough and timber vegetation of the lowlands is growing mostly on the alluvial deposits that have been formed in the last of the post-Glacial lakes, which stood only a few feet above the present water-level of lake Athabaska.

The ensuing, more or less detailed, discussion will follow the general outline given in the preceding paragraph.

## THE UPLAND FORESTS

The richest forests in Wood Buffalo park are of Canada spruce *Picea glauca*. They have a comparatively small flora, with very little undergrowth, and the mat of mosses that forms most of the ground cover is at most only 4 to 6 inches deep, over a leaf mould seldom exceeding 4 inches in thickness.

Primary spp.: *Picea glauca*  
*Salix Bebbiana*  
*Hypnum Crista-castrensis*<sup>1</sup>  
*H. Schreberi*

<sup>1</sup> The writer is indebted to Prof. J. Franklin Collins of Brown University for determinations of the mosses listed.

Secondary spp.: *Equisetum sylvaticum*  
*E. scirpoides*  
*Lycopodium annotinum*  
*Maianthemum canadense*  
*Goodyera repens* var. *ophioides*  
*Habenaria obtusata*  
*Orchis rotundifolia*  
*Corallorrhiza trifida*  
*Calypso borealis*  
*Betula papyrifera* var. *neolaskana*  
*Alnus crispa*  
*Geocaulon lividum*  
*Ribes lacustre*  
*R. triste*  
*Mitella nuda*  
*Rosa acicularis*  
*Shepherdia canadensis*  
*Cornus canadensis*  
*Arctostaphylos rubra*  
*Pyrola asarifolia*  
*P. asarifolia* var. *incarnata*  
*P. chlorantha*  
*P. secunda*  
*Moneses uniflora*  
*Linnaea borealis* var. *americana*  
*Peltigera aphthosa*

The secondary<sup>1</sup> species are much scattered in their distribution. In places it is possible to walk a hundred yards or more without seeing any other ground cover than the mosses. The absence of many species that are widespread in the Canadian forests elsewhere has been noted by the writer in another place (53). If undisturbed by fire or clearing the spruce timber seems to perpetuate itself and to be the most advanced form of mesophytism the region affords. However, due probably to a slow rate of soil development and the short time available since much of the country was exposed for the immigration of plants, such species of the more mesophytic forests of Ontario, British Columbia, or even of parts of Alaska, as *Habenaria orbiculata*, *Goodyera decipiens*, *Listera cordata*, *Cypripedium parviflorum*, *Lycopodium lucidulum*, *Circaea alpina*, and others, are either entirely absent from the forests under discussion, or are extremely localized in them.

The spruce timber is found chiefly on soils of medium drainage, which usually occur on the lower slopes of hills and in hollows where there is sufficient drainage to prevent the formation of muskegs. Such conditions are most abundant in the sandy, morainic country that extends from a point a few miles north of Peace point northward and northwestward beyond Little Buffalo river. They are probably common also in the northern area of the park between Little Buffalo river and Buffalo lake, and also in the morainic country that crosses Jackfish river south of Moose Lake basin. Parts of the eastern slopes of Caribou mountains are covered with a dense spruce forest, much of which is of small trees with an unusually scanty undergrowth.

The lodgepole pine *Pinus contorta* var. *latifolia* timber on the summits of Caribou Mountain plateau has not been studied extensively.

<sup>1</sup> Lists of secondary species will include only ferns and flowering plants, with the exception of a few species of mosses or lichens that are particularly characteristic of the habitats in question.

It was observed on July 11 and 12, 1930, in a region about 16 miles northwest of Indian graveyard, Peace river, and at an elevation of about 2,000 feet above sea-level. The pine is most abundant on semi-open knolls which it shares with black spruce. Lewis, Dowding, and Moss consider that the fully matured forest of the lower Cordilleran region of western Alberta may consist of Canada and black spruce, and show that the black spruce is invading *Pinus contorta* associations on sandhills in the country between Pembina and McLeod rivers (36). Large areas on the upper slopes of Caribou mountains are covered with a dense forest of black spruce, mixed with a few birches *Betula papyrifera* var. *neolaskana*, and a rather abundant growth of alder *Alnus crispa*. The moss mat is very deep and there is a scattering of the usual shady woodland herbs: *Equisetum sylvaticum* var. *pau-ciramosum*, *Calypso borealis*, *Pyrola secunda*, *Mitella nuda*, and *Lycopodium annotinum*. It is possible that this spruce forest is a more developed stage in which *Pinus contorta* has been crowded out. In several places decrepit old pines appeared to be in the last stages of existence, surrounded by an almost impenetrable thicket of black spruce. In the more open condition mentioned above the ground cover is dominated by a lichen mat *Cladonia rangiferina*-*Cetraria nivalis*. The substratum wherever these associations were found was of bluish clay without rocks or sand. On the semi-open *Pinus-Picea* hill it was frozen at a depth of about 1 foot at the time the notes were made, although it was exposed to the sun during a good part of the day.

In another part of the hills, approximately 5 miles to the southward, an outcrop of Cretaceous shale at about the same elevation was found on July 23. The bluish clays above mentioned may have been weathered shales of this series, a condition that appears the more probable because no other such clay soils have been seen to the eastward of the mountain front. The thin coating of clay at the top of the outcrop, formed by the recent weathering of the shale, bears an open forest of lodgepole pine *Pinus contorta* var. *latifolia*, and white birch *Betula papyrifera* var. *neolaskana*, mixed with a few Canada spruces *Picea glauca*. On a small plain along a creek at the base of the outcrop is a black spruce muskeg. The entire flora in this situation, both on the dry outcrop and at its base, resembles closely that on the clay hills described above, and is here sharply contrasted with a neighbouring flora on a morainic ridge. On the opposite side of the creek, and towering above it, are morainic deposits that reach an altitude of about 2,300 feet, upon which is a forest of Canada spruce *Picea glauca* and aspen *Populus tremuloides*.

It seems probable that certain areas, even if they were crossed by glacial ice, received no drift materials, or that if such materials were left there they have been removed in post-Glacial time. Should the latter be the case, the remnants of the cover, in the form of gravels or coarser materials, could be expected in ravines and stream channels, but in the first of the two areas just described none of these is present. In the vicinity of the recognized moraines, corresponding drainage lines contain sand, gravel, and a tumble of granite boulders up to several feet in diameter. In the small amount of digging done by the writer there was no evidence of stratification in the clay soils, nor could any be seen in the bed of a small brook draining an upland muskeg on these soils.

If this reasoning is correct, then the oldest forest in Wood Buffalo park is that of lodgepole pine *Pinus contorta* var. *latifolia*, and black spruce *Picea mariana*, on the summits of Caribou plateau which stood above the 1,600-foot post-Glacial lake. It may be considered comparable in age with the woodlands of the Cretaceous uplands to the southward, where advanced fir-spruce forests abound, and in both age and floristic content with the Cordilleran forest of the upper Peace drainage. Certain areas of it may have been exposed to plant cover during at least the later advances of Pleistocene ice.

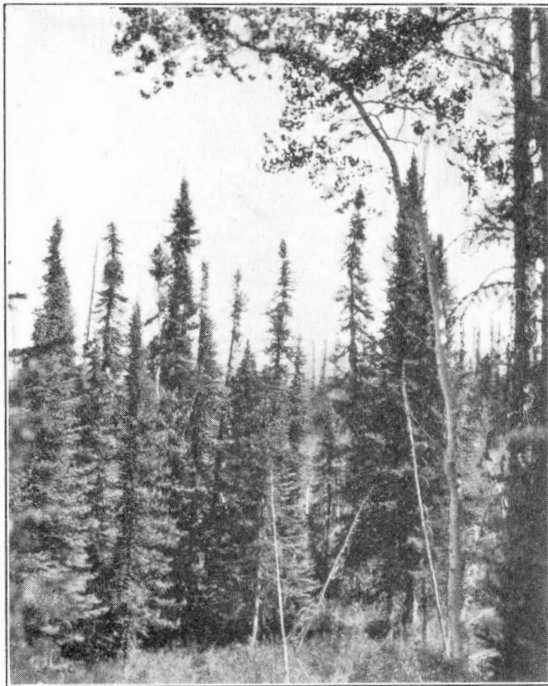
Dry ridges and sand-plains on the morainic uplands are usually clothed with an open woods of jackpine *Pinus banksiana*. The dryness, the park-like aspect, and the scarcity of undergrowth have made these ridges the main routes of travel for generations. The wood bison early sought them out for migration lines between summer and winter feeding grounds, and have worn their characteristic deep trails in them. In its simplest form this wood consists of a pure stand of the pine, with ground cover mainly of reindeer lichens *Cladonia alpestris*, *Cetraria nivalis*, and others, broken here and there by small patches of cranberry *Vaccinium* *Vitis-idaea* var. *minus*.

The lowering of the levels of the morainically dammed lake that stood in Moose Lake basin has exposed low, sandy ridges, some of which are now only a foot or two above the surrounding muskegs and small lakes. These ridges show the jackpine timber in its simplest form and indicate that it is the initial vegetation on such ground now developing. Similar evidence is to be found on the east shore of Pine lake, where a series of abandoned curved sand spits bears an open pine woods and shows that the lake level has fallen in recent geologic time. The question as to whether the pine woods was the original vegetation on the higher ridges when these were exposed after the withdrawal of the 1,100-foot lake has not been solved, but the writer is inclined to think that such was not the case (52). The habits and range of *Pinus Banksiana* at the present time indicate that it is not a tree of the most exposed sub-arctic timber. It has only a few scattered representatives in the country just south of the timber-line, where its normal habitat on rocky and sandy ridges is taken by Canada spruce. In Wood Buffalo park there is a high sandhill southeast of Lane lake which stands out prominently above the surrounding country. The pine disappears on its upper slopes where there is a park-like timber of spruce similar to that near the timber-line far to the northeast. The lichen mat on the hill-top shows also a more boreal character, with *Cetraria islandica* an abundant species. It seems reasonable to suppose that Canada spruce was the first timber on some of the ridges, at least, and that it has persisted in the more exposed places. The park-like spruce woods would probably be easily invaded by jackpines if they occurred at a lower level.

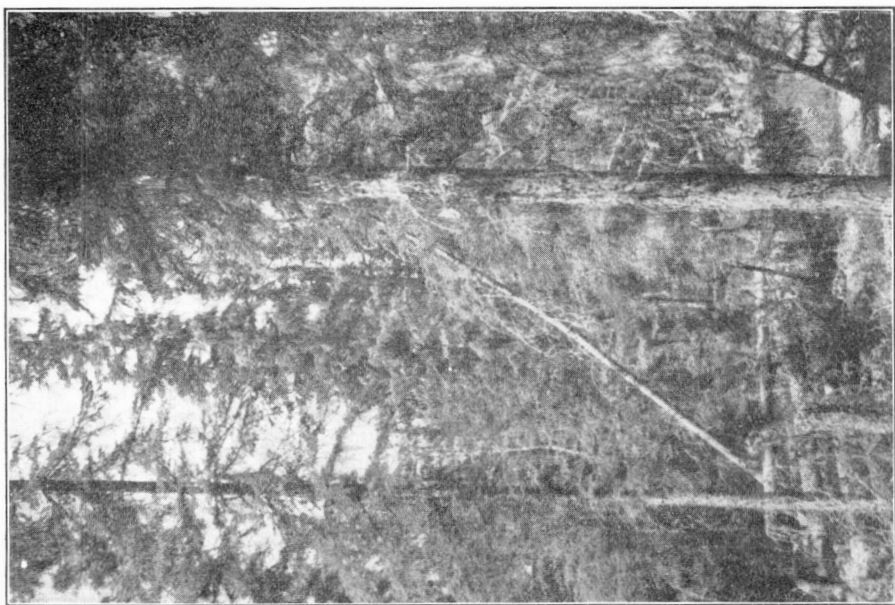
Older pine woodlands show all stages of a transition to the richer spruce forests of the lower slopes. There appears to be little question that the normal course of development, when undisturbed, is to spruce. Many of these stages are clearly shown in the vicinity of Pine lake where the writer has studied them on several occasions. The first changes come with the introduction of a scattering of shrubs and perennial herbs, and with the



A. Jackpine timber (*Pinus Banksiana*) near Pine lake.



B. Black spruce (*Picea mariana*) at the margin of a muskeg near Moose (Eight) lake.



A. Upland spruce timber (*Picea glauca*) near Pine lake.



B. Aspen timber (*Populus tremuloides*) near Pine lake.

invasion of moisture-loving mosses and lichens of the woodlands. The common floristic content of what might be called a mature jackpine *Pinus Banksiana* forest is as follows:

- Primary spp.: *Pinus Banksiana*  
*Alnus crispa*  
*Cladonia alpestris*  
*Peltigera aphthosa*  
*Vaccinium Vitis-idaea* var. *minus*  
*Hypnum Crista-castrensis*  
*H. Schreberi*  
*Polytrichum juniperinum*
- Secondary spp.: *Picea glauca* (small saplings)  
*Elymus innovatus*  
*Maianthemum canadense*  
*Populus tremuloides* (small saplings)  
*Salix Bebbiana*  
*Betula papyrifera* var. *neolaskana*  
*Geocaulon lividum*  
*Pulsatilla ludoviciana*  
*Fragaria glauca*  
*Rosa acicularis* (small bushes)  
*Shepherdia canadensis*  
*Epilobium angustifolium*  
*Cornus canadensis*  
*Arctostaphylos Uva-ursi*  
*Galium boreale*  
*Linnaea borealis* var. *americana*  
*Viburnum pauciflorum* (small bushes)  
*Campanula rotundifolia*

The scattered secondary species indicate the trend toward mesophytism above noted. The young spruce trees are thriving in the shade of the pines and in the soils which, by the accumulation of vegetable remains, are increasing their water-holding capacity and their supply of nutrient materials. As the spruce trees grow to such a size that they can shade the now moister ground, the pines fail to germinate. A common forest type on the uplands is one in which there is a vigorous stand of young spruce trees with a growing mat of mosses beneath them, and scattered among them a few ancient pines with great arching branches that are leafless except at their very tips. Semi-decayed logs in such woods prove to be those of the former pine forest. Old fallen trees in spruce forests of the more mesophytic type are of spruces, indicating the relative perpetuity of this type.

Extensive forest fires have seriously modified vast areas of Wood Buffalo park, so that the resulting deciduous or partly deciduous woodlands are among the commonest types of vegetation. The amount of influence exerted by a fire depends upon the nature of the fire and upon the stage of development of the timber burned. A crown fire, driven by a high wind, burns the leaves of the conifers and kills the trees, but does not greatly affect the ground layer. In such a case the timber seems to return to its former condition without much delay. On a sandy hill at the east side of Pine lake there is a heavy spruce forest with occasional large aspens *Populus tremuloides* in it. There are a great many old windfalls that show evidence of having been killed by fire,

but there is a thick ground cover of mosses and a layer of humus about 4 inches thick. These facts indicate that the old timber was burned in such a way as to kill the trees without injuring the humus and ground cover. A few aspens came in with the young spruces following the fire, but all except the most hardy were crowded out by the rapidly growing conifers.

A piece of woods south of Pine lake has in recent years suffered a burn which did not seriously injure the ground cover. There was formerly a mature jackpine forest with some aspens in it, as indicated by the windfalls. The young trees now coming into the area are aspen and spruce, the latter showing dense stands of strong trees. Evidently the course of the succession was not seriously affected.

When immature jackpine woods are burned there is an immediate and abundant growth of seedling pines with a very few aspens. The pines gradually thin out with age. The ground cover is so thin in such a case that a ground fire does little more damage than a crown fire, since the soil is already rather sterile. If it burned the ground cover badly it would lessen the viability of seeds, but this would only slightly lengthen the period of its return to pine woods.

In the case of older woods that have been badly burned by ground fires, notable exceptions to the normal succession of the vegetation occur. It is in such areas that the greatest growth of deciduous timber is found. The woods immediately around the Pine Lake ranger station consist mostly of aspens and poplars.

The deciduous timber is of two types: the aspen woods, and the poplar-spruce woods. The first of these is the most abundant, and next to the mature spruce forest it is the thickest timber in the region. It also contains the greatest number of species. The aspens form a close stand of trees 50 to 80 feet high, and reaching 12 to 20 inches in diameter, with straight clean boles. Other occasional trees are balsam poplar *Populus tacamahacca*, Canada spruce, and jackpine. The pines are all scraggly trees that are evidently remnants of the burn. The poplars and spruces are all young trees coming up in the shade of the aspen. A distinct shrub and young tree flora is formed mainly of grey willow *Salix Bebbiana*, and sapling poplars. Other less common shrubs are *Shepherdia canadensis*, *Amelanchier florida*, *Rosa acicularis*, *Lonicera glaucescens*, *Viburnum pauciflorum*, and *Symphoricarpos albus* var. *pauciflorus*. The ground is covered with dead leaves and other plant parts, but there are almost no mosses and lichens. The leaf mould is 1½ to 2 inches thick on a sandy substratum. The primary herbaceous species is a grass *Elymus innovatus*. It does not form a turf, but is very common considering its woodland habitat. About thirty species of herbaceous plants occur, with none in very great numbers. This seems to be a sort of common ground for most of the herbs of the other forest types, but *Botrychium Lunaria*, *Habenaria viridis* var. *bracteata*, *Delphinium scopulorum* var. *glaucum*, *Thalictrum venulosum*, *Lathyrus ochroleucus*, *Vicia americana*, *Aster junceus*, and *A. Lindleyanus* may be considered characteristic.

Occurring in patches in the aspen woods may be found the second type of deciduous timber, in which balsam poplars, accompanied by spruces, have superseded the aspens. A good view of this condition may be gained



from the top of a fire tower on the ridge just west of the Pine Lake ranger station. The darker green foliage of the poplars and dark points of the spruces are just appearing above the tall aspens. The shrub layer loses many of the willows, and *Shepherdia canadensis*, *Rosa acicularis*, and *Viburnum pauciflorum* become predominant though scattered. A notable change occurs in the ground layer by the new growth of the woodland mosses and lichens. In the dense shade of the spruces the herb flora is reduced to *Maianthemum canadense*, *Rubus pubescens*, *Pyrola asarifolia*, *Linna borealis* var. *americana*, and a few scattered grasses. The poplar-spruce woods appear to be merely a stage of development of the mature spruce timber from the aspen woods, the aspen in turn being introduced by burning.

During the field seasons of 1929-30, the writer had several opportunities to observe the initial vegetation that follows new burns. A very destructive fire swept a strip of country extending north and south between Pine and Moose lakes in 1928, much of it having occurred as late as October of that year. The first plants to appear in the growing season of 1929 were the water-leaf *Phacelia Franklinii*, corydalis *Corydalis aurea*, geranium *Geranium Bicknellii*, dragon's-head *Dracocephalum parviflorum*, and the liverwort *Marchantia polymorpha*. In recently burned spruce woods along Little Buffalo river and on the lower slopes of Caribou mountains were found large numbers of the sponge mushroom *Morchella conica*, which attains a height of 4 to 6 inches.

So little clearing has been done that it is impossible to tell the exact effects of it. The general effects, judging from the evidences around cabins, are not much different from those of a mild burn. The ground cover is not removed, and the ensuing timber seems to return rather quickly to its former state, with a certain amount of intermingling of deciduous species. A relatively unimportant influence which is modifying the upland forest in small areas is the wallowing activity of the buffalo herds. These animals find a favourite resort for rubbing and fighting flies during the summer in the open pine woods. The lichen mat is not rooted, so that it can be easily torn up and the dry sand tossed or used to roll in. The trees are slowly being killed by having their bark rubbed off a short distance above the ground. The writer has examined no areas in which this process has been carried to the extreme, but there are many wallows in the Pine Lake district that show minor plant associations introduced by partial clearing. The common herbaceous species of cabin clearings throughout the region make their appearance upon the stirred ground. Whitlow grass *Draba nemorosa*, chickweed *Cerastium nutans*, bird seed *Lepidium apetalum*, and strawberry blight *Chenopodium capitatum*, are the first invaders of new wallows. Later comes a miscellaneous mixture of grasses and other herbs, such as five-finger *Potentilla norvegica* var. *hirsuta*, goldenrod *Solidago oreophila*, chickweed *Stellaria longipes* var. *laeta*, fox-tail *Alopecurus aequalis*, blue-grass *Poa glauca*, and a few others.

Figure 2 is a map of Pine lake and the vegetation in its vicinity, derived partly from the writer's field studies, and partly from aerial photographs. The predominance of woodland over semi-open country is manifest, as well as the large proportion of the timber which is deciduous.

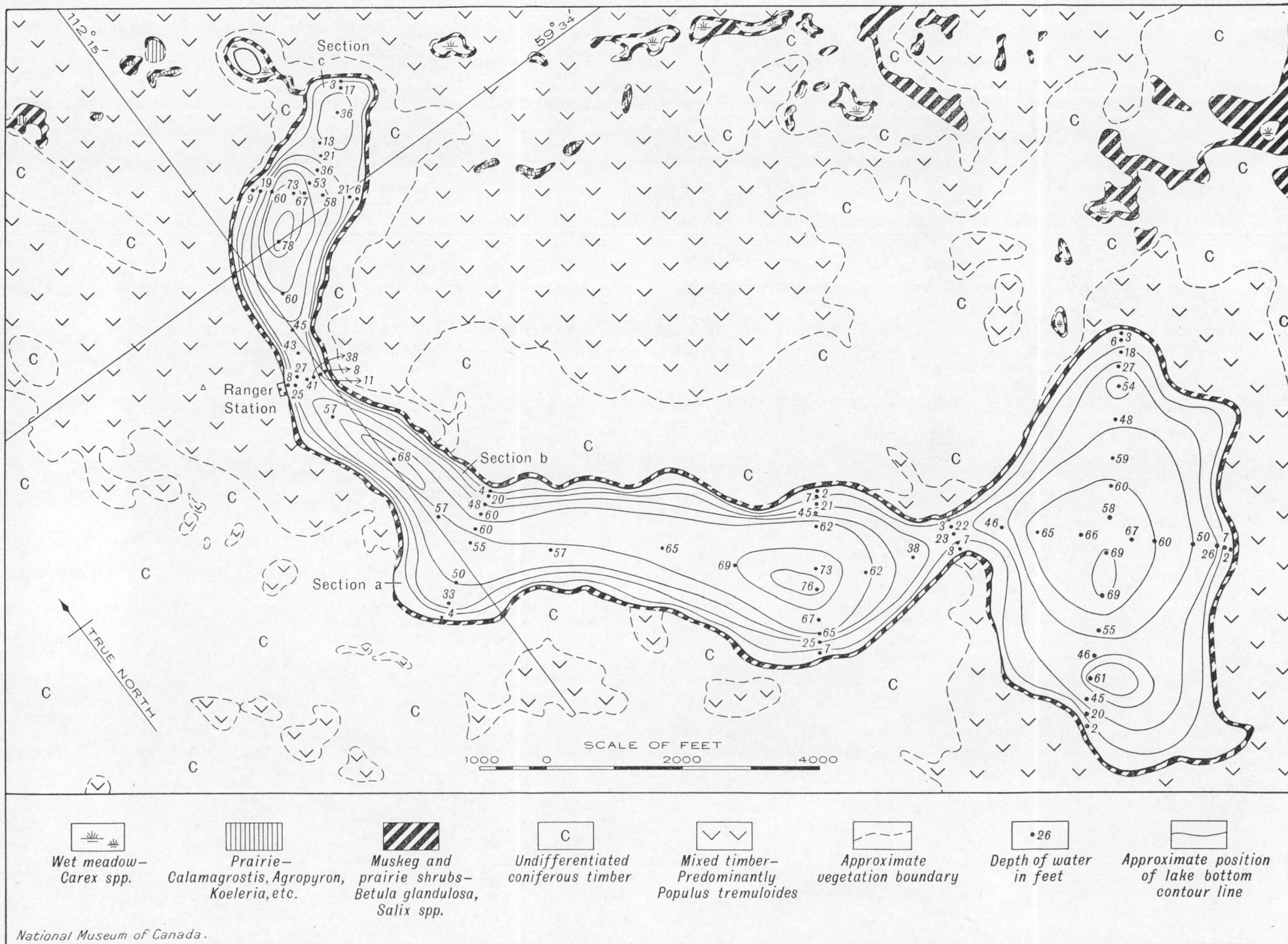


Figure 2. Map of vegetation in the vicinity of Pine lake.



## UPLAND LAKE SHORE VEGETATION

Throughout the upland districts of the park there are innumerable lakes and ponds of various sizes and origins. Some are formed through the damming of drainage by Glacial moraines, and may be looked upon as remnants of former bodies of water which have been lowered by the cutting of their barriers. Most of the small lakes in the Moose Lake basin seem to have had this sort of beginning. They are usually shallow and marshy, tending to develop muskegs in many of their shores. Many small lakes are due to beaver dams, of which there are a great many in the region. There is a long succession of these obstructions in Little Buffalo river and its tributaries, which must have modified seriously the land and water relations in many parts of the valley. These lakes resemble those described above in being commonly shallow and marshy. A third type of lake occurs in sink-holes that do not have complete drainage. These vary greatly in size and in the character of their shores, from large, deep lakes with abrupt slopes to small, relatively shallow ponds whose shores resemble those of muskeg lakes. A common form is typified by Pine lake, which is approximately 3 miles long, from an eighth to a half mile wide, and reaches a depth of 78 feet (See Figure 2). Its shores are so abrupt that there is very little marsh vegetation, and aquatic associations are mostly limited to those of deep water. Only in a few sheltered parts, where the slope into deep water is not so great, is there a beginning of shore forms. This lake is without an outlet or visible inlet, and occupies a series of large sink-holes which are so close together that they have coalesced. The level of the lake has not changed much for a long period, but the ancient beaches on the eastern shores indicate that there has been a certain amount of fluctuation.

A chain of small sink-hole lakes southeast of Pine lake, the shores of which are more gently sloping, show all gradations between clean shore-lines and very marshy or boggy ones. Sink-holes with rapidly changing water levels have relatively clean water lines, probably due to the fact that aquatic and marsh vegetation has no time to become established before it is either drowned out or dried out.

Although no rigid lines may be drawn between different kinds of lake shores, yet a simple classification into those with abrupt, relatively clean borders, and those bordered by some form of swamp, will be useful. Gently sloping, swampy shores may be divided into those that have marsh associations, and those with muskeg, or bog associations. A glance at the map will show that most of the lakes, and the largest of them, are to be found in the Moose Lake basin and its northwestward extension around the base of Caribou mountains. These are mostly shallow, with marsh or muskeg shore types. The deep sink-hole lakes appear to be commonest upon the morainic upland areas.

The distribution and development of vegetation on the lake shores show many minor variations through the country, but there is a fairly uniform general trend. The bottoms in deep water are usually covered with *Chara*, and the first plants to appear shoreward, as the water shallows, are species of pond weeds *Potamogeton*. Still farther inshore are bulrushes *Scirpus*



A. Rocky shore of Moose (Eight) lake. (See Figure 3, A.)



B. Steep, sandy shore of Pine lake. (See Figure 3, B.)



C. Marshy shore of Moose (Eight) lake. (See Figure 3, I.)

*validus*, or cow lilies *Nymphozanthus variegatus*, or both, with occasionally other emergent sedges and grasses. At the actual shore-line are such characteristic species as cat-tail *Typha latifolia*, or some species of bur-reed *Sparganium*, or sedge *Carex*. There is usually a slough or wet meadow back from the shore, dominated by sedges and grasses, and margined by willows. The main deviations from this trend occur on very steep, rocky, or sandy shores and on mossy borders of muskeg ponds, as the following discussions will show.

More or less detailed studies of upland lake shores have been made at Moose lake, Pine lake, a small lake near upper Salt river north of Pine lake, at a small lake near the base of Caribou mountains about 20 miles north of Indian graveyard, Peace river, and at some small lakes southeast of Pine lake. The main results of these studies have been checked with a large number of minor observations throughout the region, so that the writer is confident that they are fairly typical.

#### AQUATIC ASSOCIATIONS

The deepest parts of the sink-hole lakes seem to be quite barren of vegetation. A great many soundings were made in Pine and Lane lakes in an effort to determine the contours of the bottoms, and the alga, *Chara*, was brought up only from bottoms about 25 feet deep or less. Shallower lakes have a rich growth of this plant which rises in billowy masses, sometimes to the surface. The water birds at Moose lake in mid-July were using these off-shore masses as temporary roosts. In a few localities the accumulations appear to be forming the basis for the growth of other aquatic plants. In most of the lakes there is an abundant plankton consisting of green and blue-green algæ as well as many minute animal organisms.

A few sink-hole lakes are of such inverted-conical form that they have no marginal aquatic vegetation at all. There are several of these near the trail between Moose and Pine lakes, and a few notable examples along the wagon road east of Pine lake. Scarcely any peaty materials have accumulated on their steep bottoms, and from the edge one may look down many feet through the clear water. Pioneer plants on less steep shores are usually species of *Potamogeton*. These are rooted in the bottom, and by their semi-floating, supple nature, are admirably adapted to withstand wave action. Although many observations will be required to prove the point, peaty bottoms appear to favour the broad-leaved *P. praelongus*, whereas sandy, gravelly, or muddy bottoms grow the narrow-leaved *P. vaginatus* or *P. pectinatus*. Both *P. praelongus* and *P. pectinatus* were found in abundance in typical situations at Moose lake. *P. Richardsonii* is sometimes found in place of *P. praelongus*. In the second and third weeks in August, 1929, the latter species in Moose lake had its leaves broken and encrusted with lime, and was losing its ripe fruits. The floating bladderwort *Utricularia vulgaris*, and water-milfoil *Myriophyllum exalbesces*, sometimes accompany the pond weeds and *Chara* in peaty ponds, and in muskeg ponds they grow with the peat mosses that extend out



from shore. Gently sloping sandy shores that are subject to considerable wave action and the undercutting of the actual banks have a scant vegetation of which *Potamogeton filiformis* var. *borealis* is the commonest species. It is sometimes associated, in relatively quiet water, with a turf of *Najas flexilis* and a scattering of *Myriophyllum exalbesens*, *Chara* sp., *Nymphozanthus variegatus*, *Potamogeton Richardsonii*, and *P. zosteriformis*.

Emergent aquatics on relatively steep shores are usually bulrushes *Scirpus validus*. At Moose lake they are found in water 5 or 6 feet deep, growing alone or with *Potamogeton pectinatus*. They are very seldom at the water-line, on this or any other type of shore, but occupy a comparatively narrow band a few yards away from the land (Figure 3, A, F, G, I). Shallow lakes often have other associations outside the bulrushes (Figure 3, G, I). The cow-lily *Nymphozanthus variegatus* grows abundantly in many such situations. It may be alone or associated with pond weeds: *Potamogeton praelongus*, *P. Richardsonii*, and *P. zosteriformis*, water-milfoil *Myriophyllum exalbesens*, bladderwort *Utricularia vulgaris*, spike-rush *Eleocharis palustris*, an abundant plankton, and the *Chara* of the bottom. These secondary species are not evenly distributed, but are very common in patches. The zone of lilies is constant on most of the marshy shores of Moose lake where it is 100 feet wide or more over long distances. The most extended marshy shores (Figure 3, I) have still another association which involves the meadow sedge *Carex trichocarpa* var. *aristata*, and the tall marsh grass *Fluminia festucacea*. These species grow in nearly pure stands in water 3 to 4 feet deep, and were fruiting abundantly during the second and third weeks in August. It is of note that they are primary species in the flood-plain sloughs and delta lands along the main rivers. On the shores of upland lakes, however, they do not play a part in the adjacent meadow vegetation as they do in the lowlands. On a few marshy shores *Equisetum limosum* takes the place of *Scirpus*.

When the bulrush zone occurs in shallow water it serves as a place of accumulation for a number of other species: bladderwort *Utricularia vulgaris*, *U. minor*, pond weeds such as *Potamogeton Richardsonii*, *P. zosteriformis*, *P. Friesii*, *P. pusillus*, water-milfoil *Myriophyllum exalbesens*, bur-reed *Sparganium* sp. (floating seedling), floating mosses *Hypnum* spp., and abundant plankton. The part taken by the off-shore *Scirpus* association in the formation of the characteristic peat ridges at the shores of lakes in Moose Lake basin has already been discussed by the writer (56). When the general lake level is slightly lowered, as it has been frequently in rather recent times, these off-shore peat accumulations stand out as ridges at or near the shore-line, where their height and better drainage enable them to attain a mesophytic flora sooner than their surroundings (Figure 3, I). Some lake shores show several of these ridges at intervals back from the water, indicating earlier changes in water-levels. In places the *Scirpus* association shuts off from the main lake a small narrow lagoon which when under water has a very open growth of *Myriophyllum*, *Utricularia*, and a few other species, but when exposed by drainage acquires a sedge marsh aspect.

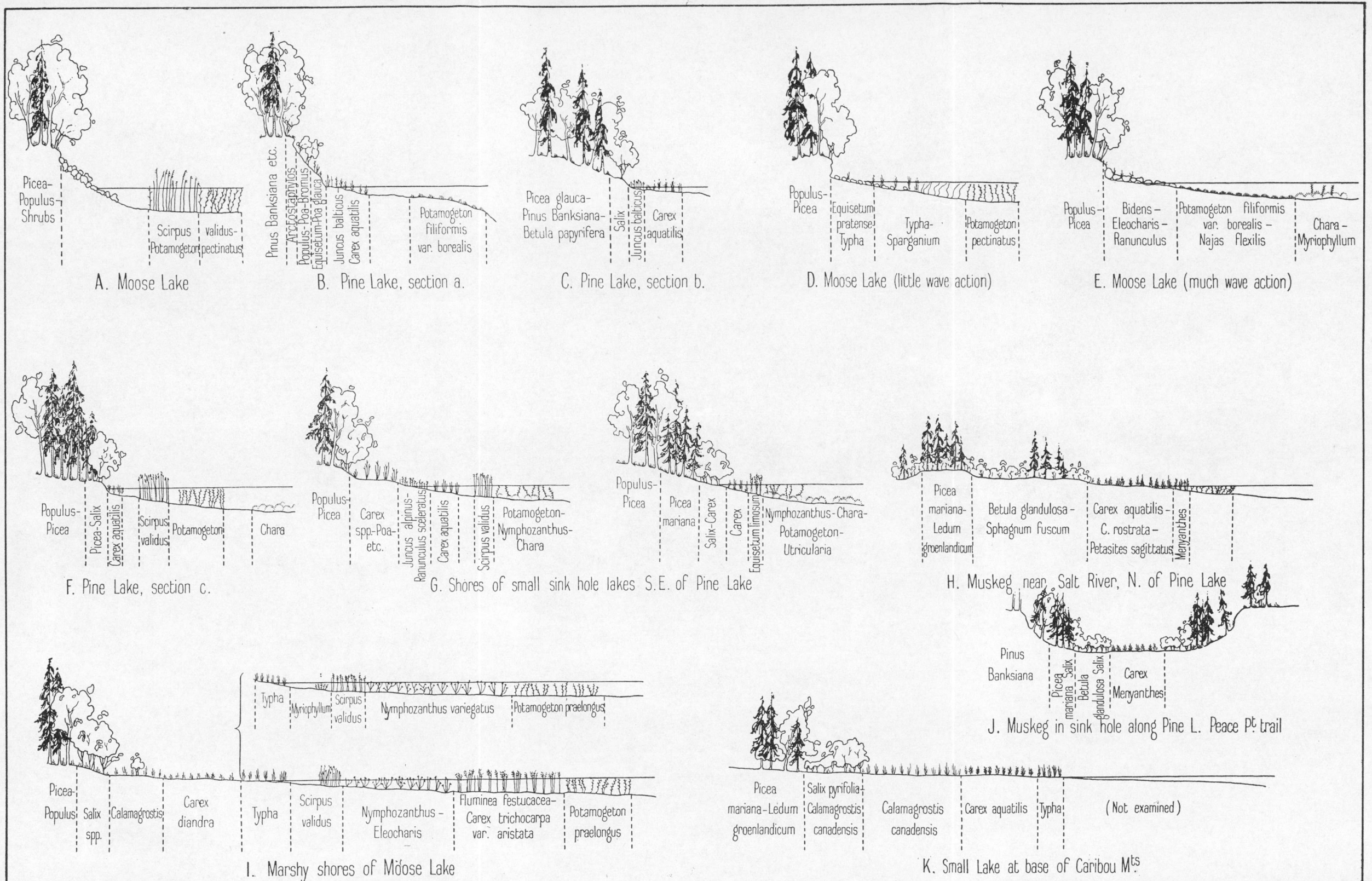


Figure 3. Sectional diagrams of upland lake shore and muskeg vegetation.





## SHORE-LINE AND WET MEADOW ASSOCIATIONS

On marshy lakes the actual shore-lines are ill-defined, but for a description of the vegetation they will be considered as involving the area that is usually being colonized actively by amphibious plants with strongly developed rootstocks.

Sandy, wave-washed shores at Pine lake usually have sedges *Carex aquatilis*, and the baltic rush *Juncus balticus*, occupying the soil for a short distance on either side of the water's edge (Figure 3, B, C). Somewhat similar shores of Moose lake, however, are more muddy and there is an influx of species from the meadow zone described below. Very steep, sandy, or stony shores are nearly or quite barren of vegetation at the water-line (Figure 3, A), and at the other extreme is the wet marsh (Figure 3, I). A section at Moose lake will be considered as typical of the latter and described in detail.

The first turf association of the shore is composed of the following species:

- Primary spp.: *Typha latifolia*  
*Carex aquatilis*  
*C. diandra*  
*Calamagrostis inexpansa* var. *brevior*  
*Eleocharis palustris*
- Secondary spp.: *Potamogeton Richardsonii*  
*Bidens cernua*  
*Galium trifidum*  
*Rumex maritimus* var. *fueginus*

*Calamagrostis* and *Eleocharis* are playing a part in the colonization of the open water only in a few places, and otherwise should be listed as secondary species. The other three primary species are commonest in the order of their listing. *Typha* forms dense and often pure stands with its stalks standing in water. The sedges and grasses are growing in hummocks and, like *Typha*, are sending out floating or semi-floating masses into the lake. Where the masses are more firmly fixed the meadow shore conditions begin. The substratum is of decaying vegetation, and when disturbed it gives off the disagreeable odour of marsh gases. The zone is usually a narrow one, but when it extends into bays and the lake shore slopes off very gradually it is considerably widened.

Following the pioneer association, *Carex diandra* becomes the predominating plant, forming hummocks. It has a large group of semi-aquatic species with it as secondaries:

- Rumex occidentalis*  
*Potentilla palustris*  
*Epilobium palustre*  
*Cicuta bulbifera*  
*Stellaria longifolia*  
*Rorippa palustris*  
*Galium trifidum*

*Sium suave*  
*Scutellaria epilobifolia*  
*Ranunculus sceleratus*  
*Glyceria pulchella*  
*Carex canescens*  
*C. aquatilis*  
*Rumex maritimus* var. *fueginus*

On somewhat drier areas occur *Urtica gracilis*, *Potentilla norvegica* var. *hirsuta*, and occasionally *Epilobium angustifolium*. The zone is wet and is evidently not far developed from the semi-floating *Typha*-sedge zone.

Progressively drier areas back of the *Carex diandra* association have a meadow vegetation dominated by *Calamagrostis inexpansa* var. *brevior*. The grass is in tufts and is associated with the more mesophytic plants of the sedge zone, as well as with seedling *Salix planifolia* and *S. myrtillofolia*, *Achillea Millefolium*, *Geum macrophyllum* var. *perincisum*, *Erigeron acris* var. *asteroides*, *Aster junceus*, *A. Lindleyanus*, and *Agrostis scabra*.

This general arrangement is the common one on marshy lakes throughout the upland, although the shores differ greatly in width and in the relative prominence of the associations. There are some minor specific differences such as the replacement of *Carex diandra* by *C. aquatilis*, or the insertion of *C. rostrata* as a predominating sedge. A treatment of the vegetation of muskeg pond shores where mosses are dominant will be deferred to the discussion of muskeg vegetations as a whole.

#### SHRUB ASSOCIATIONS

On the shores of most lakes that have been formed by a more or less precipitate fall in sink-holes, the vegetation has no genetic relationship to that of the surroundings. The dry pine woods often come nearly to the water's edge. In lakes where there has been a slow but appreciable change in water level, the sandy shores have been worked over and formed into small ridges, plains, and spits, upon which is developing typical sand-plain vegetation of open jackpine woods. There are several such situations on Pine lake (Figure 3, B). On marshy shores, however, the upper, more mesophytic parts of the slopes are developing forests by a regular set of stages. The shore section at Moose lake discussed above may be continued to illustrate the transition to timber.

The first association of woody plants is dominated by *Salix planifolia* and *S. myrtillofolia*. Secondary species are as follows:

*Calamagrostis canadensis*  
*Alnus incana*  
*Potentilla norvegica* var. *hirsuta*  
*Geum macrophyllum* var. *perincisum*  
*Castilleja Raupii*  
*Achillea Millefolium*  
*Agrostis scabra*  
*Erigeron acris* var. *asteroides*

It will be noted that this is a repetition, in part, of the preceding zone as far as the secondary species are concerned.

The *Salix* association passes to the spruce forest of the surrounding country through a narrow transition zone involving *Populus tacamahacca* much like that of the river flood-plains. In the event of burns, *Populus tremuloides* also plays an important part in the arrangement. Where very low land adjoins the lake the *Salix* association passes directly to a *Picea mariana-Larix-Sphagnum* muskeg, and the muskeg forest merges imperceptibly with the *Picea glauca* timber. On the low semi-muskeg shore of a small lake at the base of Caribou mountains *Salix pyrifolia* takes the place of *Salix planifolia*.

### MUSKEG VEGETATION

Hundreds of square miles in Wood Buffalo park are covered with muskegs, which are locally distinguished from "sloughs" by the presence of mosses that predominate in their ground cover. In the early part of the summer season they are wet at the surface but not thawed below a foot or two. By late June or early July they become soft to much greater depths and make formidable barriers to overland travel through the country. Where there has not been much standing water the surface layers begin to dry appreciably in August, so that they become more passable in late summer or early autumn. Ponds that persist throughout the year are abundant and are of large size in some districts. The largest muskeg areas in the park are in Moose Lake basin, where they are almost continuous for many miles. One may look westward and southwestward from the top of the Ninishith hills at the point where Little Buffalo river cuts through them and see clearly the Caribou mountains (16) 30 miles away. Only a few low ridges rise above the flat-lying lowlands that intervene, and nearly the whole area is a maze of muskegs and lakes (16). From the surface of Moose lake much the same view may be had. The contrast between this type of terrain and that farther eastward is shown by the fact that it is possible to travel from Fort Smith overland to Peace point in midsummer with almost no hindrance from muskegs. They are common on the uplands but are usually small and separated by dry ridges.

Lewis, Dowding, and Moss (36) have published excellent descriptions of the muskeg vegetation in the northern forest of central Alberta, where the results of their studies show considerable similarity to the writer's on Wood Buffalo park. The general trend in the development of a mesophytic forest by the filling of shallow lake and pond basins described above is greatly modified by the introduction of bog mosses. In some places (Figure 3, H) these appear at the actual margin of the lake, but are more often separated from it by a wet meadow of sedges and other plants of the shore-line associations. The mosses are commonly associated with sedges and are being invaded by a hummocky growth of *Sphagnum* with typical muskeg shrubs. The next stage is the growth of a muskeg forest of black spruce and tamarack and the gradual accession of the Canada spruce of the surrounding country. This trend, in a more or less complete series, may be seen on the shores of muskeg ponds, or may have its various later stages occupying whole depressions where the wetter conditions have ceased to exist.



A. Muskeg with shrub cover, near Moose (Eight) lake.



B. Muskeg partly timbered with black spruce, eastern edge of Caribou Mountain plateau.



C. Sink-hole 16 miles east of Moose (Eight) lake. (See Figure 8.)

Detailed studies have been made by the writer at a muskeg north of Pine lake, at various places on the shores and in the vicinity of Moose lake, and on the shore of a small lake at the base of Caribou mountains (Figure 3, H, J, K).

#### AQUATIC AND SHORE-LINE ASSOCIATIONS

Mossy shores are typified by a section of the muskeg near Pine lake (Figure 3, H). The open water is being invaded actively by a moss, *Hypnum* sp., which fills large areas and is associated with *Utricularia vulgaris*. In this pond there is not much free space left in the centre. The dominant moss, accompanied by *Meesia longiseta*, forms the substratum for the associations that lie between the water and the invading *Sphagnum* hummocks. The more compact mats of moss have a stand of the buck-bean *Menyanthes trifoliata*, which was in fruit on July 9, when the survey was made.

A zone of sedges follows that of the buck-bean and the moss.

- Primary sp.: *Carex aquatilis*
- Secondary spp.: *Triglochin maritimum*  
*Carex diandra*  
*Eriophorum spissum*  
*Stellaria crassifolia*  
*Potentilla palustris*  
*Epilobium palustre*  
*Menyanthes trifoliata*  
*Utricularia vulgaris*  
*Galium trifidum*  
*Hypnum* sp.  
*Meesia longiseta*

The sedge stands in rather close arrangement, and none of the other species is present in any numbers. In a few places this association alternates with another:

- Primary spp.: *Carex rostrata*  
*Petasites sagittatus*
- Secondary spp.: *Sparganium minimum*  
*Carex aquatilis*  
*Eriophorum angustifolium*  
*Potentilla palustris*  
*Epilobium palustre*  
*Utricularia vulgaris*

The *Carex rostrata*-*Petasites* association may be distinguished at a distance by its lighter green mixed with the grey-green of the latter plant.

The two associations just described, with minor variations, are very common throughout the region. Vast areas of the Moose Lake basin are covered with them to such an extent that overland travel is nearly impossible. Figure 3, J, shows them in a muskeg along the Pine Lake-Peace Point trail about 15 miles north of Peace point.

In a muskeg observed in Caribou mountains *Sphagnum* is the moss that has invaded the centre of the pond, where it is associated with a grass-like plant whose identity has not been determined. At the outer margin the moss grows with *Carex paupercula* var. *irrigua*. The latter species accompanies the invading bog shrubs into the depression.

#### BOG SHRUB ASSOCIATIONS

The manner in which *Sphagnum* invades the sedge associations, or low moors, has been well illustrated by Lewis, Dowding, and Moss (37). In the muskeg near Pine lake the association is somewhat as follows:

- Primary spp.: *Sphagnum capillaceum*  
*Betula glandulosa*
- Secondary spp.: *Larix laricina*  
*Picea mariana*  
*Carex paupercula* var. *irrigua*  
*C. aquatilis*  
*C. capillaris*  
*C. capitata*  
*C. gynocrates*  
*C. limosa*  
*C. disperma*  
*C. tenuiflora*  
*Eriophorum spissum*  
*Salix pedicellaris* var. *tenuescens*  
*Drosera rotundifolia*  
*Andromeda Polifolia*  
*Chamaedaphne calyculata*  
*Vaccinium Oxycoccus*

There are many square miles of this birch muskeg in the park area. The above list is fairly complete for the immediate situation, but is not so when the type as a whole is considered. It is the most noticeable and most stable intermediate stage between the wet bog associations and the developing timber. The elements of the latter may be commonly observed invading the shrubby areas, as the list indicates. The following species have been noted or collected in similar situations in the park.

- Equisetum limosum*  
*E. scirpoides*  
*Arctagrostis arundinacea*  
*Calamagrostis canadensis* var. *robusta*  
*C. inexpansa* var. *brevior*  
*Deschampsia caespitosa* var. *glauca*  
*Scirpus hudsonianus*  
*Carex atratiformis*  
*C. vaginata*  
*Eriophorum opacum*  
*Smilacina trifolia*  
*Tofieldia glutinosa*  
*Salix candida*  
*S. myrtillofolia*

*S. athabascensis*  
*Myrica Gale*  
*Betula pumila*  
*Rumex occidentalis*  
*Stellaria longifolia*  
*Chrysosplenium tetrandrum*  
*Potentilla fruticosa*  
*Rubus acaulis*  
*R. Chamaemorus*  
*Ledum groenlandicum*  
*L. palustre* var. *decumbens*  
*Lomatogonium rotatum*  
*Valeriana sylvatica*  
*Achillea Millefolium*  
*Aster junceus*  
*Erigeron acris* var. *arcuans*  
*Petasites vitifolius*  
*Senecio pauperculus*

On Caribou mountains the birch association does not appear to be accentuated, *Ledum* and *Chamaedaphne* being the pioneer bog shrubs.

#### TREE ASSOCIATIONS

The first bog forest to invade the wet muskegs is made up chiefly of black spruce *Picea mariana*, and Labrador tea *Ledum groenlandicum*. Tamarack *Larix laricina*, although quite common, does not take a primary position. The *Sphagnum* is gradually replaced by woodland mosses such as *Hypnum Crista-castrensis* and *H. Schreberi* with an association of typical herbs and shrubs.

- Primary spp.: *Picea mariana*  
*Ledum groenlandicum*
- Secondary spp.: *Equisetum scirpoides*  
*E. variegatum*  
*E. sylvaticum* var. *pauciramosum*  
*Carex gynocrates*  
*C. vaginata*  
*C. capillaris*  
*C. disperma*  
*C. diandra*  
*Eriophorum opacum*  
*Maianthemum canadense*  
*Orchis rotundifolia*  
*Habenaria obtusata*  
*H. hyperborea*  
*Calypso borealis*  
*Listera borealis*  
*Corallorrhiza trifida*  
*Spiranthes Romanzoffiana*  
*Salix glauca*  
*S. Bebbiana*  
*S. myrtillofolia*  
*S. arbusculoides*



*Betula papyrifera* var. *neolaskana*  
*B. glandulosa*  
*Geocaulon lividum*  
*Ribes triste*  
*R. hudsonianum*  
*R. oxyacanthoides*  
*R. lacustre*  
*Parnassia multiseta*  
*P. montanensis*  
*Mitella nuda*  
*Rubus acaulis*  
*Shepherdia canadensis*  
*Vaccinium Vitis-idaea* var. *minus*  
*Arctostaphylos rubra*  
*Pyrola asarifolia*  
*P. secunda*  
*P. chlorantha*  
*Moneses uniflora*  
*Castilleja Raupii*  
*Linnaea borealis* var. *americana*  
*Peltigera aphthosa*

The general aspect of the woods does not show an abundance of secondary species, since these are usually much scattered. The spruces make a rather close stand at the actual margins of the birch muskegs, where *Ledum* reaches its greatest abundance, but older woods are more open and the moss carpet is the most prominent feature of the lower strata.

The invasion of certain types of marshy lake shores by the bog forest is shown in Figure 3, K. Instances of this are not regular in occurrence, and may be isolated on such shores as that of Moose lake. The writer can see no reasons for this sporadic occurrence other than the extremely gradual slope and poor drainage of the land and the usual presence of a typical bog forest immediately back of the lake margin. This is the case in every instance thus far examined. Another problem is that of the elevated portion of the muskeg forest north of Pine lake. The explanation most commonly offered for this phenomenon is the differential burning of peat in the fires that have swept the region. Such may indeed be the case, but in a country like this, where lake and pond levels can be demonstrated to have fluctuated so noticeably in very recent post-Glacial time, much further study is necessary before the determining causes can be found. These elevated peat deposits are not uncommon, either in Wood Buffalo park or in other places in the Athabaska-Great Slave Lake region.

A comprehensive study of the muskeg vegetation and peat deposits of the region can be said to be scarcely begun. With the limited time and equipment available the writer has made only a superficial record of general aspects, and has not attempted to make borings or to try by any other means to learn the earlier conditions of the muskegs. Such a study would reveal a great deal concerning the post-Glacial and post-lacustrine history of the vegetation.

The bog forest appears to develop directly into Canada spruce woodland. This may be seen near the shores of Moose lake, but it is not com-

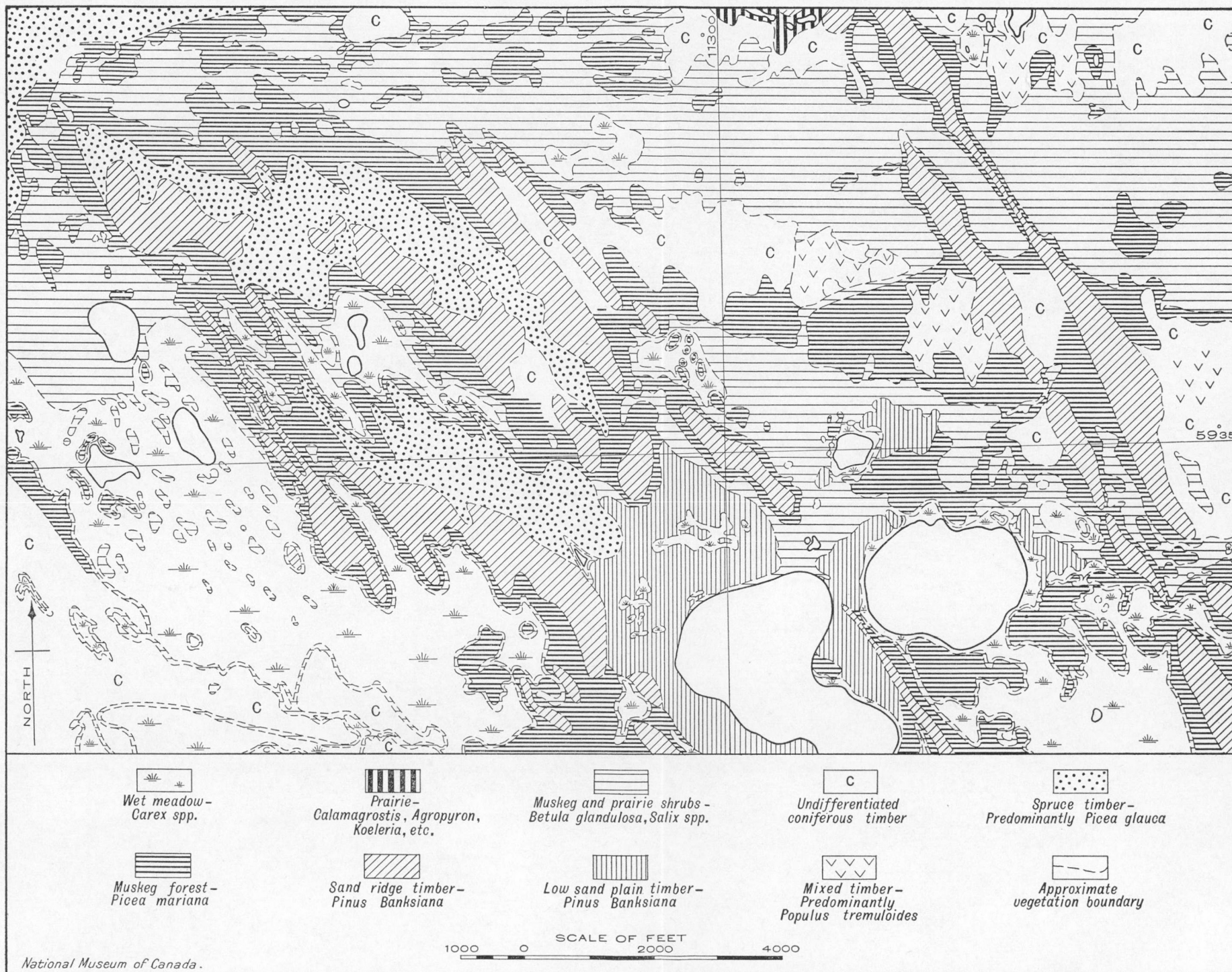


Figure 4. Map of vegetation in an area about 3 miles east of Moose (Eight) lake.



monly apparent throughout the park. Many muskegs are bordered abruptly by sand ridges, where there is no close relationship with the upland vegetation.

Figure 4 is a map of a bit of country a few miles east of Moose (Eight) lake, showing the general arrangement of the vegetation in the marginal part of Moose Lake basin. The relatively large areas covered by wet meadow and muskeg shrubs, as well as the large amount of surface water, indicate the character of the topography. The diagonal strips of jackpine timber are on sandy morainic ridges which appear to be superposed upon an older topography consisting of low, broad elevations and depressions that have a trend to the west-northwest. This latter trend is in the direction thought to have been followed by the Pleistocene ice in its movement westward, whereas the sand ridges are most probably parts of the great lobate morainic system that converges to form the Ninishith hills to the northward. Many of the smaller lakes show evidences of lowering water levels, and one of the most interesting features of the region is the presence of low sand-plains that have been but recently exposed by this gradual drainage. They have a nearly pure stand of jackpine on them. Plate VI, A, B, shows muskegs in shrubby and partly timbered conditions.

#### SEMI-OPEN PRAIRIE<sup>1</sup> VEGETATION

Open areas in the forest, with herbaceous vegetation consisting largely of prairie grasses and other herbs common to open ground, have been described by several travellers who have visited parts of the uplands west of Slave river. Many early explorers, traders, and casual travellers ascended Salt river to the springs at the base of Salt mountain, but very few have contributed anything other than a general description. Camsell in 1902 (13) and Seton in 1907 (65) visited the upland prairies southwest of Fort Smith and made excellent notes on their extent and condition, and Seibert's map (63) (1922) shows clearly the outline of the semi-open area that lies between Grassy slough and Flatgrass lake. The writer has found no published accounts of the prairies north of Peace river at the base of Caribou mountains.

The wood buffalo have used the prairies as summer feeding grounds from time immemorial (54). Their deep-worn migration trails near Pine lake converge upon the Grassy Slough-Flatgrass Lake openings, where the animals make their appearance in spring as soon as the new green shoots of the prairie grasses start growing. The open places, as well as the neighbouring ridges, are dotted with the saucer-like depressions of their wallows. No buffalo were seen at the base of Caribou mountains, nor was there any indication of their presence there for many years, but long-abandoned wallow holes show that they must have lived there before their range was restricted to the area just west of Slave river.

The Roman Catholic Mission at Fort Smith for many years maintained a farm at Salt river, in the Salt Plain country. Oats, barley, hardy vegetables, and some wheat were raised successfully, and a herd of cattle sup-

<sup>1</sup> The term "prairie" is here used in a broad sense, to include all grassland vegetation in the uplands.



A. Semi-open prairies at base of Caribou mountains.



B. Semi-open prairie at Peace point. (See Figure 5.)

plied dairy products and beef to the mission. The prairies in that vicinity yield excellent hay and grazing, and the Salt Plains have long been used for wintering horses. An old Indian informed the writer that in former times the people at Salt River settlement, Fort Smith, and vicinity used to set out in late summer or early autumn with pack horses to hunt the buffalo southward to Pine Lake district and westward of it. They spent the winter in the interior upland, turning their horses loose to wander of their own accord out to the Salt Plains. The Indians returned with dog-teams in the spring, and the horses came through the winter in splendid condition.

So far as they have been examined the prairies occur on clayey, lacustrine soils which were formed in the post-Glacial lakes that stood at about the 1,000- and 800-foot levels. As noted in the summary of topography and geology, these soils occur chiefly in three districts. One is at the eastern base of Caribou mountains where the prairie extends in a northeast and southwest direction within the park area and is said to extend to the westward of the fifth meridian north of Peace river. The writer found north-eastern extensions of it about 25 miles north of the Peace, but has no precise information as to whether it has representatives still farther northward and northwestward at similar elevations (54). Another prairie lies in a strip beginning a short distance north of Pine lake, in the Grassy Slough district, and reaching northwestward to the vicinity of Flatgrass lake near Little Buffalo river. A third is on the more or less level area between the Slave River lowlands and the Salt Mountain upland, and has long been known as the Salt Plain. The extensions of this and the preceding area beyond the Little Buffalo have not been ascertained, though the descriptions of parts of that region by a few travellers seem to indicate that they are present there in some form (61, 48, 54). The presence of saline conditions in shallow depressions in the Salt Plain has already been discussed.

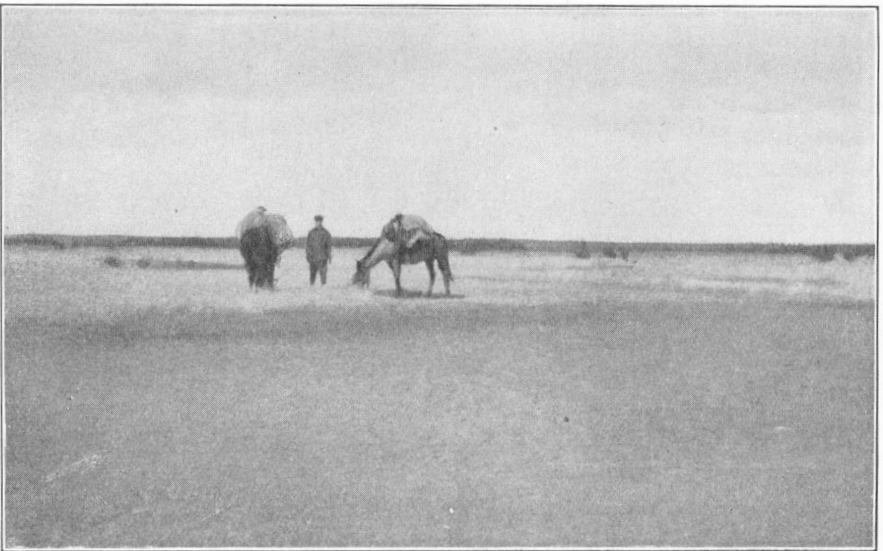
Other occurrences of certain elements of the prairie vegetation are in small openings in the upland forests, observed mostly in the vicinity of Pine lake and in sink-holes that still have or have had in former times a water level that fluctuates greatly.

It seems best, in the following discussion, to give more or less detailed descriptions of the several different types of prairie opening vegetation before attempting any correlation. Like the upland forests, the initial stages in their history are now lost, and there is only the most scanty evidence of the causes of their occurrence and the course of their development. Willow and poplar or spruce clumps seem to be encroaching slowly upon the open spaces, and appear to have done so within the memory of men. E. T. Seton notes a statement by an old Indian inhabitant that he could remember when the prairies near the Salt Mountain escarpment were larger than they were in 1907 (65). Studies made by the writer in 1930 on soil sections show that the marginal poplar groves have not existed for very long upon the ground they now occupy. There is very little humus or leaf mould, and so little rotten wood that it seems apparent that at least some of the groves are of comparatively recent development. However, the marginal districts of these openings show, in the aggregate, a very small encroachment. The prairie extends to the very base of the first slopes of the





A. Salt Plain prairies about 10 miles northwest of the Government Hay Camp.



B. Saline flats in the Salt Plains near Heart (Raup) lake.

mountains, and is bounded in other places by muskegs to which it shows scarcely any transition stages. Very few depressions in the upland prairies hold enough water to show what vegetation the lake shore margins would possess. Those observed show a succession of associations that bear some resemblance to that of the river flood-plain sloughs.

The writer's most extensive notes on the prairie openings were made at the eastern base of Caribou mountains in June and July, 1930, and in the Peace Point and Salt Plain districts in July and August, 1928. The openings north of Pine lake were crossed so early in the summer of 1928 (June 15 to 17) that the herbaceous flora was insufficiently developed for study. The recent history of the prairies is so obscure that very little material could be gathered relative to the effects of burning.

#### PRAIRIES AT THE BASE OF CARIBOU MOUNTAINS

Two localities north of the Indian graveyard, Peace river, were selected as typical. The first of these is about 18, and the second 11, miles from the river. There is a gradual slope in the openings, away from the mountains. Along the trail southward from the 11-mile locality this amounts to approximately 100 feet in 5 miles. The difference in elevation between the two localities was not recorded. The 11-mile district is about 960 feet above sea-level, and about 200 feet above Peace river.

The vegetation at the 18-mile locality is as follows:

- Primary spp.: *Poa pratensis*  
*Calamagrostis canadensis* var. *robusta*  
*Equisetum sylvaticum* var. *pauciramosum*
- Secondary spp.: *Schizachne purpurascens*  
*Hierochloë odorata*  
*Bromus Pumpellianus*  
*Carex siccata*  
*Populus tremuloides* (young)  
*Salix Bebbiana*  
*Urtica gracilis*  
*Arenaria lateriflora* (few)  
*Stellaria longipes* var. *laeta*  
*S. longifolia*  
*Thalictrum venulosum*  
*Delphinium scopulorum* var. *glaucum*  
*Erysimum cheiranthoides*  
*Descurainia* sp.  
*Ribes oxyacanthoides*  
*Fragaria glauca*  
*Geum strictum*  
*G. macrophyllum* var. *perincisum*  
*Rubus idaeus* var. *canadensis*  
*Rosa acicularis*  
*Lathyrus ochroleucus*  
*Vicia americana*  
*Epilobium angustifolium*  
*Mertensia paniculata*



*Stachys scopulorum*  
*Galium boreale*  
*Achillea Millefolium*  
*Solidago canadensis*  
*Taraxacum dumetorum*

The grasses and perennial herbs make a close turf on the rich soil of sandy loam. There is a tangle of grass roots to about 3 or 4 inches below the surface, and then a brownish loam to a depth of about 10 inches below the surface. A layer about 7 inches thick beneath this has much the same texture but not the darkening due to the humus content. The next 7 inches show an increase in the amount of sand, the remainder above frost-line is composed of layers of pure sand crossbedded with clay. In all of these layers are occasional living roots of the shrubs and small trees that occur as secondary species in the plant cover. There is no indication of the former presence of timber.

The most prominent shrub is the gooseberry *Ribes oxycanthoides*. It is so common that the Indians have named this region the "Gooseberry Prairie." Grey willow *Salix Bebbiana* is the leading representative of the shrub layer of the neighbouring poplar and spruce woods, and seems to be actively invading the openings. The primary species are not uniform in distribution, the two grasses commonly alternating in dominance. The gradual transition to the poplar woods is featured by the appearance of such characteristic species as *Viburnum pauciflorum*, *Shepherdia canadensis*, *Lonicera glaucescens*, and *Amelanchier florida*. The poplar in the woods is probably the result of fires, as elsewhere in the timbered areas, and once established it has taken the place of spruce as colonizer of the openings. The bottoms of dry creeks contain a somewhat different flora which will be treated in connexion with the 11-mile area where more material from it was collected.

There is a notable difference in the predominating species in the latter locality, with the introduction of the sedge *Carex trichocarpa* var. *aristata* as a primary species and the reduction of the blue-grass *Poa pratensis* to relative unimportance. The secondary species include all those given in the above list, with a few additions that will be given here.

- Primary spp.: *Calamagrostis canadensis* var. *robusta*  
*Carex trichocarpa* var. *aristata*
- Secondary spp.: *Agropyron trachycaulum* var. *unilaterale*  
*Koeleria cristata*  
*Bromus ciliatus*  
*Carex pratensis*  
*Potentilla arguta*  
*Rosa Woodsii*  
*Heracleum lanatum*  
*Collomia linearis*  
*Symphoricarpos occidentalis*  
*Petasites sagittatus*

The primary species were selected because they were found dominating the turf more commonly than others. In a few places nearly pure stands of fireweed *Epilobium angustifolium*, goldenrod *Solidago canadensis*, brome-grass *Bromus Pumpellianus*, or wheat-grass *Agropyron trachycaulum* var. *unilaterale*, are to be seen covering small areas. *Petasites* is limited to the

wettest places, chiefly near the willow margins. As reference to other parts of this paper will show, *Carex trichocarpa* var. *aristata* is extremely variable in its selection of habitats, for it seems to flourish equally well in the broad marshes of delta plains, in semi-dried flood-plain sloughs, in water 4 feet deep on the shores of marshy lakes, and here in the semi-open prairie where it has to compete with a large number of grasses and other herbs. Its more common wet shore habitat, however, indicates wetter conditions for the whole growing season in the 11-mile area than in the 18-mile area. Occasional marshy depressions show typical wet meadow plants such as *Glyceria pulchella* and *Rumex occidentalis*.

One of the most striking features of these prairies is in the colour and luxuriance of their vegetation. In late June and early July they were turned blue by the cowslip *Mertensia paniculata*. By the latter part of July this was mostly changed to purple by delphiniums, with dashes of white made by the northern bedstraw *Galium boreale*, and yarrow *Achillea Millefolium*, and of yellow made by the mustards and by avens *Geum strictum* and *G. macrophyllum* var. *perincisum*. *Delphinium* was growing abundantly over 5 feet high, and one record plant measured 9 feet 3 inches with a portion of its inflorescence still unfolded. Blue-joint grasses, blue-grasses, and fireweeds were growing over 5 feet tall, and the cow-parsnip *Heracleum lanatum* was well over 6 feet.

At the 11-mile area the spruce timber margins the prairie, where it seems to be growing in a virgin state. The transition is marked by clumps of grey willows, and an indefinite mingling of prairie and woodland species. With the appearance of woodland mosses there come wetter conditions than occur at poplar margins. Most of the prairie species are present in reduced numbers, so the list of secondary species given here will be limited to the woodland element in the flora.

- Primary spp.: *Salix Bebbiana*  
*Calamagrostis canadensis* var. *robusta*  
 Secondary spp.: *Picea glauca* (young saplings)  
*Betula papyrifera* var. *neolaskana*  
*Arenaria lateriflora*  
*Ribes hudsonianum*  
*Fragaria glauca*  
*Rubus pubescens*  
*R. acaulis*  
*Lathyrus ochroleucus*  
*Cornus stolonifera*  
*Viburnum pauciflorum*  
*Solidago multiradiata* var. *scopulorum*  
*Arnica rhizomata*  
 Wetter areas  
*Carex disperma*  
*C. vaginata*  
*Parnassia multiseta*  
*P. montanensis*  
*Senecio pauperculus*  
*Erigeron acris* var. *arcuans*

*Rosa acicularis* and *Symphoricarpos occidentalis*, listed with the prairie flora, show considerable increase in abundance at the willow margins. The young spruce saplings have long, horizontal roots which reach through the new leaf mould beneath the willows. A tree 5 or 6 feet tall will have one

large root,  $\frac{1}{4}$  to  $\frac{1}{2}$  inch in diameter at the base and 7 or 8 feet long. It never leaves the leaf mould layer, and remains mostly about 2 inches below the ground surface. These long, pliable roots are easily peeled and split, and have long been used by the Indians as sewing or binding materials for their birch bark utensils and canoes.

Throughout these openings are small stream beds which evidently have had no flowing water in them for a long period. A little moisture may collect in them in the spring but it soon seeps away and leaves them dry. There are usually a great many large ant hills along the lateral slopes, with a few in the more or less flat bottom. The most interesting feature of these dry creeks is the presence in their beds of a quite different assemblage of prairie herbs, and, what seems entirely anomalous, it represents a more xerophytic association than the one that grows on the surrounding prairie. Many of its species are drawn from a group that inhabits such relatively dry plains as the river bluff at Peace point. The writer listed forty-one species, sixteen of which (one of them primary) do not occur outside the dry bottoms. The remainder are drawn from the immediate surroundings. By following up a creek bed one finds that it gradually shallows and that as it shallows it loses its peculiar flora, which is best seen at depths of 3 or 4 feet below the level of the prairie. Deeper creeks present semi-marsh conditions. The following list contains only those plants peculiar to this type of terrain. The primary species are easily dominant over the scattered secondaries.

- Primary spp.: *Carex siccata*  
*C. obtusata*
- Secondary spp.: *Festuca saximontana* (A)  
*Agrostis scabra* (A)  
*Poa glauca* (A)  
*Carex abbreviata*  
*Smilacina stellata*  
*Cerastium arvense*  
*Draba nemorosa* (A)  
*Geum triflorum*  
*Potentilla pennsylvanica*  
*P. pulcherrima*  
*Campanula rotundifolia*  
*Erigeron glabellus*  
*Aster laevis* var. *Geyeri*  
*Artemisia dracunculoides* (A)

Those marked (A) are commonest on the ant hills, and are among the most xerophytic of the lot. The blue-bell *Campanula* was found sparingly in the surrounding prairie, but was abundant in the creek bed. *Carex obtusata*, a predominant species here, was found elsewhere only on the drier parts of Peace Point prairie. This flora was found in both the 11- and the 18-mile areas.

The soil sections at the 18-mile area show increasing permeability with increasing depths. Between 24 inches and frost line, on June 26, was found a layer of pure sand interbedded with clay. On July 6 this was found to continue down to 41 inches in a nearby poplar grove. It seems clear that the creeks were once part of a temporary drainage system that carried the run-off from the exposed and rather impermeable bottom of the ancient lake in which these soils were laid. The streams continued until the mountain brooks into which they drained had cut deep ravines, and until they

had so dissected the clays that they exposed the more permeable sandy layers beneath. The action of the prairie vegetation, increasing the water-holding capacity of the soil and opening the upper layers to seepage, together with the facilities presented by the sands for carrying away the now decreased run-off, have entirely eliminated running water and exposed the sandy bottoms as the most xerophytic habitat in the vicinity. The abundance of ant hills is further evidence of the dryness of the soil. The depth to which the permeable layer goes is not known. A creek bed 6 or 8 feet deep was observed to be in a ponded condition with wet meadow vegetation, indicating that in its locality the layer is not a thick one. The same type of topography has been observed in the prairies north of Pine lake and in those near Salt river, south of Heart lake.

Although no detailed collections have been made by the writer in the prairies in the Grassy Slough district or from their extensions northward, descriptions given by other travellers indicate that the flora is quite similar to that just described (13, 63, 65). Some small prairie openings a short distance north of Pine lake were studied in 1928, and appeared to be small outliers of the larger ones farther northward. They were much modified, however, by local fires and from being used extensively as buffalo wallows. Some of these openings have sandy soils and but few elements of the prairie vegetation, and may be the result of long-continued wallowing by the buffalo. Wallow areas on jackpine ridges, where the trees are being killed off, have already been described, but further study is needed before such a correlation can be verified. The herbaceous and shrubby species in some of the open spaces are derived almost wholly from the neighbouring woods.

#### PRAIRIES AT PEACE POINT

As the trail approaches Peace point from the north it leaves the last sand ridges at about 5 or 6 miles north of the river and descends to the present water level by three bluffs, or escarpments. The uppermost one is not prominent, but is said to be more so farther to the eastward. The middle one, about 50 feet high, is abrupt and subtends the present "point", appearing at the bank of the river above and below. The sketch map (Figure 5) shows the general topography of the area. The third bluff is at the present bank of Peace river, where it is formed of a broken cliff of gypsiferous limestone that stands about 50 feet above the stream. The prairie openings are on the plain of the top of the third bluff, where their distribution is shown by the map. The vegetation on the upper levels is composed of willow clumps, mainly *Salix Bebbiana*, scattered stands of aspen, and local muskegs.

The soil of the prairie is a clayey loam about 2 feet deep, with some Glacial boulders in it. The upper part is black from humus materials, shading off so that the lower third is reddish brown. The upper part is enmeshed with a tangle of roots, mainly those of grasses. In a recently formed sink-hole about 6 feet deep, the lower 4 feet was in nearly horizontal layers of soft, much-broken, gypsiferous limestone. Sink-holes are abundant throughout, some with water and slough vegetation in them and some quite dry.

The herbaceous associations of the prairie fall rather definitely into two types that appear to be caused by greater or less desiccation of the

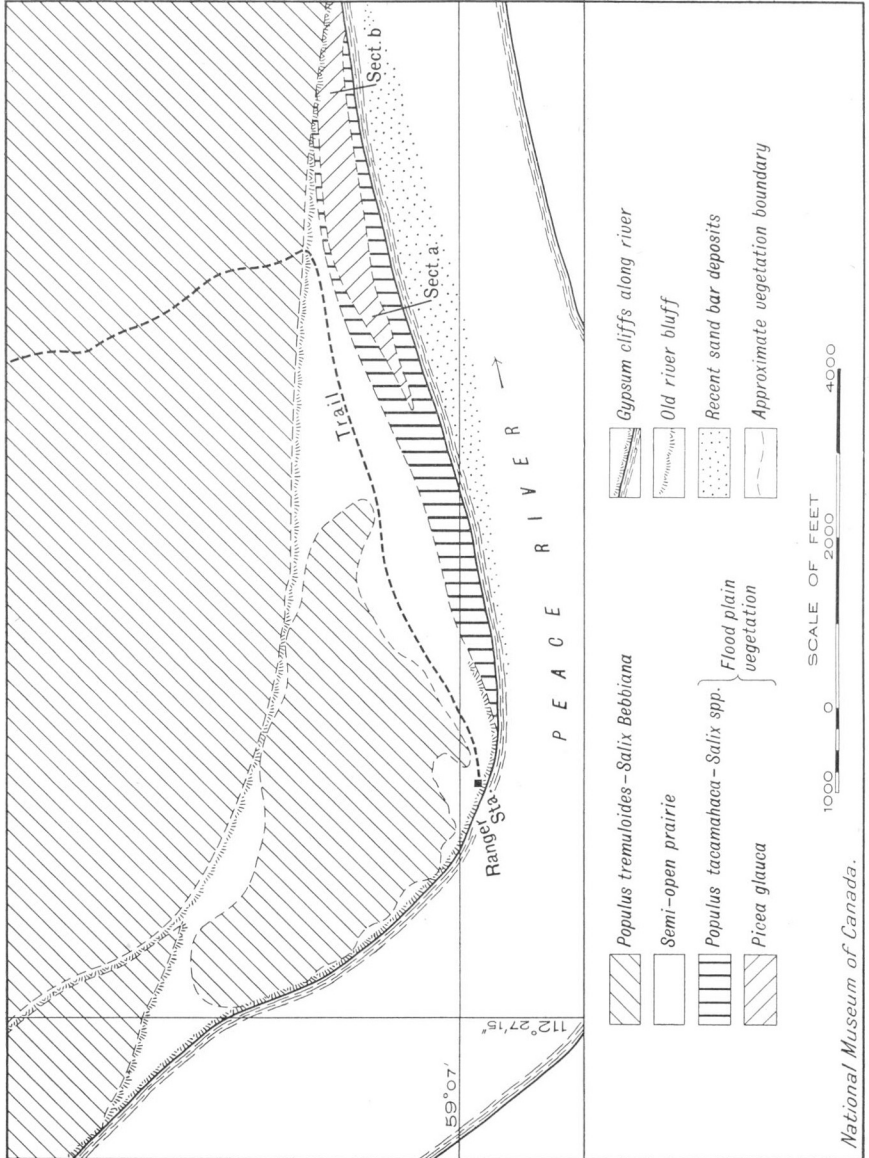


Figure 5. Map of vegetation in Peace Point district.

soils. The more xerophytic of these, of which *Stipa comata*, *Avena Hookeri*, and *Koeleria cristata* are characteristic or dominant species, is limited to the wind-swept, well-drained margin of the bluff that is just above the

present river, and to the dry top of the second bluff. It is variable in its floristic content, but the following species are commonly found in it.

- Primary spp.: *Stipa comata*  
*Koeleria cristata*
- Secondary spp.: *Elymus innovatus*  
*Agropyron trachycaulum* var. *unilaterale*  
*A. trachycaulum* var. *typicum*  
*A. Smithii* var. *molle*  
*Hierochloë odorata*  
*Poa pratensis*  
*P. glauca*  
*Danthonia intermedia*  
*Carex obtusata*  
*Smilacina stellata*  
*Comandra pallida*  
*Stellaria longipes* var. *laeta*  
*Lychnis Drummondii*  
*Pulsatilla ludoviciana*  
*Anemone cylindrica*  
*Thalictrum venulosum*  
*Arabis hirsuta*  
*A. retrofracta*  
*Erysimum parviflorum*  
*Geum triflorum*  
*Potentilla pennsylvanica*  
*Vicia americana*  
*Oxytropis splendens*  
*Hedysarum alpinum* var. *americanum*  
*Astragalus adsurgens*  
*A. tenellus*  
*Elaeagnus argentea*  
*Arctostaphylos Uva-ursi*  
*Stachys scopulorum*  
*Galium boreale*  
*Campanula rotundifolia*  
*Achillea Millefolium*  
*Artemisia dracunculoides*  
*A. frigida*  
*Erigeron glabellus*  
*Aster ericoides*

In less dry areas there is an association dominated by the wheat-grass *Agropyron trachycaulum* var. *unilaterale*, and by an assemblage of perennial herbs of which *Geum triflorum*, *Stachys scopulorum*, *Geum macrophyllum* var. *perincisum*, and *Galium boreale* are the most prominent. Most of the secondary species are common to the drier places, so that only those that are characteristic will be listed below.

- Secondary spp.: *Equisetum pratense*  
*Bromus Pumpellianus*  
*Schizachne purpurascens*  
*Calamagrostis inexpansa* var. *brevior*  
*C. montanensis*  
*Sisyrinchium angustifolium*  
*Anemone multifida* var. *hudsoniana*  
*Rosa acicularis*  
*Lathyrus ochroleucus*  
*Monarda mollis* var. *menthaefolia*  
*Symphoricarpos occidentalis*  
*Aster Lindleyanus*  
*Cirsium Drummondii*  
*Antennaria nitida*

In its zones of contact with neighbouring woods the prairie is slowly being invaded by a group of shrubs that make a dense tangle over large patches.

Primary spp.: *Rosa acicularis*  
*Symphoricarpos occidentalis*  
*Agropyron trachycaulum* var. *unilaterale*  
*Salix Bebbiana* (in clumps)

The secondary species are drawn largely from the more mesophytic types in the prairie flora, with a few such as sapling aspens from the woods farther back from the river.

The gradual transition to the woods is finally consummated by the dominance of the aspens and the presence of a few accompanying species such as the red raspberry *Rubus idaeus* var. *canadensis* and the green orchid *Habenaria viridis* var. *bracteata*. This rather open aspen woods is the most advanced timber on the lower plain. On the next higher level to the northward is a much heavier growth of larger aspens, with much greater humus accumulation, the dominance of the grey willow in the shrub layer, and a general elimination of the prairie species.

The gypsum bluff at the river is of varying slope, in some places precipitous, and in others more gentle with a mantle of soil that has fallen down from above. The commonest and most characteristic species are *Artemisia frigida*, *Elaeagnus argentea*, and *Hedysarum alpinum* var. *americanum*. Among the secondary species, the cinquefoil *Potentilla Anserina*, lettuce *Lactuca puchella*, and Indian hemp *Apocynum sibiricum* are not found on the prairie. About twenty species are derived from the latter, whereas the sand-bar willow *Salix interior* var. *pedicellata* represents the river margin. On the steepest places *Artemisia frigida* is almost the only plant. The older bluff at the north side of the plain has much more soil on it, although in some places this is a sliding, whitish material, weathered out of the underlying gypsum. Where better soils have fallen from the top and covered the slope, a thicket of aspens and service berries *Amelanchier florida* has attained a foothold. It has a scattered mixture and shrubs and herbs from both prairie types. Less stable soils have open associations in which *Artemisia frigida*, *Arctostaphylos Uva-ursi*, *Astragalus adsurgens*, and *Amelanchier florida* are the most prominent species. They have with them various herbs from the driest parts of the prairie.

The sand-bar deposits on the lower side of the point have been forming there since the river commenced cutting its present channel. The topography and vegetation of these bars, new and old, are shown on Figure 11, B, C, and will be discussed in detail in connexion with local river flood-plain deposits. The sharp contrast between the timber on the oldest bars and the herbaceous vegetation of the adjacent prairie is striking (Figure 5), and raises the question of the possible origin of the prairie. Explanations involving fires, clearing, or varying local conditions of exposure seem quite inadequate, since burning or clearing would hardly be so well confined to prairie spaces between the heavy spruce timber of the river deposits and the encroaching aspen clumps. If exposure to winds of the broad valley of the river were significant, then the prairie could not be expected to persist so far inland where it is protected by the timber. There remain only soil and moisture factors. The prairie stands at about 750 feet above sea-level, and is probably growing on a portion of the bottom

of the post-Glacial lake that stood at about the 800-foot level. Consequently it may be correlated in age and origin with the Salt Plain prairies. At the withdrawal of this lake the clay deposits on its bottom must have acquired plant cover of low stature that was either similar to the present one or has developed into it. It has persisted longest on the river side of the plain, being colonized from the northwest by willows and aspens, and shut away from the river below the present site of the ranger station by the development of a flood-plain timber on river-deposited soils.

A few sink-holes in the plain have fluctuating but constant water supplies. Local inhabitants state that the water levels change with the seasonal changes in the river, but this was not verified. Typical wet meadow and shore marsh vegetations are developed, involving *Carex rostrata*, *Beckmannia Syzigachne*, and *Glyceria pulchella*, and a common association on the drier margins consists of *Hordeum jubatum* and *Potentilla Anserina*. A shrub zone with *Salix Bebbiana* and *Symphoricarpos occidentalis* as primary species separates the sloughs from the surrounding prairies or aspen woods.

#### THE SALT PLAIN PRAIRIES

The greatest extent of open prairies in the park is on the Salt Plain, the name used in this paper to designate the level country lying just west of Slave river. Its boundaries have already been defined or approximated, and its general topography described in another section, so they will not be discussed at length here. The plain is regarded as part of the bottom of what has been called the 800-foot post-Glacial lake (8), its clay soils being derived from deposits in this lake. As indicated elsewhere, it is broken by a few morainic ridges, the exact positions of which have not all been mapped. The most prominent of these lies in a broad arc extending eastward from the vicinity of Heart (Raup) lake. The aerial photographs show clearly the positions of the ridge, which is composed largely of sand, and also the topography of the neighbouring salt plains to the northeast of it. These have broad, shallow depressions separated by minor ridges that are more or less parallel to the main one.

It is thought by the writer that this ridge, as well as the lesser ones northeast of it, is a member of the lobate morainic system of which the Ninishith hills and the tangle of ridges to the south and southeast of them form the terminus. With the recession of the glacier from the terminal moraine, the waters of the 1,100-foot lake were lowered as far as the passes in the moraine would permit. Then a series of lower lakes was formed as the ice front receded to the northeastward. One of these seems to have occupied part of the country southwest of the Salt Mountain escarpment, and to have accumulated as bottom deposits such clayey materials as occur in the Grassy Slough district. Another, or an eastward extension of the same one, was probably formed in the part of the Salt Plain which lies southwest of the ridge above described. The recession of the ice from the latter moraine and its near members may have left all these higher lake bottoms exposed or it may have maintained the lakes and simply formed new settling basins still farther to the northeast and north in which the most recently formed soils may be found. From these notes it seems that instead of a single lake level at about 800 feet, there may have been two or three lakes whose levels ranged in the vicinity of 800 and 900 feet. These



conclusions are, however, based upon too few data to be regarded as anything more than working hypotheses.

The vegetation of the plain is modified profoundly by the salt springs that water parts of its surface. Where the soil surfaces have not had sufficient gradient to enable drainage lines to become established, shallow settling basins have collected thin deposits of saline materials from the spring outwash. In other places streams have carried off the outwash, leaving the surrounding soils with little or no salt. Thus there are two well-defined types of herbaceous vegetation on the plains: the first consisting largely of halophytic species, and the second of prairie species in an aggregate that somewhat resembles that of Peace point.

The writer has made detailed studies (1928) at points about 16 miles southwest of Fitzgerald, in the vicinity of Heart lake, with additional notes along routes from this area to the Government Hay Camp and to Fitzgerald. The Salt Plains were crossed in 1929 between Salt River settlement and Little Buffalo river, and along the wagon road between Pine lake and Slave river. Figure 6 is a map made from aerial photographs in the vicinity of Heart lake. It is supplemented with diagrams of vegetational details (Figure 7).

Figure 7 shows a section of a dry watercourse and neighbouring prairie about 2 miles south of Heart lake. The creek probably has a spring flow which enters Salt river a short distance below this point. The bottom of the creek bed has an open salt marsh vegetation which will be described later in connexion with the other halophytic types. The prairie is dominated by grasses that make a close turf. The area is nearly level and was very dry when the notes were made on August 20.

- |                 |  |
|-----------------|--|
| Primary spp.:   | <i>Agropyron trachycaulum</i> var. <i>unilaterale</i><br><i>Koeleria cristata</i>  |
| Secondary spp.: | <i>Juniperus horizontalis</i><br><i>Hierochloë odorata</i><br><i>Deschampsia caespitosa</i> var. <i>glauca</i><br><i>Danthonia intermedia</i><br><i>Schizachne purpurascens</i><br><i>Agrostis scabra</i><br><i>Populus tremuloides</i> (saplings)<br><i>Cerastium arvense</i><br><i>Thalictrum venulosum</i><br><i>Erysimum cheiranthoides</i><br><i>E. parviflorum</i><br><i>Ribes oxyacanthoides</i><br><i>Geum triflorum</i><br><i>Potentilla arguta</i><br><i>P. Anserina</i><br><i>Fragaria glauca</i><br><i>Rosa acicularis</i> (few)<br><i>Vicia americana</i><br><i>Oxytropis splendens</i><br><i>Linum Lewisii</i><br><i>Galium boreale</i><br><i>Symphoricarpos occidentalis</i><br><i>Achillea Millefolium</i><br><i>Aster Lindleyanus</i> |

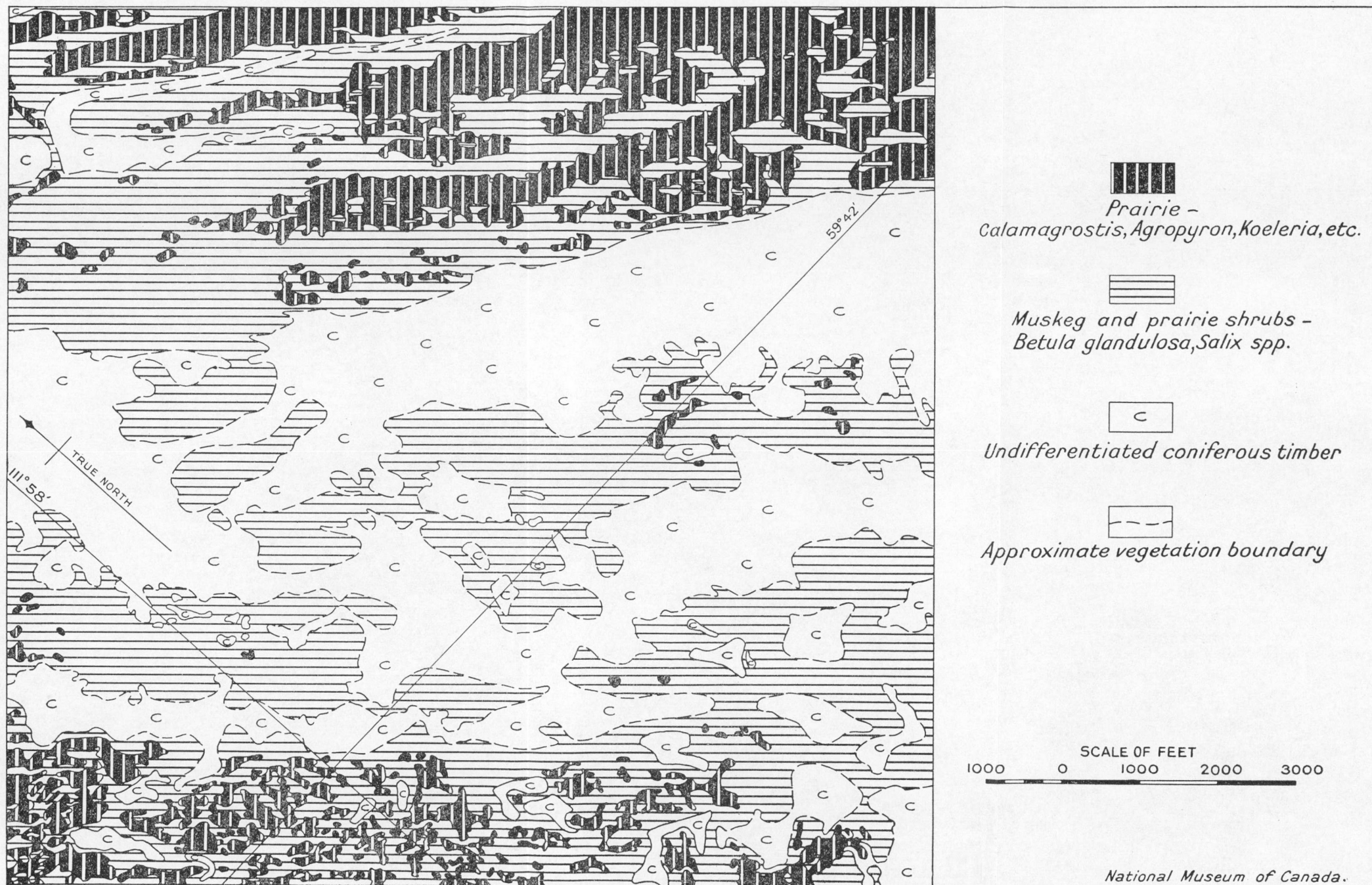


Figure 6. Map of semi-open prairie vegetation near Heart (Raup) lake.



The presence of *Rosa*, *Symphoricarpos*, and *Populus* indicates the trend toward mesophytism. The prairies here as elsewhere on the upland seem to be encroached upon by the surrounding bush and timber. The floristic similarity of these areas to the Peace Point prairie and to the vegetation of the dry creeks at the base of Caribou mountains is at once striking.

The most characteristic feature of the Salt Plains is the salt marsh vegetation that inhabits undrained depressions. When the snow melts in the spring these depressions nearly all contain shallow pools of water that are all dried up by the last of August (9). The result of the temporary marsh conditions is a complex zonation of plants around the centres of the pools. Gradual evaporation of the water concentrates the salt in such a way that the most saline conditions are to be found in the centres which, if the pools are large enough, are quite barren of vegetation. Naturally, the largest of these barren areas are to be found near the salt springs from which the outwash comes. Between the Mission Farm and Salt mountain, near the largest of the brine springs, are hundreds of acres of flats devoid of vegetation. Small prairie spaces only a few feet above the last-mentioned flats have no trace of the halophytic flora, and have timber advancing into them. The dried surfaces of the flats are much cracked and many have a thin layer peeling off.

A typical section of the marginal vegetation is given in Figure 7. The widths of the associations are variable, of course, with the slopes of the depressions. At the edge of the barren space is a rich growth of glasswort *Salicornia europaea*, which is bright red in colour, shading to bluish green at the drier edge of its zone. Associated with it are *Puccinellia Nuttalliana*, *Suaeda depressa*, *Spergularia salina*, and *Plantago oliganthos*. *Puccinellia Nuttalliana* grows in tufts and becomes the primary species in the next association, which is a rather narrow one all around the depression. The species in the *Salicornia* association persist and are joined by *Glaux maritima*, *Triglochin maritimum*, *Chenopodium rubrum*, and *Distichlis stricta*. The last becomes primary in places. Along the muddy margins of salt streams and around brine springs the flora is largely made up of *Triglochin maritimum*, *Salicornia europaea*, and *Glaux maritima*.

One of the more prominent associations, in the late summer, is just outside that of *Puccinellia*, and is dominated by wild barley *Hordeum jubatum*. It is easily distinguished at a distance by the reddish to straw-coloured, waving heads of the grass. The zone seems to indicate a change toward non-saline conditions, wherein some of the halophytic types disappear and several distinct mesophytes come in. Secondary species are *Triglochin maritimum*, *Calamagrostis inexpansa* var. *brevior*, *Deschampsia caespitosa* var. *glauca*, *Atriplex patula* and var. *hastata*, *Glaux maritima*, *Aster pauciflorus*, and *A. ericoides*.

By far the largest herbaceous areas are covered by a close turf made of the baltic rush *Juncus balticus*, and blue-joint grass *Calamagrostis inexpansa* var. *brevior*. Neither of these species was found to be fruiting extensively. Like the sedges of many of the flood-plain sloughs they seem to depend very largely upon vegetative means of propagation. The *Juncus* is known locally as wire-grass, and is not much eaten by stock. In a few places *Plantago eriopoda* takes a primary position in the list.

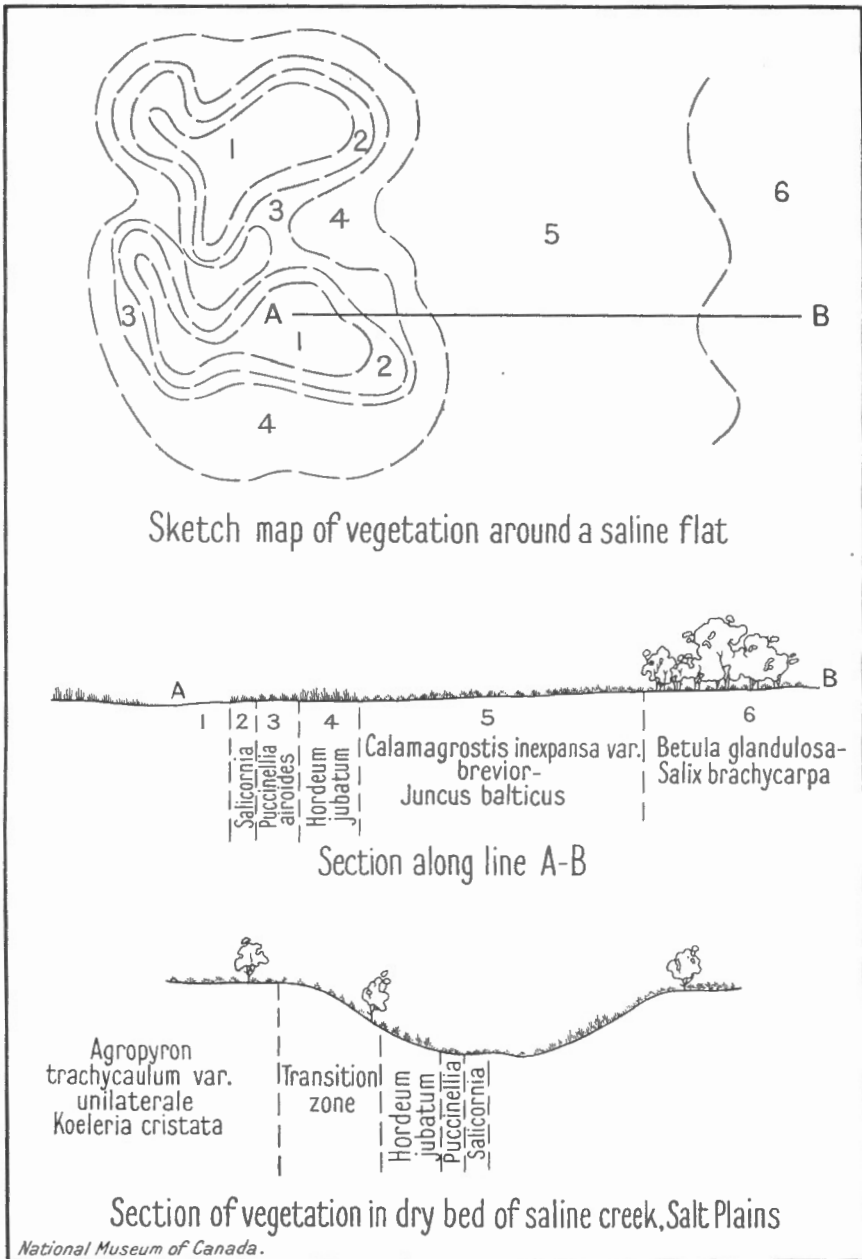


Figure 7. Diagrams of vegetation on the Salt Plains near Heart (Raup) lake.

Some of the secondary species are characteristic, others show relationships to neighbouring bush or prairie flora. There is a general mixture of halophytic and freshwater prairie types.

Secondary spp.: *Juniperus horizontalis*  
*Triglochin maritimum*  
*Agropyron trachycaulum* var. *typicum*  
*Spartina gracilis*  
*Carex Buxbaumii*  
*Smilacina stellata*  
*Allium Schoenoprasum*  
*Hedysarum alpinum* var. *americanum*  
*Epilobium palustre*  
*Primula incana*  
*Dodecatheon pauciflorum*  
*Gentiana elegans*  
*Lomatogonium rotatum*  
*Plantago eriopoda*  
*Galium boreale*  
*Achillea Millefolium*  
*Aster juncus*  
*A. ericoides*  
*Solidago canadensis*  
*S. oreophila*  
*Antennaria nitida*  
*Grindelia perennis*  
*Artemisia canadensis*  
*A. biennis*

The dry bed of the small creek already described (Figure 7) shows the main elements of the salt flat margin associations. They are greatly condensed, however, and somewhat telescoped. The steep terrace shows a transition to the prairie involving some of the halophytes of the bottom and the more xerophytic species from the prairie.

Clumps of willows and dwarf birches are slowly invading the prairies from the low ridges that separate the depressions and which, if high enough, have spruce and aspen timber on them. Both primary and secondary species in the advancing shrub association indicate a semi-muskeg type of vegetation.

Primary spp.: *Betula glandulosa*  
*Salix brachycarpa* var. *antimima*  
 Secondary spp.: *Picea glauca* (small saplings)  
*Calamagrostis inezpansa* var. *brevior*  
*Juncus balticus*  
*Salix candida*  
*S. glauca*  
*S. MacCalliana*  
*Parnassia multiseta*  
*Rosa acicularis*  
*Shepherdia canadensis*  
*Petasites sagittatus*

With such a changeable supply of brine in the salt flat depressions it is only natural that there should be all gradations between the above type of marginal arrangement and that in a freshwater wet meadow. Somewhat less alkaline situations with barren or wet depressions support an association of *Atriplex patula* var. *hastata*, *Ranunculus sceleratus*, and *Hippuris vulgaris*. The *Atriplex* is the most abundant species. This association

passes to one dominated by the tall grass *Fluminia festucacea*, with which occur *Rorippa palustris* var. *hispida*, *Rumex maritimus* var. *fueginus*, and *Sium suave*. The *Fluminia* association is narrow and soon gives way to the broad *Juncus-Calamagrostis* association. Where there is standing water in the depressions there is a growth of *Scirpus validus*.

A still less alkaline depression is indicated, at its margin, by an association of *Typha latifolia*, *Atriplex patula* var. *hastata*, and *Triglochin maritimum*, of which the first is the most abundant. The *Typha* may be at the edge of the pool or standing in the water. In very wet areas, *Atriplex* is replaced by a crowfoot *Ranunculus (sceleratus?)*. Between the *Typha* zone and the *Juncus-Calamagrostis* association of the prairie there is a narrow zone of *Eleocharis palustris*, accompanied by *Triglochin maritimum*, *Calamagrostis canadensis*, and *Atriplex patula* var. *hastata*.

#### SINK-HOLE MEADOWS

A highly developed, and as yet uninvestigated, system of underground drainage in the upland areas of Wood Buffalo park has led to a type of sink-hole structure which is notable for its varying water levels. As stated elsewhere, completely drained holes have a vegetation that does not differ materially from that of the surrounding country, whereas very poorly drained holes develop muskegs at their margins. In a third kind of hole there is unmistakable evidence of the rise and fall of water levels amounting to as much as 50 or 100 feet. The slopes are nearly all of sand, and range from very steep grades of unstable materials to gentle ones covered with a turf. Many of the depressions are very irregular in shape, being made up by the coalescence of several holes in the vicinity. In such a one from which the writer made collections in August, 1929, there were terraces on the slopes and a small stream running through to the deepest hole. The formation indicates that the original series of large holes was later deepened by the falling of smaller holes within it and by the erosion of the former bottom. Figure 8 shows the arrangement of the topography at this place, which is along the Moose Lake-Pine Lake trail about 16 miles from the former. Small streams, flowing from a lake just south of the hole, have supplied the water that has done the eroding of the deep gullies in the old bottoms. Beaver dams at the upper margins of the hole where the streams enter have undoubtedly modified the rate of flow and erosion to a certain extent.

The steepest slopes, both of the newest depressions and of the older ones at higher levels, have a flora that depends upon the mobility of the sandy soil. Where it is loosely sliding it is being colonized by such plants as *Equisetum arvense*, *Veronica peregrina* var. *xalapensis*, and *Artemisia canadensis*. On more stable slopes are *Hordeum jubatum*, *Potentilla norvegica* var. *hirsuta*, *Stachys scopulorum*, *Chenopodium album*, *Plantago major* var. *asiatica*, *Thalictrum venulosum*, and *Geum macrophyllum* var. *perincisum*. On the newer slopes this association is a very open one, but it is much intensified on the old slopes of the original holes.

The flora of the highest terrace, which appears to be the bottom of the older hole, has the most consistent type of vegetation for this kind of situation. It is very common throughout the region and was studied to a

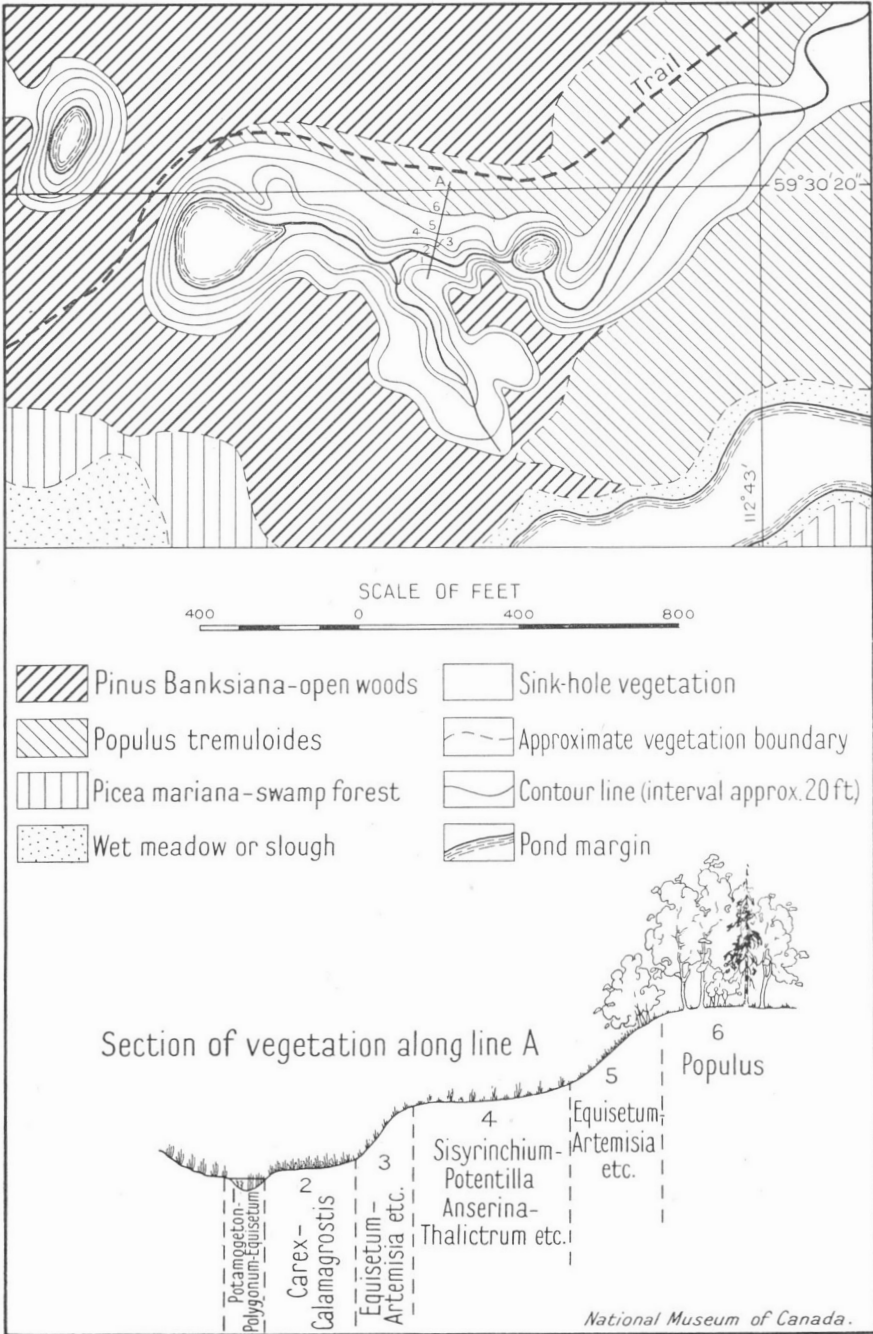


Figure 8. Vegetation of a sink-hole area, 16 miles east of Moose (Eight) lake.



certain extent at a place called Round Lake, about 20 miles north of Peace point, in the summer of 1928. Characteristic species are *Potentilla Anserina*, *Sisyrinchium angustifolium*, *Oxytropis splendens*, *Potentilla norvegica* var. *hirsuta*, *Agrostis scabra*, *Arenaria dawsonensis*, *Anemone canadensis*, *Thalictrum venulosum*, *Agropyron trachycaulum* var. *typicum*, and *Equisetum prealtum*. In many of its elements this association resembles the prairies above described.

The lower levels have a somewhat different type of vegetation whose primary species are *Carex rostrata* and *Calamagrostis inexpansa* var. *brevior*. The prairie aspect is maintained, but the substratum is more moist and bears a rich growth of the above species. Notable associates of these are *Phalaris arundinacea* and *Gentiana elegans*. If this area were drained more completely it would probably acquire a vegetation similar to that of the higher levels.

The wet margins of the small stream have an association of *Carex rostrata*, *Equisetum limosum*, *Eleocharis acicularis*, *E. palustris*, and *Juncus nodosus*. Accompanying species include *Sium suave* and *Glyceria borealis*. In the quieter pools are *Potamogeton Richardsonii*, *Polygonum natans* forma *Hartwrightii*, *Sparganium* sp., and *Equisetum limosum*. Where the water collects in larger pools there is a more extensive association of aquatic species, with *Potamogeton Richardsonii* most abundant. Other species found there are *Potamogeton foliosus*, *Callitriche hermaphroditica*, *Sagittaria cuneata*, *Alopecurus aequalis*, and various algæ. *Alopecurus* grows in the shallow water or very wet sand at the margin of the pond, as does also *Sagittaria*. Dry stream and pool bottoms such as occur in other parts of the depression have a semi-prairie vegetation like their surroundings.

The transition from the sink-hole vegetation to the adjacent timber is a sharp one. A small, shrubby growth of *Rosa acicularis*, *Symphoricarpos occidentalis*, and other shrubs of the upland woods marks the border.

#### SUMMARY OF PRAIRIE VEGETATION<sup>1</sup>

The foregoing discussion shows two major types of prairie-opening vegetation, the distribution of which seems to be directly correlated with the water-holding capacity of the soils. They are largely confined to regions in which the soil has a considerable percentage of clayey materials, and in which the post-Glacial lakes had their settling basins. Heavier soils have a turf dominated by blue-joint grass *Calamagrostis canadensis* var. *robusta*, the sedge *Carex trichocarpa* var. *aristata*, blue grass *Poa pratensis*, or combinations of these with a variety of other perennial herbs. Lighter soils are dominated by more xerophytic grasses and sedges, of which *Agropyron trachycaulum* var. *unilaterale*, *Stipa comata*, *Carex siccata* or *C. obtusata*, *Koeleria cristata*, are the most abundant. The commonest variation from these types is caused by local salt deposits from brine springs, which introduce a halophytic element.

As there is no evidence of an earlier, forested condition, the grasslands or possibly tundra forebears of them must have persisted as a type of

<sup>1</sup> A more complete summary of the problem of the northern prairies will be found in the author's discussion of the Peace River grasslands (55).

vegetation from their inception. This eliminates fires and other secondary influences as causes for their existence, and pushes their history back to the origin and exposure of the soil itself. The exposure of the ground evidently did not take place immediately after the recession of the glacier, but only upon the drainage of the post-Glacial lakes. Furthermore, unless it may be considered that grasslands or tundra formerly covered all of the upland soils, they had their beginning only after the final stages of drainage, when the finest soils, deposited in the deepest parts of the lakes, were exposed. From present available knowledge of the region it is impossible to determine how long ago this was, or what the time relations are between the different districts in which prairies occur. The general outline of post-Glacial history indicates that the Salt Plain is much younger than the prairies at higher elevations, and lesser extent of timber development on the former shows that the slow process of displacement of the openings is far behind that on the latter. The extreme slowness of decay and humus formation, as well as of physiographic change, has been emphasized by the writer elsewhere. These things render developmental changes in vegetation much slower than they are in more southern regions, so that time correlations with post-Pleistocene vegetations in other regions seem quite impossible.

The early stages of the prairies were probably not hydrophytic except in local depressions. There was sufficient general slope to set up a drainage system immediately, so that the first plants must have been mesophytes or xerophytes, but their specific nature is unknown. There seems no reason to think that prairie formerly covered the sandy uplands in other parts of the park. The ability of such trees as Canada spruce to live at the margins of existing glaciers and to push far out into the sub-arctic plains of northern Canada upon similar soils leads one to believe that it could very well have been an early vegetation on these hills, preceded only by a lichen mat of some sort. High morainic hills near Lane lake, already described, have what may be a relic of this early forest. There is almost no humus in the sand, and no evidence of an earlier, grassland vegetation.

So little is known of the climatic history of the area that it is impossible to form any other than the most general idea of the course of events. So far, there is no evidence, botanical or otherwise, of any other climatic change since the last ice, than gradual amelioration. The presence of semi-open country eastward from the Great Plains region, in post-Glacial time, has been explained on the basis of a warm-dry period which no longer prevails (28), but it seems unnecessary at present to project this period into the north. If such alternating climatic changes did occur, it seems clear that they were ineffective in modifying the essential character of the present semi-open lands, which must have remained treeless, and which were probably covered with grasses or some kind of tundra that did not form much peat.

A close study of the arctic prairie, north of the tree line, should throw much light upon the history of all sub-arctic grasslands.

## VEGETATION OF THE PEACE-ATHABASKA DELTA REGION

## Description of the Area

Wood Buffalo park embraces the larger part of the vast delta deposits of Athabaska, Birch, and Peace rivers. These marshy lowlands lie around the western end of Athabaska lake and enclose the shallow depressions in which are lakes Claire, Mamawi, and Baril (locally known as Deep lake), as well as innumerable smaller bodies of water. Although no contour lines have been drawn below 800 feet, the data compiled from land surveys and aerial photographs indicate that the boundary of the plain is near the 750- or 760-foot levels (24, 12). This line skirts the northern base of Birch mountains, and extends northeastward from a point at Birch river, near longitude  $112^{\circ} 45'$ , to Peace river in the vicinity of point Providence, near longitude  $112^{\circ}$ . The eastern boundaries are the rocky, Precambrian plateau north of Athabaska lake and the uplands that lie southeast of the Athabaska delta. Long extensions of the lowland are to be found in the lower valleys of the Athabaska, Peace, and Birch, and along upper Slave river.

Several earlier descriptions of the region have already been mentioned, the best of which are by E. M. Kindle (33), John Macoun (40, 41), and Emile Petitot (47). That of Macoun contains excellent notes on the vegetation.

The shallow basin of lakes Claire and Mamawi contains three main delta plains, those of Athabaska and Peace rivers being the largest and entering from the southeast and north, respectively. Birch river deposits its alluvium in the southwestern part. Each of the deltas contains several channels now in use, and many others that carry current in flood time or not at all. The presence of the large lake, Athabaska, with its relatively stable water-level, so near the embouchure of the Peace, causes the current in such channels as the Quatre Fourches, Revillon Coupe, and Rocher to change direction according to whether the Peace is in flood or not. The channels of the two great rivers that are at present most important in the filling of the Lake Claire-Lake Mamawi basin are the Embarras from the Athabaska and the Quatre Fourches from the Peace.

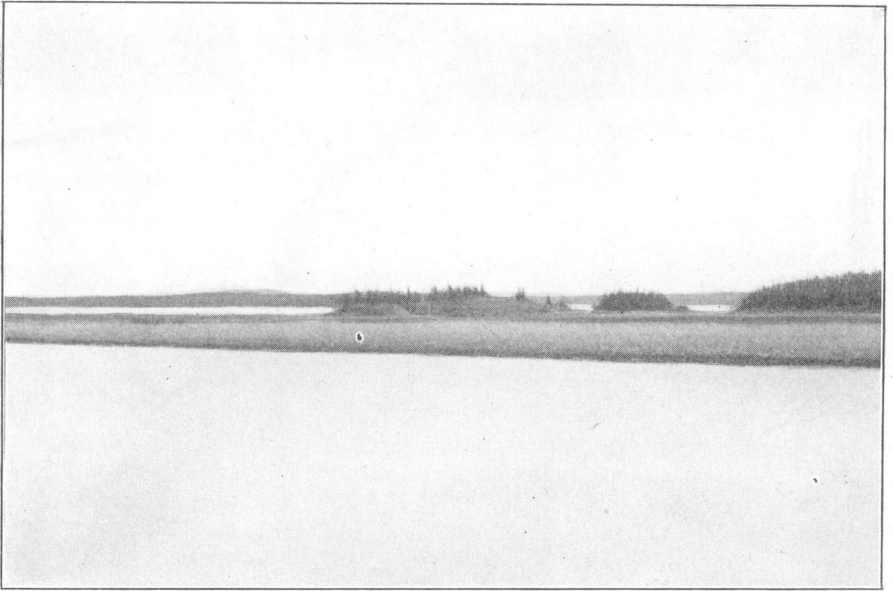
The only relief in the plain is afforded by granite outliers of the Precambrian rocks to the eastward. These are rounded hills standing like islands in the flats, for the most part having very little soil on them, and disappearing a short distance west of the Quatre Fourches. They decrease in height to the westward, those on the eastern shore of lake Mamawi being only a few feet above the general level. The lakes, although of large area, average only 4 to 5 feet in depth. As a rule their shores are very marshy, but in places where they are exposed to the action of storm waves they are cut back and comparatively dry. The abandoned channels of the streams, and the ponds formed by the cutting off of sections of the lakes are in all stages of filling, in general being drier toward the outer margins of the basin.

In the valleys of the main rivers are to be found the normal effects of meandering: local deposits of alluvium in the form of shore bars and islands, and the abandonment of channels. Several small streams, such as Murdock creek, flow through the lowlands before entering the main rivers, and have their own systems of alluvial deposits and erosion.

Although the differences in the elevation of the plain above the water-table are slight, they are enough to determine the arrangement of the plant cover. Lands subject to inundation, or at most only a few inches above the water-table, have an herbaceous vegetation ranging from semi-floating aquatic plants to sedges and grasses. Large areas in the lower deltas have nearly pure stands of the meadow sedge *Carex trichocarpa* var. *aristata*, or blue-joint grass *Calamagrostis canadensis*. On the margins of stream channels, abandoned or otherwise, are long lines of willows *Salix* spp., which are limited to the slightly elevated ridges peculiar to such areas. The farther toward the margins of the basin the more land is covered by shrub and tree growth, so that the upper deltas and the banks of the larger channels support a forest of Canada spruce and balsam poplar. Forest growth extends farthest into the lowlands along the actual margins of the streams. The granite hills have a scrubby timber of Canada spruce *Picea glauca*, jackpine *Pinus Banksiana*, and canoe birch *Betula papyrifera* var. *neoalaskana*. Not only are the positions of these major types of vegetation determined topographically, but also most of the lesser plant associations within them. An attempt to account for the phenomena of distribution necessitates, therefore, some knowledge of local topographic history. This has been treated in a general way in an earlier part of the paper, but will now be examined in more detail.

The last post-Glacial lake stage in Athabaska-Great Slave Lake region, which stood above the present levels, had its bottom at about the present 800-foot contour (11). With subsequent change in drainage conditions the Athabaska division of this lake was lowered until it was separated from Great Slave lake except for Slave river; but it still covered the Lake Claire-Lake Mamawi basin and had long extensions in the valleys of the main rivers. It received the heavily loaded waters of the Peace and Athabaska, and formed, in this western section of the Athabaska division, a wide settling basin for these rivers, serving to stop immense quantities of detritus. The large amount of drift timber brought from the mountains by these streams has greatly increased the rate of filling, due not only to the volume of the timber itself, but also to the part played by logs as lodgment places for other materials. The basin has been filled to its present condition largely by this process of deposit.

The Athabaska formerly had its main outlet much farther to the west than it does at present, probably to the west of Embarras channel. As these earlier channels so filled their mouths as nearly to reach a graded condition (Cree [or Mamawi] creek appears to be such a channel) their waters were shunted farther to the eastward where they reach the main lake by a greater fall in level. The Athabaska seems to be doing the greatest amount of building at present at the mouths of the Embarras, Fletcher Goose Island, and Big Point channels. The southeast shores of lake Claire, the land between lakes Claire and Mamawi as far north as Hay (Prairie) river, and the south shore of lake Mamawi must have been formed in this way. The Peace, a larger stream, must have sent a large part of its waters, even from the early history of this lake, into Slave river, but it also had a series of channels that deposited the present north and northeast shores of lake Claire. The deposits from these streams meet those of the Athabaska in Hay River area and in the delta of the Quatre Fourches. The



A. Granite hills in the delta of Peace river, near the western end of lake Athabaska.



B. Delta of Cree (Mamawi) creek, near lake Mamawi.  
(See Figures 9 and 12, B.)

latter stream, with Revillon Coupe and Rivière des Rochers, are the only communications now maintained with lake Athabaska and the Claire-Mamawi basin, and as above stated when the Peace is not high the water in these channels flows away from the lake. At present nearly all the detritus carried by the Peace continues on down the Slave, where it still continues the filling of the southern part of Great Slave lake (33). The Quatre Fourches maintains at present two connexions with lake Mamawi, and two with lake Athabaska. Lake Claire, carrying the waters of Birch river, no longer has any connexion with the Peace except by the channels of Hay (Prairie) river and lake Mamawi.

The topography of the delta plains shows a gentle rise away from the lake shores, broken only by the low ridges that have been formed as natural levees along the water courses, and by the granite hills. When channels are abandoned, the ridges remain to separate the sloughs and wet meadows thus formed. By the interaction of neighbouring channel deposits, large lagoons are cut off from the main lake.

The granite hills stood out as islands in the former lake and are now in many cases completely encompassed by land. Their presence has been of considerable significance in determining the contours of the plain in the region where they are common, since they have diverted the streams and caused eddy currents which have facilitated deposit. The vicinity of the Government Dog Camp on lake Mamawi, to be discussed later, will serve to illustrate this point.

Peace and upper Slave rivers have meandered extensively through their deposits in the old lake bed. They are actively undercutting their banks in places, and in others forming great island bars and shore deposits. As a rule the inside shore on curves has the deposits, while the outside one is being torn away rapidly during flood times. Such shore deposits have a characteristic topography consisting of a series of successively higher terraces whose tops slope downward away from the river. The soil in these deposits seems to depend upon the relative activity of the currents that produced them. If the eddy currents made by the curve of the river are swift and active the deposits are coarser, consisting mainly of sand. A gentle curve, with slower currents, usually produces less prominent terraces with a larger amount of clayey materials in the soils. These differences are reflected, in turn, in the manner in which the plant cover develops.

The way in which the great rivers are diverted, and islands formed in them, has been admirably described by E. M. Kindle. Rock outcrops, or the lodgment of drift timber on shallow bottoms, may serve to start the formation of bars and islands. Eddy currents thus formed, or arising from cross-currents in the streams, are the scenes of further accumulations. Once an island is started it acts upon the current of the river much as does a meander curve, tending to divert and retard the speed of the water along its flanks. Thus its growth usually takes the form of lateral bars which cut off long narrow lagoons from the main stream. These lagoons soon lose the connexion they have maintained with the river for a while at their downstream ends, and become sloughs, eventually filled with characteristic slough vegetation. A section through the large island in Slave river at the 30th base line (Figures 11, D, and 14) shows this formation clearly. Further changes in the currents frequently start the undercutting of the banks of these islands and eventually cause their destruction.

Abandoned channels, either of the main streams or their tributaries, remain as sloughs separated by low levee ridges much like those in delta plains. More detailed accounts of such phenomena in specific localities will be given in connexion with the vegetation.

It is evident from this brief treatment that the lowland districts present endless changes in the form of the land surfaces, involving the deposit of vast areas of new land in the deltas, local flood-plains, and on islands in the main streams. As these new lands come into being they are exposed for the acquisition of a cover of vegetation which is selected from similar habitats in the surroundings. The process has been going on since the whole area was exposed at the recession of the former lake, and by a study of the present program of development it is possible to gain some insight into the earlier stages.

### General Trend in the Development of the Vegetation

Succession of vegetation types in the lowlands is comparatively simple in outline. On new land formed in delta plains the early stages are submerged or partly floating aquatic plants rooted in shallow mud flats. These are followed immediately by a marsh vegetation dominated by sedges and various grasses. On mud and sand-bars in the main streams aquatic plants are prevented by the current, and the first land plant to appear is usually some species of horsetail *Equisetum*. The next notable change in the succession is the growth of various species of willows, closely followed by an admixture of alders *Alnus incana*. The balsam or black poplar *Populus tacamahacca* is the first tree to appear, and gradually gives way to spruce *Picea glauca*. The spruce forest appears, as it does on the upland, to be the most advanced stage attainable, and perpetuates itself if not altered by clearing or fire. The general outline may be indicated as follows:



There are many minor stages interpolated into this outline, differing according to the mode of origin of the succession, but the general arrangement is almost universal for the area under discussion. The convergence of all successions to the spruce forest indicates that eventually this forest may cover the whole region, provided no major changes in climate or topography occur. Furthermore, most of the variations in the major trend are to be found in those stages that precede the willows (See diagram of successions, Figure 15) and are nearer to the differing physiographic origins of the series.

An outline for the more or less detailed description of the vegetation of the lowlands may be derived from the above plan of its development. The first division will have to do with the delta plains, the second with local river deposits, and the third with those phases of the first two that are concerned with sloughs and wet meadows formed in abandoned channels, and warrant more elaboration due to their diversity.

## Vegetation of Delta Plains

The following account of the delta plains is based upon collections and notes made chiefly during the month of August, 1930, at three places in Lake Mamawi district: the vicinity of the Government Dog Camp about 4 miles south of the Quatre Fourches, the Cree (Mamawi) Creek district between the lake and Reed portage on the upper Embarras, and the channels of Hay (Prairie) river on the west shore of the lake. To this material are added miscellaneous notes from the writer's journeys through the Athabaska and Peace deltas in the preceding four seasons, and the correlative data furnished by the aerial photographs.

Figure 11 A is a generalized section illustrating this vegetation.

### AQUATIC ASSOCIATIONS

The shallow lake contains large areas of pondweeds that are rooted in the mud bottom but whose upper stems and leaves float at the surface. The whole lake is so filled with them that it is nearly impossible to find a way across without getting into their tangled patches. The densest growth occurs near marshy shores and about the entrances to such channels as Cree creek and Hay river.

Primary spp.: *Potamogeton vaginatus*  
*P. Richardsonii*

Secondary sp.: *P. gramineus* var. *graminifolius*

There appears to be a succession of these species related to the depth of the water. *P. vaginatus* grows in the greatest depths, followed by *P. Richardsonii*. The secondary species is more common among the outer vegetation of the shore.

### SHORE ASSOCIATIONS

On very gently sloping shores these associations merge in broad bands with those on either side of them, so that their exact margins cannot be designated. At the time of this survey it was possible to push a light canoe all the way through the shore vegetation and well into the first of the meadows, but such high water conditions were regarded as unusual by the local inhabitants.

Primary spp.: *Scirpus validus*  
*Potamogeton gramineus* var. *graminifolius*  
*Eleocharis palustris*

Secondary sp.: *Glyceria grandis*

*Eleocharis* is not so generally distributed as *Scirpus* and *Potamogeton*, and *Glyceria* attains great abundance in a few places. As will be brought out in further records, *Scirpus validus* and *Potamogeton gramineus* var. *graminifolius* are the chief pioneers in colonizing this type of lake shore, and are general in such situations throughout the deltas. Where the section was made this association is about 20 yards wide.



## MEADOW ASSOCIATIONS

Merging with the shore type is a wet meadow of sedges and tall, coarse grass. It is between 100 and 200 yards wide at this place, and although in standing water it forms a dense growth.

- Primary spp.: *Carex trichocarpa* var. *aristata*  
*Fluminia festucacea*  
 Secondary spp.: *Potamogeton gramineus* var. *graminifolius*  
*Beckmannia Syzigachne*  
*Calamagrostis canadensis*  
*Glyceria grandis*  
*Carex aquatilis*  
*Scirpus validus*  
*Eleocharis palustris*  
*Sium suave*

*Glyceria*, *Eleocharis*, and *Potamogeton* are found mainly at the wetter, lakeward margin. *Carex trichocarpa* var. *aristata* is one of the most important plants in the lowlands due to its abundance and value as forage. Most of the hay that has been cut for many years in the sloughs along upper Slave river is of this plant, as will be shown later. It is also an important source of winter feed for the buffalo. The tall grass, *Fluminia*, is not so uniform in distribution as the sedge, becoming more common in wetter areas like those that occur on the delta plains. In drier parts of the sedge meadow, semi-aquatic plants such as *Potamogeton*, *Scirpus*, *Carex aquatilis*, *Eleocharis*, and *Glyceria* disappear and the stand of the dominant *Carex* becomes nearly pure, with the grasses *Phalaris arundinacea* and *Fluminia festucacea* appearing in a few places.

Between the sedges, which appear dark green on the landscape, and the nearest willow groves, there is an extensive meadow of blue-joint grass *Calamagrostis canadensis*.

- Primary sp.: *Calamagrostis canadensis*  
 Secondary spp.: *Polygonum natans* forma *Hartwrightii*  
*Mentha canadensis* var. *glabrata*  
*Stachys scopulorum*

The predominating species is one of the commonest in the Athabaska-Great Slake Lake region, but outside the delta plains and some of the upland semi-open prairies it is confined to the willow margins of shores and sloughs (See Figures 9, 10, 11, 12). In the Athabaska-Peace delta it covers many square miles with a close turf, accompanied by very few other species, and is one of the most important sources of hay and forage the country possesses. Many buffalo feed upon it the year around, and it serves as autumn and winter feed for the herds that migrate to the lowlands at those seasons of the year. Along the Quatre Fourches the inhabitants of Chipewyan have for many years cut excellent hay from the meadows of this grass. Plate X A is a photograph of new stacks of hay cut during the summer of 1930. In the latter part of August the fruiting panicles were turning to a rich golden colour, reminding one of fields of ripening grain on the prairies farther south.

Variations in the associations of the shores and meadows are chiefly in the way of expansions and contractions in width and prominence. The low-lying deltas around the eastern ends of the Hay River channels show a general widening, particularly of the shore types, involving a much more abundant growth of *Scirpus* and *Glyceria* than in the section discussed

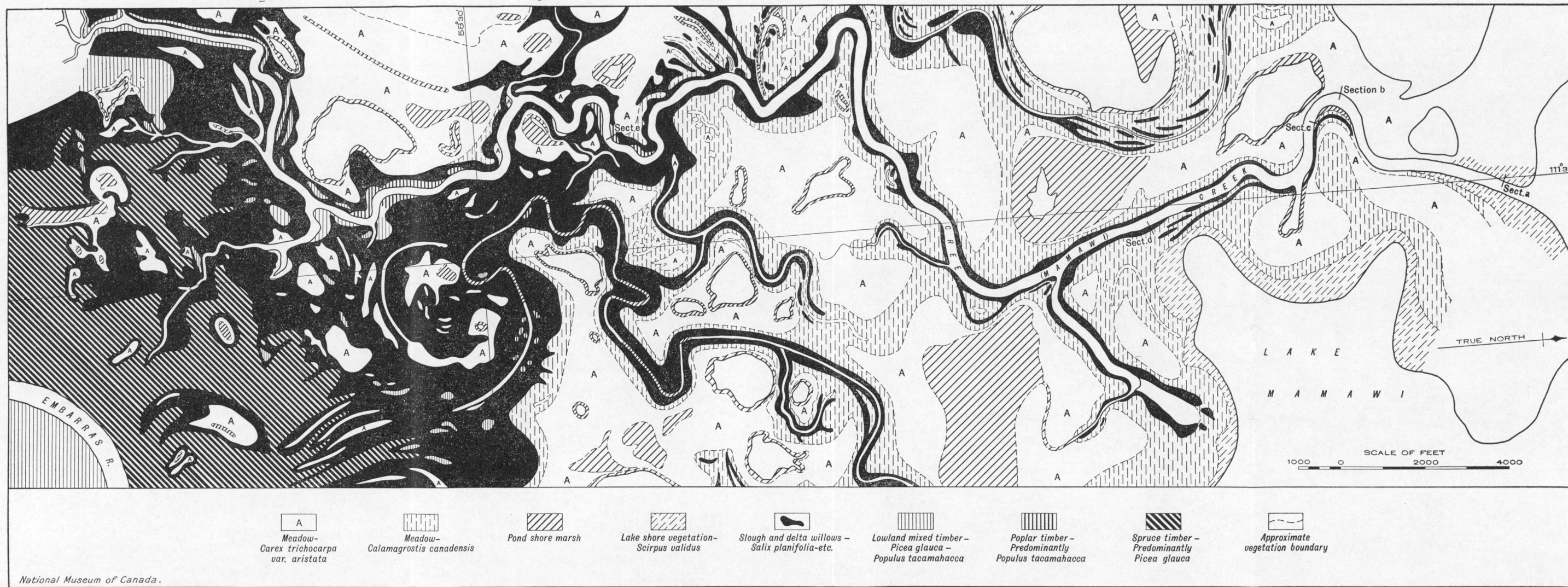
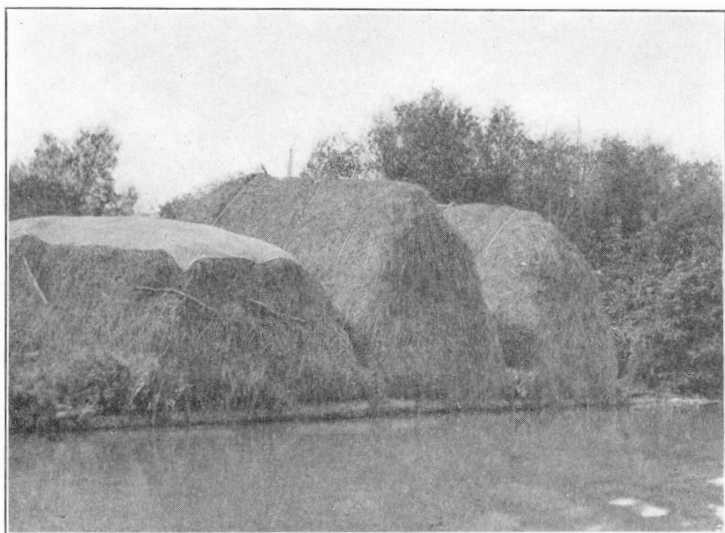
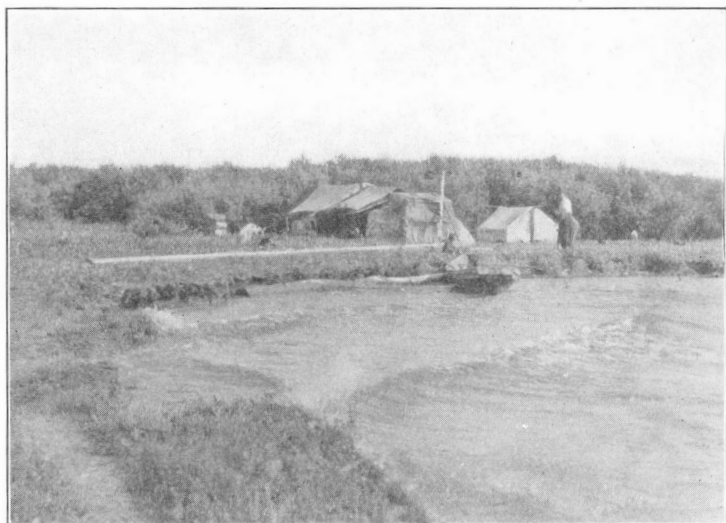


Figure 9. Map of vegetation in the Cree (Mamawi) Creek district, Athabaska River delta.





A. Stacks of hay from the meadows along Quatre Fourches river,  
August, 1930.



B. Storm waves eroding alluvial deposits, east shore of lake Mamawi  
at the Government Dog Camp.

above. On shores exposed to wave action, as at the Government Dog Camp, the marsh has nearly disappeared, and the alluvial soil is cut back to such an extent that the *Calamagrostis* meadow grows on a low bank at the water's edge. This was also noted on the east shore of lake Claire, at the western end of Hay river. The waves not only cut back the shores but also they pile up low ridges of debris which lead to a more mesophytic vegetation in the form of willows. A thin line of willows is clearly seen along the east side of lake Mamawi (Figure 10). Plate X B is a photograph of storm waves actually eroding the shore at the Dog Camp.

#### SHRUB ASSOCIATIONS

Low ridges on the margins of stream channels, old mud bar formations around the bases of granite hills, and certain shores subject to wave erosion have willow groves covering them and pushing out into the drier parts of the *Calamagrostis* meadows. The pioneer species is usually *Salix planifolia*. A considerable number of other species occupy the loose growth of willows at the margins of the groves.

- Primary spp.: *Salix planifolia*  
*Calamagrostis canadensis*  
 Secondary spp.: *Poa pratensis*  
*Phalaris arundinacea*  
*Salix petiolaris*  
*S. lasiandra*  
*S. Bebbiana*  
*Urtica gracilis*  
*Polygonum natans* forma *Hartwrightii*  
*Rumex mexicanus*  
*Ranunculus pennsylvanicus*  
*Anemone canadensis*  
*Potentilla Anserina*  
*Geum strictum*  
*Sium suave*  
*Cicuta occidentalis*  
*Mentha canadensis* var. *glabrata*  
*Stachys scopulorum*  
*Physostegia parviflora*  
*Achillea sibirica*  
*Erigeron philadelphicus*  
*Solidago canadensis*  
*Aster junceus*

Only the primary species have any importance as ground cover, since the others are much scattered in the partial shade of the willow clumps.

Following this open association comes a dense growth of willows whose slender trunks are so interlaced as to be nearly impenetrable, and which cause a deep shade. The ground vegetation under them is sparse and composed of plants that are prominent elements in the shrub and ground covers of the poplar and spruce forests.

- Primary sp.: *Salix Bebbiana*  
 Secondary spp.: *Equisetum pratense*  
*Corallorrhiza trifida*  
*Ribes oxyacanthoides* (seedling)  
*Rubus idaeus* var. *canadensis* (seedling)  
*Vicia americana*  
*Cornus stolonifera*  
*Viburnum pauciflorum* (seedling)  
*Aster Lindleyanus*



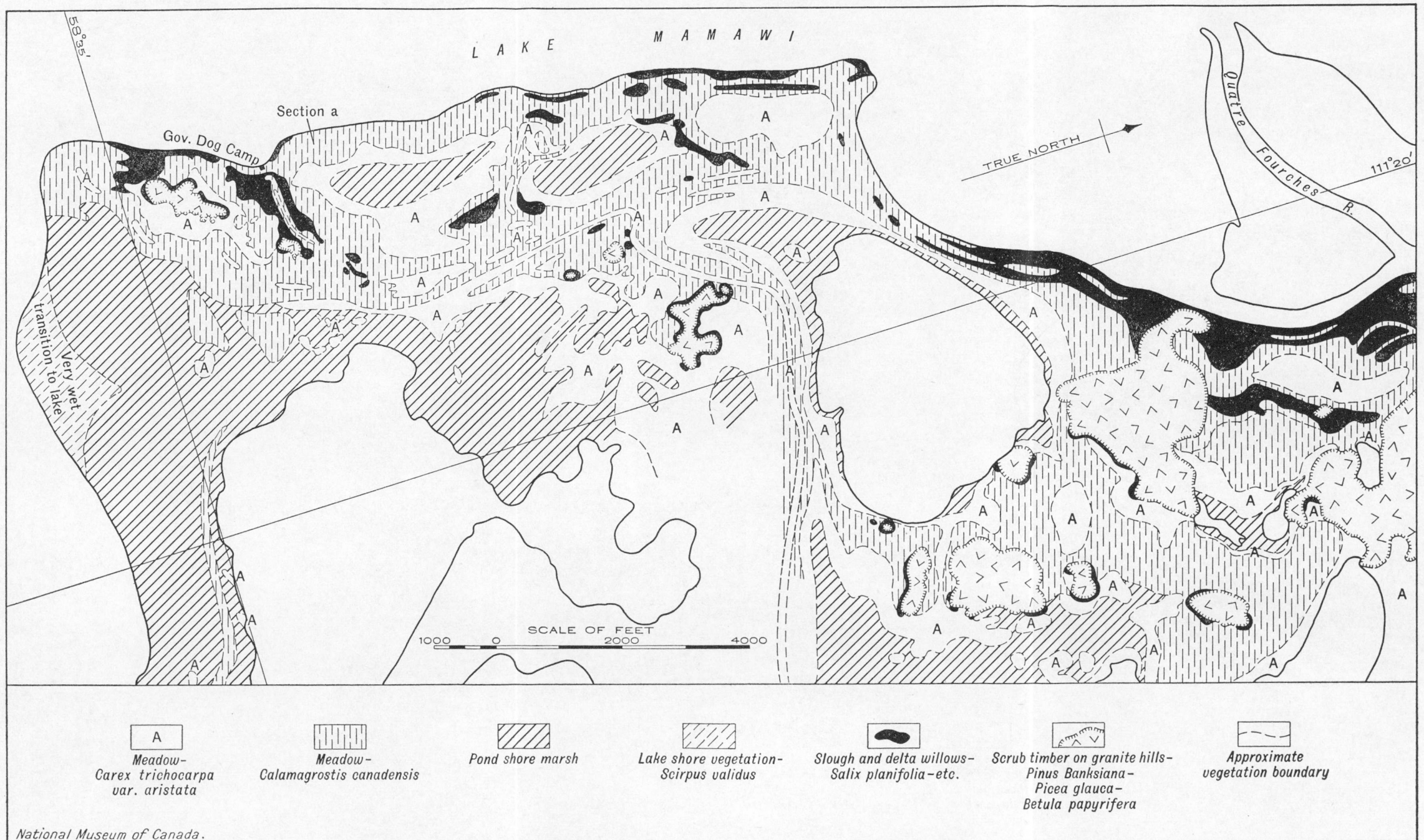


Figure 10. Map of vegetation in the delta of Quatre Fourches river, east shore of lake Mamawi.



The maps indicate the way in which the willow ridges reach out into the delta along the watercourses, appearing in large, continuous areas only on higher ground where they gradually give way to poplar and spruce. On the low delta flats adjacent to the Dog Camp (Figure 10) nearly all of the land is still in the meadow and slough condition, and the willows are limited to the levees near the mouth of the present Quatre Fourches channel, a strip along the lake margin in discontinuous lines, and to the slightly raised levees at the former mouths of the little creek that exists now only as a *Carex* slough. This small creek appears to have had at least three openings into the lake along this shore, each of which is indicated now only by the low levees and the remains of the slough channels. The only one of these mouths at which willow groves of any size have formed is the one at the Dog Camp. The granite hills in this vicinity seem to have caused, probably by eddy currents in the former outwash, higher ridges than occur elsewhere, resulting in the greater prominence of the willows. The activities of the present Quatre Fourches, along with those of the small stream that originally had its beginning farther eastward in another branch of the Quatre Fourches, have cut off the shallow ponds from the main lake by the coalition of their lakeward deposits. Similar coalitions are shown in the delta of Cree creek, now in a state of arrested development due to the alteration of the main channels of the Athabaska. Branches at the mouth of this creek (Figure 9) show ponds in process of being cut off and others not far back from the shore. The second eastern branch of the creek above the mouth shows clearly the way in which willow-covered levees were left stranded when the channel ceased to function. The willow clumps at the Dog Camp must have had the same origin.

Higher in the delta the last areas to be overgrown by willows are the sloughs that have arisen as the ponds above mentioned. A treatment of this process will be found in the discussion of slough vegetations.

Where larger and more active streams are building levees far out into the lakes, as at the Quatre Fourches and Embarras, the pioneering willow listed above, *Salix planifolia*, is replaced wholly or in part by the sand-bar willow *Salix interior* var. *pedicellata*. This species is the commonest throughout the more actively developing flood-plains of the region.

#### TREE ASSOCIATIONS

As shown by the map, the first tree growth in the delta occurs as isolated patches of balsam poplar *Populus tacamahacca* along the banks of the streams in the upper parts of the willow area. Alders *Alnus incana* appear among the willows before the poplars and form a transition species between the two types of vegetation. The poplar association is widespread throughout the flood-plains, and is merged with spruce forest in all sorts of combinations.

- Primary spp.: *Populus tacamahacca*  
*Equisetum pratense*  
*Salix Bebbiana*
- Secondary spp.: *Picea glauca* (young trees)  
*Salix arbusculoides*  
*Alnus incana*  
*Actaea rubra*  
*Rosa acicularis*

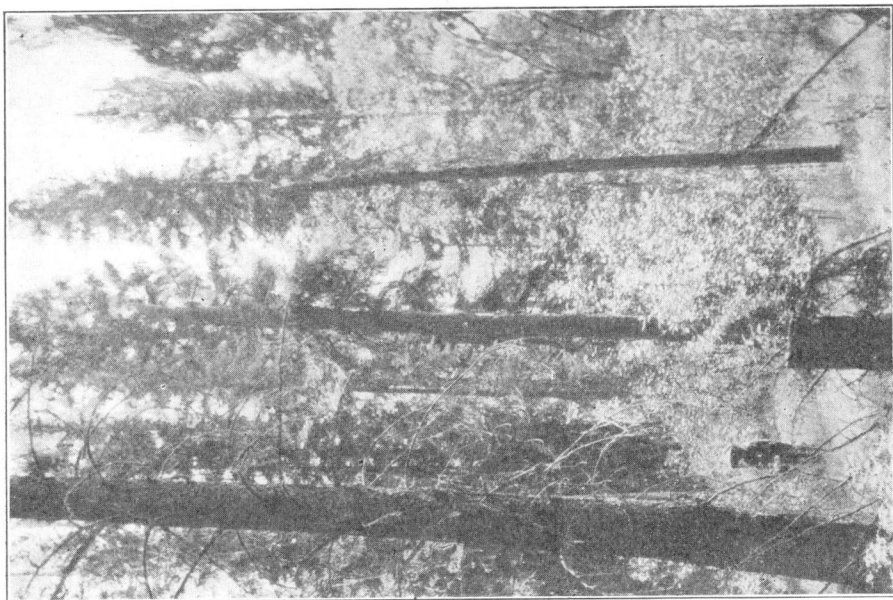


*Rubus idaeus* var. *canadensis*  
*Vicia americana*  
*Epilobium angustifolium*  
*Aralia nudicaulis*  
*Cornus stolonifera*  
*Pyrola asarifolia*  
*Viburnum pauciflorum*  
*Aster Lindleyanus*

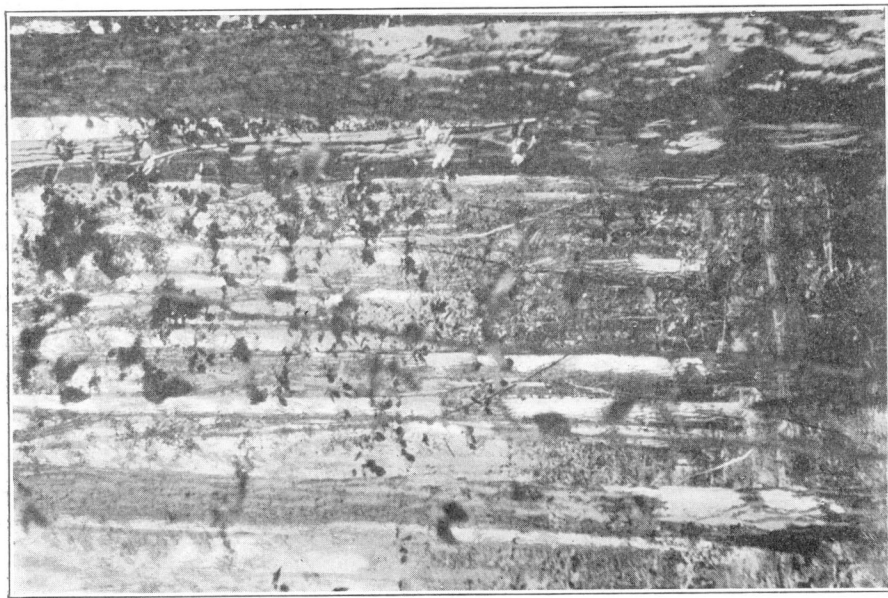
Although this list of secondary species is not complete, it contains those that are the most characteristic and shows the trend of the forest toward mesophytism. Young Canada spruces germinate in the shade of the poplars, alders, and willows, and gradually occupy larger areas. If undisturbed, the dominance of the spruce becomes complete, so that pure stands of it are not uncommon along the main rivers. The ground cover in the poplar forest is very scanty, containing but few mosses. With the coming of the spruce a close mat of mosses is formed, over a relatively thick layer of leaf mould. The herbaceous and shrub floras in the spruce are exceedingly scant. *Viburnum pauciflorum*, *Rosa acicularis*, *Shepherdia canadensis*, *Rubus acaulis*, *R. pubescens*, *Equisetum pratense*, *Maianthemum canadense*, *Orchis rotundifolia*, *Goodyera repens* var. *ophioides*, *Habenaria obtusata*, *Geocaulon lividum*, *Mitella nuda*, *Pyrola secunda*, *Moneses uniflora*, and *Linnaea borealis* var. *americana* make up the most of this scattered cover.

Since the combination of spruce and balsam poplar, with the spruce often predominating, is the commonest type of timber seen in the deltas, it will be listed in more detail.

- Primary spp.: *Picea glauca*  
*Populus tacamahacca*  
*Salix Bebbiana*  
*Viburnum pauciflorum*  
*Cornus stolonifera*
- Secondary spp.: *Equisetum pratense*  
*Maianthemum canadense*  
*Alnus incana*  
*Geocaulon lividum*  
*Actaea rubra*  
*Ribes oxycanthoides*  
*R. hudsonianum*  
*R. triste*  
*Mitella nuda*  
*Rosa acicularis*  
*Rubus pubescens*  
*R. idaeus* var. *canadensis*  
*Fragaria glauca*  
*F. vesca* var. *americana*  
*Vicia americana*  
*Lathyrus ochroleucus*  
*Astragalus frigidus* var. *americanus*  
*Shepherdia canadensis*  
*Cornus canadensis*  
*Pyrola asarifolia*  
*P. asarifolia* var. *incarnata*  
*P. secunda*  
*P. chlorantha*  
*Moneses uniflora*  
*Mertensia paniculata*  
*Galium boreale*  
*Linnaea borealis* var. *americana*  
*Aster Lindleyanus*



B. Flood-plain timber of Canada spruce (*Picea glauca*)  
along lower Peace river at Peace point.



A. Flood-plain timber of balsam poplar (*Populus tremuloides*)  
along upper Slave river.

It has been stated elsewhere that the balsam fir *Abies balsamea* finds its northern limit in the lower Athabaska valley. It was found in the Athabaska delta in the summer of 1930, near the head of Cree (Mamawi) creek, but has not been seen by the writer elsewhere in the district under discussion. In more southern regions it accompanies Canada spruce in the mature forests.

### **Vegetation of Local River Deposits**

One of the commonest sights on the local river flood-plains and islands is the "stepped" or "banked" vegetation that grows on them. It is accentuated during the summer months by the wide range in different shades of green which appear between the water's edge and the spruce or poplar forest of the background. Although many random observations have been recorded throughout the flood-plain, detailed studies have been made at only a few representative places, namely, along Peace river just below Peace point, near the Government Hay Camp on Slave river, and on the large island that lies in Slave river at the 30th base line. The general topography of such areas has already been described.

#### **HERBACEOUS ASSOCIATIONS**

The early stages of the river shore flood-plain vegetation seem to be determined by the soil and its configuration, which are in turn determined by the rate and activity of the current in the stream. Peace point is at a northward bend of Peace river, in the lower part of the district where the stream is confined by high gypsum cliffs on both sides. The blunt "point" itself is a low cliff of rock whose top is only a few feet above the spring high-water levels of the river. On the lower side of the point eddy currents have caused the deposit of a series of long, narrow flood-plains. These have started with bars more or less parallel to the shore, which have been abandoned as the general level of the stream has been lowered in recent geologic time. New bars are at present forming on the existing shore (Figure 5) which indicate the process. Flood waters of the present river cut back the outer sides of the bars, causing a sharply terraced appearance with the top surfaces of the terraces sloping backward away from the river. The fact that the same process has been going on at this place for a very long time is shown by the extension of similar topographic forms far above the present high water, and at considerable distance inland. Figure 5 is a map of Peace Point area showing the arrangement of these deposits.

The shore is predominantly sandy, with prominent, well-drained bars. Consequently it supports practically no herbaceous vegetation on the lower levels, since such vegetation is of mud-flat or marsh type. Its first plants are sand-bar willows *Salix interior* var. *pedicellata* and the lowest bars have no plants whatever. The island bars at the 30th base line (Figure 11, D) illustrate the same condition.

The meander curves formed where the streams have less fall show the same general types of deposits except that the currents are much slower, causing bars and terraces that are very low and composed of finer, more muddy soils. These are well illustrated at the Government Hay Camp and at many places in the lower deltas (See Figure 11). Their initial vegeta-

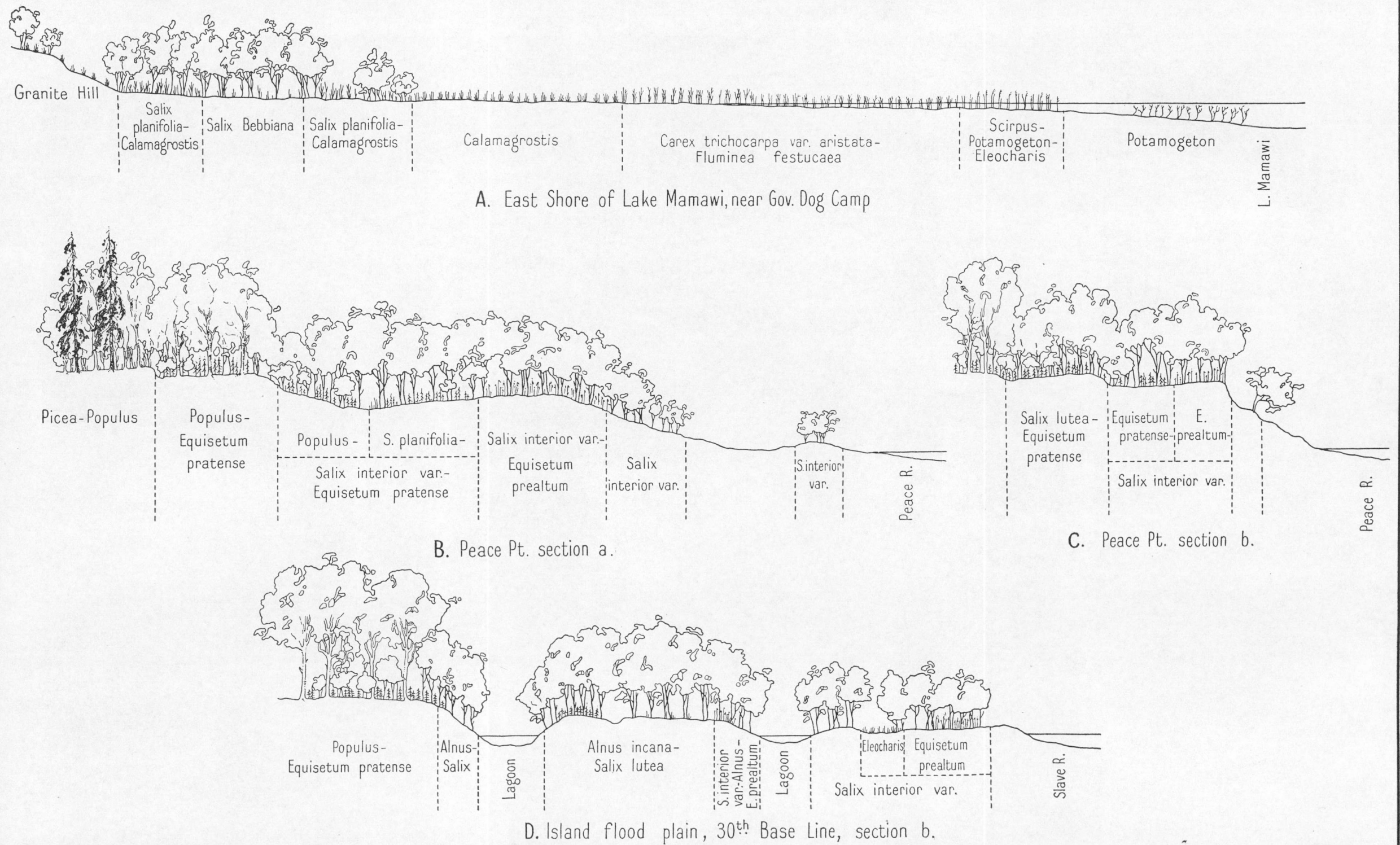


Figure 11. Sectional diagrams of delta and local river flood-plain vegetation.



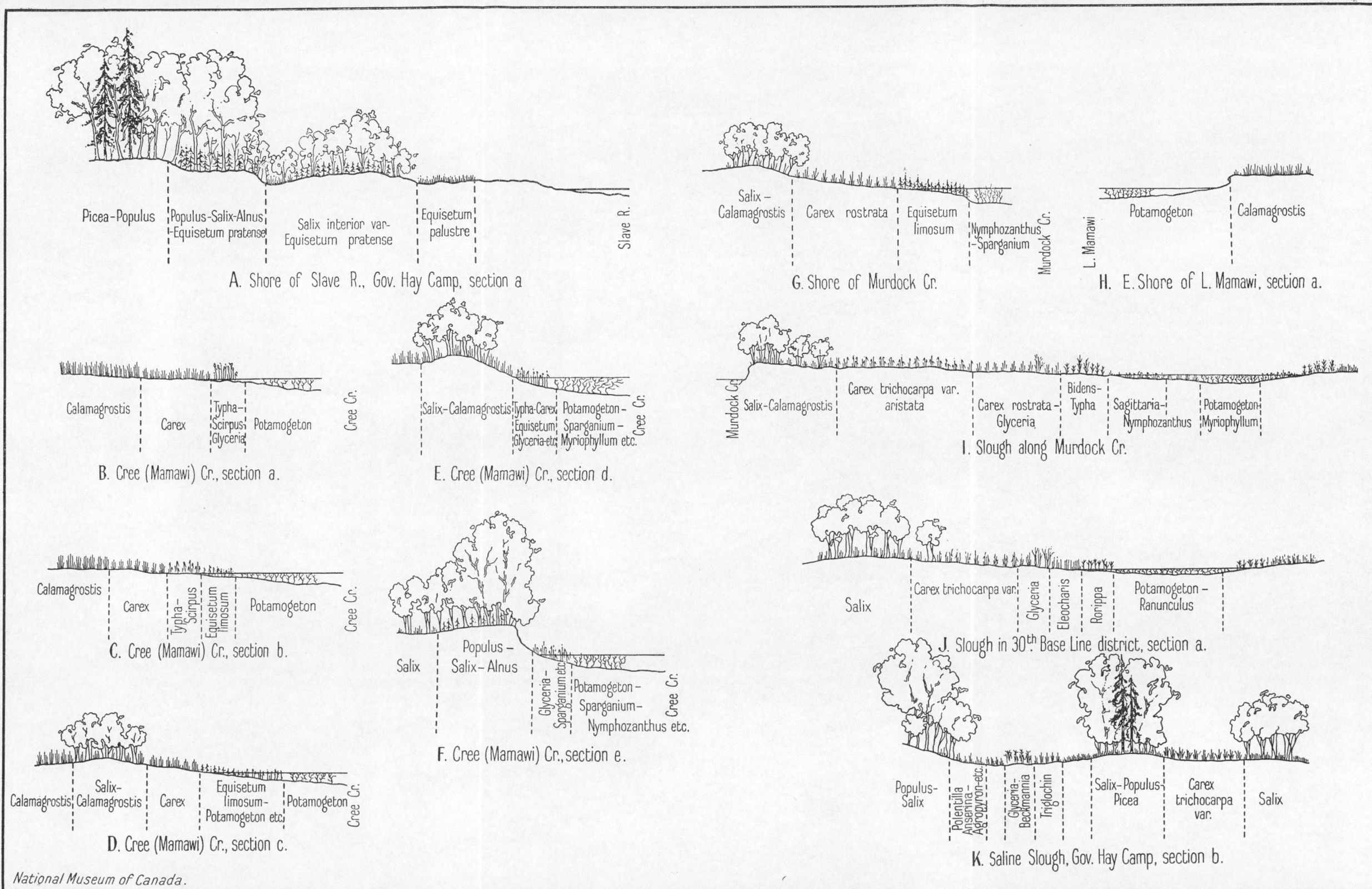


Figure 12. Sectional diagrams of lowland delta, slough, and local river flood-plain vegetation.

tion consists mainly of species of horsetail *Equisetum*. Where the current is sufficiently gentle to permit it, *E. limosum* forms dense, nearly pure growths in the quiet water along shore and in the mud of the lower banks. The *Equisetum* association attains its greatest purity in the upper parts of the deltas, and when seen near the actual mouths of the rivers is associated with a number of slough margin species drawn from surrounding habitats. The secondary species listed below were collected at the place where Embarras channel makes its last branching before entering lake Athabaska. All stages in the sorting out of this complex appear between this point and the upper parts of the Embarras. The same stages may be seen along the Quatre Fourches and along Cree creek, although the latter no longer has a current.

- Primary sp.: *Equisetum limosum*  
 Secondary spp.: *Typha latifolia*  
*Sagittaria cuneata*  
*Alopecurus aequalis*  
*Glyceria borealis*  
*G. grandis*  
*Phalaris arundinacea*  
*Beckmannia Syzigachne*  
*Poa palustris*  
*Phragmites communis* var. *Berlandieri*  
*Puccinellia Nuttalliana*  
*Carex trichocarpa* var. *aristata*  
*Eleocharis acicularis*  
*E. palustris*  
*Scirpus validus*  
*Juncus nodosus*  
*Rumex maritimus* var. *fueginus*  
*R. mexicanus*  
*Ranunculus pennsylvanicus*  
*R. sceleratus*  
*Potentilla norvegica* var. *hirsuta*  
*Epilobium glandulosum* var. *adenocaulon*  
*Hippuris vulgaris*  
*Sium suave*  
*Mentha canadensis* var. *glabrata*  
*Stachys scopulorum*  
*Senecio palustris*

The shore section at the Government Hay Camp (Figure 12, A) was made at a low-water stage when a wide, barren mud flat was exposed between the river and the first vegetation. The characteristic terrace formation is evident though low in relief, and in this case is caused by a minor slackening of currents below the rocky point shown on the map (Figure 13). Further notes on the development of the Hay Camp area will be found in another part of the paper. The lower ground has an open association of *Equisetum palustre*, which trails over the mud on a terrace about 30 feet wide, reaching its greatest abundance at the landward margin.

- Primary sp.: *Equisetum palustre*  
 Secondary spp.: *Equisetum arvense*  
*Eleocharis calva*  
*Juncus nodosus*  
*Salix interior* var. *pedicellata* (seedlings)  
*Rorippa palustris* (seedlings)

The secondary species are of small importance and are commonest at the landward side, where the willow from the following association is actively colonizing the mud. There is much driftwood on the shore, mostly of large dimensions.

To summarize the herbaceous associations on these shores—they range from complete absence on sandy, well-drained bars, to the abundance and complete dominance of species of *Equisetum* on low mud shores. The *Equisetum* associations vary from pure stands on the higher mud deposits of streams in which the currents are active, to associations with a large number of secondary marsh species on bars in the lower deltas where more nearly ponded conditions prevail.

#### SHRUB AND TREE ASSOCIATIONS

The sand-bar willow *Salix interior* var. *pedicellata* is of nearly universal occurrence as a pioneer on the local river flood-plains. It is either the first vegetation or follows the horsetail directly in the developmental succession, and is admirably adapted to the rôle by its prolific vegetative means of reproduction. Its secondary associates appear to be determined largely by the major soil differences described above, the sandy soils growing the more xerophytic types of plants. The latter condition is best shown at Peace point and on the island at the 30th base line. The initial vegetation is a pure stand of *Salix*, but it is followed immediately on slightly higher ground by a more complex association.

- Primary spp.: *Salix interior* var. *pedicellata*  
*Equisetum prealtum*
- Secondary spp.: *Picea glauca* (seedling)  
*Agropyron trachycaulum* var. *typicum*  
*Agrostis scabra*  
*Calamagrostis canadensis* var. *robusta*  
*Salix lutea*  
*S. planifolia*  
*Alnus incana* (young plants)  
*Potentilla Anserina*  
*Fragaria glauca*  
*Epilobium angustifolium*  
*Cornus stolonifera* (seedling)  
*Castilleja Raupii*  
*Achillea Millefolium*  
*Solidago canadensis*  
*Erigeron philadelphicus*  
*E. acris* var. *asteroides*

The primary species are abundant, but the secondary ones are much scattered, and for many a careful search must be made. Many of them appear elsewhere in more mesophytic associations, and here indicate the trend of the succession. On the driest spots, particularly at the outer edge of the association, the primary species are almost alone. As indicated on the diagram (Figure 11, B), however, the lower, landward slope of the terrace shows a notable change in conditions. *Salix planifolia* is advanced to a primary position, whereas *Equisetum pratense* shares prominence with *E. prealtum*. In wetter places *Juncus balticus* is abundant, but most of the secondary species remain the same. *S. planifolia* is characteristically a

plant of slough margins, and probably finds its way into this situation on account of the semi-ponded conditions where the lower slope of one terrace meets the more or less steep front of the next oldest one above it. The landward side of this association contains saplings of *Populus tacamahacca*, forerunners of the timber.

Sharply separated from this association by the front of the next landward terrace is one that may be another willow association or one of trees. If the former occurs it is dominated by a tall species of wide distribution in these flood-plains, *Salix lutea*, with a ground cover of the goose-grass *Equisetum pratense*. The ground vegetation is scanty except for the close stand of *Equisetum*, but such shrubs as occur in the poplar association or at its margin are rather common: *Cornus stolonifera*, *Rosa acicularis*, *Amelanchier florida*. The sand-bar willow is still present in small numbers along with sapling balsam poplars.

Transitions from willows to timber on the local flood-plains do not differ essentially from those already described in the deltas, and the poplar and spruce forests are, of course, the same. *Alnus incana*, *Salix Bebbiana*, *S. arbusculoides*, and *S. planifolia* are involved, and the ground cover of *Equisetum pratense* is gradually replaced by mosses and woodland herbs.

As seen from the river, therefore, the lowest, grass-green bank of vegetation is of horsetail *Equisetum limosum*, the next highest is formed of the sand-bar willow *Salix interior* var. *pedicellata*. The latter is of light yellow-green and has a filmy appearance caused by its pendulous, narrow leaves. Due to differing stages of growth on terraces of varying age, this willow often forms more than one bank, the upper shading off in colour, by way of *Salix planifolia*, to the darker green of the taller *Salix lutea*. Above the yellow willow (so named because of its yellow branchlets) is the bluish green of the balsam poplars, mixed with the nearly black spires of the spruces.

Essentially the same succession is to be found on the island at the 30th base line (Figure 11, D, and Figure 14). The different associations are there made even more prominent by being separated by long, narrow sloughs or lagoons. The low mud terraces at the Government Hay Camp do not have a yellow willow association, and the sand-bar willow, with a ground cover composed mainly of *Equisetum pratense*, immediately follows the *E. palustre* association and adjoins the timber. It stands on a low bar having a wet depression at its landward side in which are a number of marsh or wet meadow plants such as *Typha latifolia*, *Beckmannia Syzigachne*, *Poa pratensis*, *Glyceria grandis*, *Carex trichocarpa* var. *aristata*, *C. rostrata*, *Eleocharis calva*, *Juncus balticus*, *Ranunculus Cymbalaria*, *Physostegia parviflora*, *Plantago major* var. *asiatica*, and *Aster junceus*. A few individuals of *Salix arbusculoides* come from the margin of the timber. The lack of transition stages to the timber appears to be due to some comparatively recent shift in the activity of the river along this shore. Subsequent to some erosion period in which the river has cut an earlier flood-plain back to the terrace that now holds the timber, a new deposit has been begun which now bears the earlier stages of the vegetation. This change may be a seasonal one, but this is not likely on account of the relative permanence of the vegetation on the highest of the new bars. It





A. Local river flood-plain deposit at Peace point. (See Figures 5 and 11, B, C.)



B. Local flood-plain deposit in the channel of Embarras river, showing *Equisetum*, willow, and poplar associations.

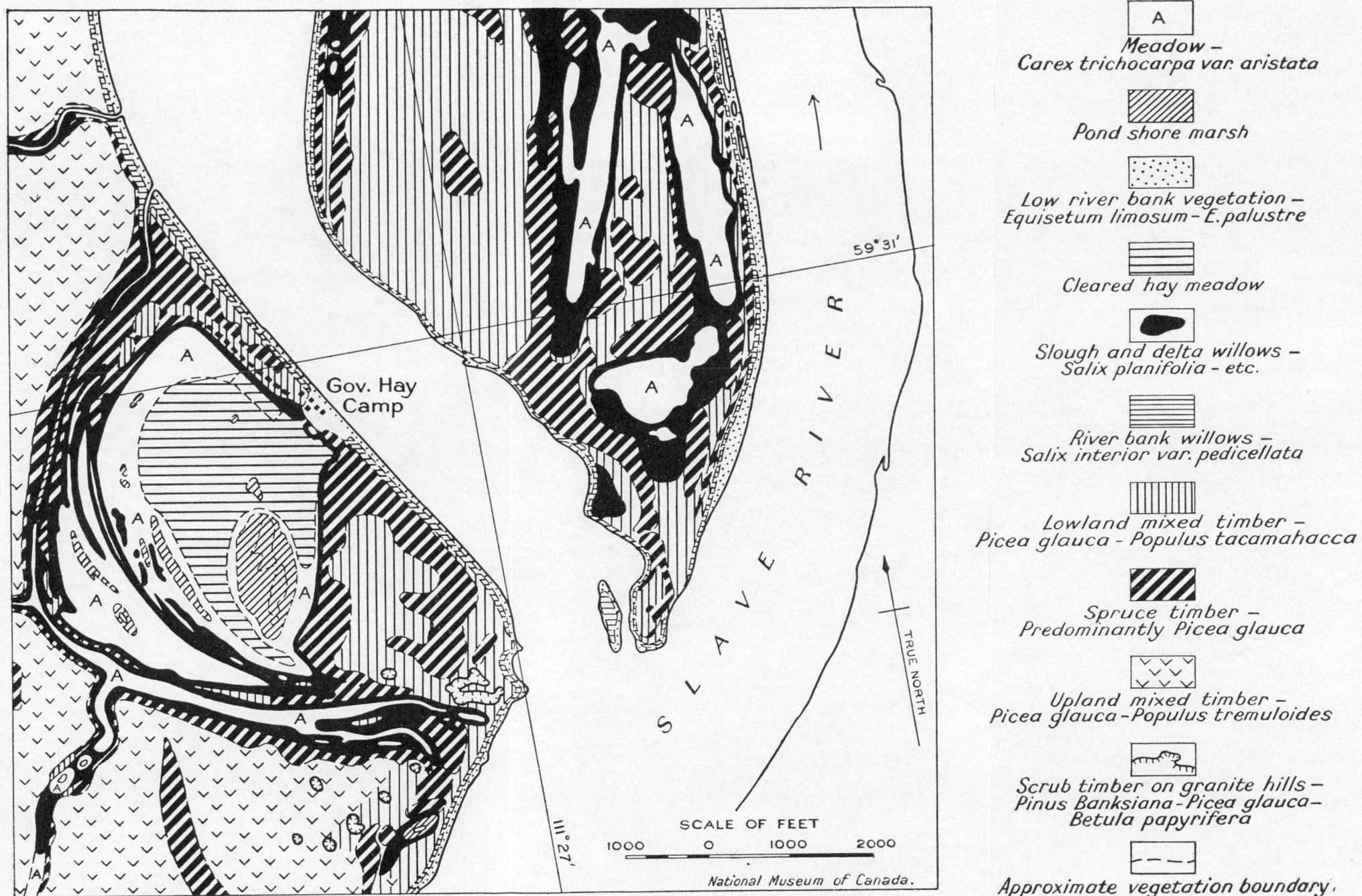


Figure 13. Map of vegetation in the Government Hay Camp district, Slave river.



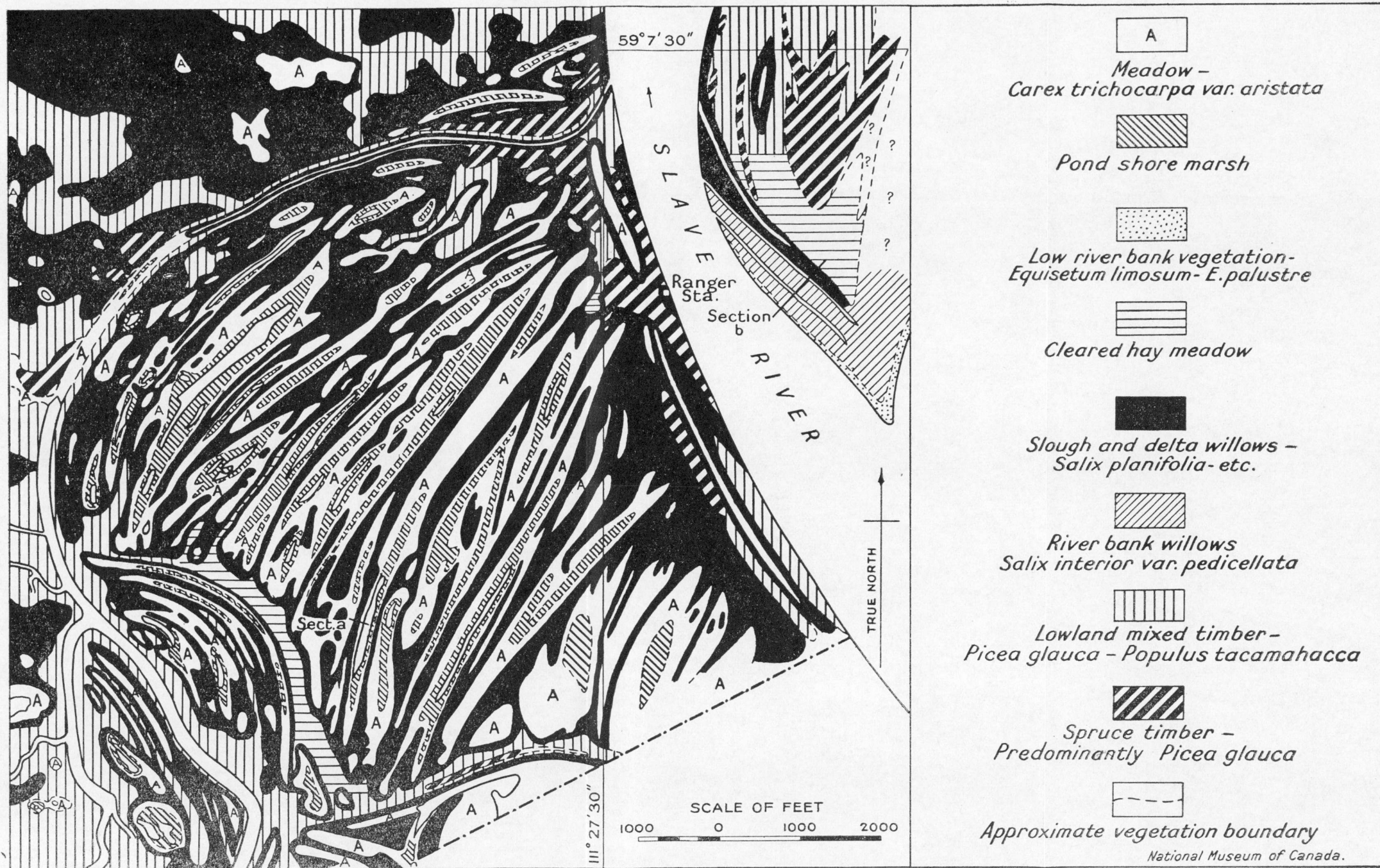


Figure 14. Map of vegetation in the 30th baseline district, Slave river.

appears, rather, to be a change involving a period of at least several years, and is possibly recurrent according to some cyclic differences in the water levels of the river in this district.

### Slough and Wet Meadow Vegetation

Elements of slough and wet meadow vegetation have already been mentioned as occurring in the shallow, relatively undrained depressions on local river flood-plains and in similar situations on delta plains. They are very closely allied to the earlier stages of development in the delta vegetation, but differ from these largely because they are situated on smaller bodies of water where wave action is little felt. They occur chiefly in and around small ponds isolated from the larger lakes in the deltas and in the abandoned channels of meandering streams. Both types of terrain occur in all states of development, and as a result it is possible to find slough vegetations in many conditions, ranging from floating aquatic plants to something approaching the mesophytic forests. The general arrangement and contents of the associations differ little from those situations in the uplands of the park, but in none of those areas is there so complete a series to show the stages of development.

Detailed studies of these floras have been made at the Government Hay Camp, along Murdock creek at about latitude  $59^{\circ} 14'$ , in the sloughs on the west side of Slave river at the 30th base line, and in Cree (Mamawi) creek. These will be used for the following discussion in the order of their increasing mesophytism.

An inspection of the maps of the 30th base line and Hay Camp areas (Figures 14, 13) gives some knowledge of the topographic history involved. At the 30th base line the small, ponded creek that flows in a half circle at the outer edge of the meadow district has obviously had a series of earlier, straighter channels that are now represented by the sloughs. Although its course has not been closely examined, the topographic features of the country indicate that the creek was once a channel of Peace river, either by itself or as a branch of the present Scow channel. The general lowering of the rivers and the opening of new drainage lines has caused it to be abandoned and to form a series of sloughs that represent late meanders. Murdock Creek valley gives the impression of having been, also, a former channel of the Peace, and to have had a much stronger flow of water in comparatively recent time. The present crooked stream lies between long sloughs that are quite straight and must have carried parts of a large river.

Hay Camp meadow differs from most abandoned channel sloughs in being nearly as wide as it is long. The lowland is here separated from the back country by a definite escarpment or bluff which may be followed around the west side of the small drainage stream and then through a timbered area to the river above the rocky point. This bluff evidently was the former bank of the river when the latter covered the entire Hay Camp district and was obstructed by granite islands that are now seen as low hills above the region south of the meadows. It seems clear that these islands formed the nucleus of a large area of sand and mud-bars which eventually turned the stream entirely to the eastward into its present course. The timbered district that lies between the meadow and the granite hills is

composed of low ridges that decrease in elevation toward the north, and have the form of bars. Those nearest the hills are most prominent and are largely made of sand. The island nucleus formed an embayment, later to become the present meadow, which was finally cut off completely by the long, low bars on which the present camp buildings stand. A section of the vegetation on these long levees has already been discussed (Figure 12, A). The small streams that emptied into the old embayment maintained their connexion with the river for a long time after the former was made into a slough, one to the south among the hills and the other northward around the base of the old bluff. Both of these occupied what was probably the last western channel of the river to be cut off as the deposits directed its course eastward. The remains of this ancient channel are to be seen in the comparatively broad sloughs that lie to the southwest of the main one. The northernmost of the small creeks probably still has a slight current in it at times of high water, but the other is reduced to a slough with its old channel now cut off from the main river by low banks upon which is a heavy growth of timber.

The richest vegetation now found in the Hay Camp lowland is the spruce forest on the old bars about the granite hills. It has a rather thick mat of mosses and leaf mould and has the scant herbaceous ground flora of this type of woods. The association grades off, on younger areas, to woods with a greater proportion of poplars and willows, in which spruce predominates on the higher of the levee ridges. The meadows themselves are well advanced in the process of drying up, and there is practically no standing water in them by the latter part of the summer.

#### AQUATIC ASSOCIATIONS

Murdock creek flows in an exceedingly crooked channel through a lowland parallel to upper Slave river. It has so little current that vegetation whose normal habitat is in quiet ponds has begun to grow in it, particularly on the lower, inside margins at the curves where the current is slow and depositing a little silt. Deeper water has open associations of the cow-lily *Nymphoanthus variegatus*, and the bur-reed *Sparganium angustifolium*. Nearer shore are *Potamogeton gramineus* var. *graminifolius*, *Sagittaria cuneata*, *Polygonum natans*, and *Hippuris vulgaris*. *Sagittaria* is commonest of these species and in many places is rooted in deep water, sending its long, ribbon-like leaves to the surface.

Although Cree (Mamawi) creek has the form of a flowing stream it has no perceptible current. Consequently it has begun to develop a much more dense aquatic vegetation which increases toward the upper end of the channel. The open water contains pond-weeds such as *Potamogeton Richardsonii*, *P. gramineus* var. *graminifolius*, and *P. vaginatus*. Close to the shore are *Myriophyllum exalbescens*, *Sagittaria cuneata*, *Nymphoanthus variegatus*, *Ranunculus aquatilis* var. *capillaceus*, *Polygonum natans*, *Sparganium multipedunculatum*, and *Chara* sp. None of these attain any great abundance, but occur in patches of individual species or of two or three together. There is an abundant plankton flora that has not yet been examined. Near the lake the patches of *Potamogeton* are similar to those in the open water off the delta.

The next stage is to be found in ponds that have no connexion with larger bodies of water, and is well illustrated in the abandoned channel



A. Slough vegetation along Murdock creek. (*See Figure 12, I.*)



B. Hay meadow slough at the Government Hay Camp, Slave river.

sloughs along Murdock creek and at the 30th base line. Cow-lily *Nympho-  
zanthus variegatus* is the commonest species, but there is a dense tangle  
of other aquatics.

- Primary sp.: *Nympho-zanthus variegatus*  
 Secondary spp.: *Potamogeton Friesii*  
                   *P. praelongus*  
                   *P. pusillus*  
                   *P. Richardsonii*  
                   *P. zosteriformis*  
                   *Sagittaria cuneata*  
                   *Lemna trisulca*  
                   *L. minor*  
                   *Ceratophyllum demersum*  
                   *Ranunculus aquatilis* var. *capillaceus*  
                   *R. Purshii*  
                   *Myriophyllum exalbescent*

The water is only 1 or 2 feet deep over a thick accumulation of vege-  
table remains in the form of black muck. The level is subject to consider-  
able fluctuation during the summer season, so that in July and August such  
aquatic plants as the cow-lily and the arrow-leaf *Sagittaria cuneata* grow  
as emergent vegetation on the semi-dried substratum.

#### SHORE ASSOCIATIONS

As already stated, slough margins have much in common with the  
marshy shores of low river flood-plains and deltas. Their main divisions  
consist of a zone of emergent aquatic plants which have well-developed  
rootstocks colonizing submerged peaty materials, and a zone of sedges and  
grasses which forms a transition to the surrounding meadows. These have  
their simplest organization in partly ponded places like Murdock and Cree  
creeks, where the first zone is nearly all *Equisetum limosum*, and the second  
is a close growth of *Carex rostrata* with *Sium suave* occasional. Near the  
mouth of Cree creek the inter-relationship between this type of shore and  
that of the delta margin is clearly seen (Figure 12, C). *Scirpus validus*,  
a lake shore plant, is in an association with *Typha latifolia*, a pond margin  
species, and enclosed between zones of *Equisetum limosum* and *Carex*  
*rostrata*.

In slough ponds the emergent aquatic association is quite variable in  
its floristic content, not only in different ponds but also around a single  
pond. At the 30th base line a dense growth of the cress *Rorippa palustris*  
surrounds the water, advancing into it with an abundance of floating seed-  
lings. Following this is a zone of *Eleocharis palustris*, and then one in  
which *Glyceria grandis* is the primary species. In similar sloughs at the  
Hay Camp and along Murdock creek *Bidens cernua* takes the place of  
*Rorippa*.

- Primary sp.: *Bidens cernua*  
 Secondary spp.: *Sparganium eurycarpum*  
                   *Sagittaria cuneata*  
                   *Glyceria grandis*  
                   *Beckmannia Syzigachne*  
                   *Eleocharis palustris*  
                   *Rumex maritimus* var. *fueginus*  
                   *Ranunculus sceleratus*  
                   *Epilobium palustre*  
                   *Hippuris vulgaris*



Where the water is nearly or quite evaporated off during the summer, leaving a semi-dry condition for a short period, *Bidens* ceases to make a consistent zone, and is broken up by alternating *Typha latifolia*, *Carex rostrata*, and *Glyceria grandis*. The cat-tail *Typha* is variable in its selection of a habitat, sometimes appearing at the edge of standing water where it alternates with *Bidens*, and in others showing its ability to withstand desiccation better than the latter species by growing in semi-dry muck. Sloughs in a nearly dry state, like those at the Hay Camp, have an open association, on exposed damp ground, of *Beckmannia Syzigachne*, *Alopecurus aequalis*, *Eleocharis acicularis*, and *Rumex maritimus* var. *fueginus*. Several random observations here and in the Murdock Creek meadows indicate that *Beckmannia* finally dominates this group and is possibly the last stage prior to the complete dominance of the meadow vegetation by *Carex trichocarpa* var. *aristata*. There are small patches of *Beckmannia* in nearly pure stand surrounded completely by the sedge.

The second zone of shore plants is made up almost exclusively of *Carex rostrata*, which usually follows the emergent aquatics already described. It has only a few associates, mainly the more water-loving plants of the meadow flora, and merges imperceptibly into the *Carex trichocarpa* association.

#### MEADOW ASSOCIATIONS

In general aspect the wet meadow association of the tall sedge *Carex trichocarpa* var. *aristata* closely resembles that of the delta plains. It is drier here, however, and contains a number of secondary species not observed in the lower areas.

- Primary sp.: *Carex trichocarpa* var. *aristata*  
 Secondary spp.: *Fluminia festucacea*  
*Calamagrostis inextensa* var. *brevior*  
*Agrostis scabra*  
*Polygonum natans* forma *Hartwrightii*  
*Rumex occidentalis*  
*Stellaria longifolia*  
*S. borealis*  
*Rorippa palustris*  
*Geum macrophyllum* var. *perincisum*  
*Potentilla norvegica* var. *hirsuta*  
*Epilobium palustre*  
*Sium suave*  
*Mentha canadensis* var. *glabrata*  
*Stachys scopulorum*  
*Scutellaria epilobiifolia*  
*Galium trifidum*  
*Aster puniceus*  
*A. junceus*  
*Cirsium Drummondii*

The dominant *Carex* is rarely found in fruit in these meadows. The writer has collected the species in deep water on the shore of Moose lake where it was fruiting heavily in August, 1929. It was also fruiting in the wet meadows about lake Mamawi and in the semi-open prairies at the base of the Caribou mountains in 1930. During its fruiting season in 1928 it was necessary to make a long search in the meadows at the Hay Camp and at Murdock creek to find enough fruit for specimens. In these meadows



the plants have interwoven, more or less decumbent stolons or off-sets which produce the current year's growth at their tips. A green bud persists through the winter among the dead leaf-bases at the tip of the stolon, and appears to be an important item in the winter feed of herds of buffalo which have for a long time frequented the sloughs at that season. It is possible that continued yearly "pruning" of these plants has induced a nearly total reliance upon vegetative means of propagation. The sedge makes up the bulk of the hay cut at the Government Hay Camp and at Ryan's Hay Camp on the east side of Slave river just above Demicharge rapids.

The *Calamagrostis* association so prominent on the delta plains is here confined to the willow margins of the sloughs where it is associated with other herbaceous species similar to those listed for such places in the deltas.

#### SHRUB AND TREE ASSOCIATIONS

The configuration of the willow thickets around the sloughs is shown on Figures 13, 14. The transition through these to timber need not be discussed further since it differs very little from that in the deltas. *Populus tremuloides* and *Betula papyrifera* are rather common on the higher ridges separating the sloughs, indicating a somewhat more mesophytic trend in the successions than appears in the newer flood-plains.

The contrast between the shrub successions on sandy river flood-plains and on slough margins is clearly indicated by the willows in the 30th base line district. The following is a table of the species in the order of succession:

#### SLOUGH MARGINS

*Salix planifolia*  
*S. petiolaris*  
*S. Bebbiana*

#### ISLAND FLOOD-PLAIN

*Salix interior* var. *pedicellata*  
*S. lasiandra*  
*S. lutea*  
*S. Bebbiana*

It will be noted that the two situations have no species in common except in the later stages.

At the western margin of the Hay Camp lowland, small streams flow from the Salt Plain to the westward and contribute a little water to the narrow sloughs. A section of one of these sloughs (Figure 12, K) shows the effect of the slightly saline condition. The centre is nearly dry and has a close growth of *Beckmannia Syzigachne* and *Glyceria grandis*, but instead of being followed by a zone of *Carex rostrata* as would be expected, there is one of *Triglochin maritimum*, a characteristic plant of saline slough margins in the upland.

Primary sp.: *Triglochin maritimum*

Secondary spp.: *Hordeum jubatum*  
*Beckmannia Syzigachne*  
*Atriplex patula*  
*Ranunculus Cymbalaria*  
*R. Macounii*  
*Potentilla Anserina*  
*Hippuris vulgaris*  
*Sium suave*  
*Mentha canadensis* var. *glabrata*  
*Plantago major* var. *asiatica*

In some places certain of the secondary species, *Mentha* and *Ranunculus Cymbalaria*, attain primary rank.

Between the *Triglochin* association and the willow margin is a narrow, meadow-like area dominated by *Potentilla Anserina*, *Poa pratensis*, and *Agropyron trachycaulum* var. *typicum*. A mixture of secondary species from the willow margin and from the preceding association occurs with them.

### Flora of the Granite Hills

The granite hills, which rise out of the lowlands, have a distinctive flora which is unrelated to that of most of Wood Buffalo park, and which is made up of extensions of the scrub vegetation east of Slave river, just as the hills themselves are outliers of the Precambrian rocks. No extensive studies of the history of the hill vegetation have been made, and the following list is from general collections and notes made along the Quatre Fourches in 1927, at the Government Hay Camp in 1928, and on the east side of lake Mamawi in 1930. More or less extensive investigations of this flora were carried on by the writer and his wife in 1926, in the vicinity of Shelter point, on the north shore of lake Athabaska (51, 57, 58).

- Primary spp.: *Pinus Banksiana*  
*Betula papyrifera* var. *neolaskana*  
*Picea glauca*  
*Amelanchier florida*  
*Arctostaphylos Uva-ursi*  
*Saxifraga tricuspidata*
- Secondary spp.: *Cryptogramma crispa* var. *acrostichoides*  
*Polypodium virginianum*  
*Juniperus communis* var. *montana*  
*Agrostis scabra*  
*Festuca saximontana*  
*Elymus innovatus*  
*Poa palustris*  
*P. glauca*  
*Calamagrostis canadensis*  
*Carex siccata*  
*Maianthemum canadense*  
*Salix Bebbiana*  
*Populus tremuloides*  
*Alnus crispa*  
*Geocaulon lividum*  
*Anemone multifida* var. *hudsoniana*  
*Corydalis sempervirens*  
*Heuchera Richardsonii*  
*Ribes oxycanthoides*  
*Fragaria glauca*  
*Potentilla tridentata*  
*P. pennsylvanica*  
*Geum triflorum*  
*Prunus pennsylvanica*  
*Rubus idaeus* var. *canadensis*  
*Rosa acicularis*  
*Lathyrus ochroleucus*  
*Shepherdia canadensis*  
*Epilobium angustifolium*  
*Vaccinium canadense*  
*Galium boreale*

*Symphoricarpos albus* var. *pauciflorus*  
*S. (vaccinoides?)*  
*Campanula rotundifolia*  
*Solidago oreophila*  
*Achillea Millefolium*  
*Arnica chionopappa*  
*Antennaria nitida*  
*Hieracium canadense*

The chief variations in the jackpine-birch scrub timber occur where crevices or depressions are left undisturbed for sufficient time to develop a spruce forest, or where clearing and burning have been the rule for a long time. The first of these conditions is found in a few places among the larger hills along the Quatre Fourches. A moss and humus carpet develops, with a rather open stand of spruce and scanty herbaceous flora. On the other hand the low "islands" in the Lake Mamawi district have been campsites for generations of hunters and travellers, and have been burned off repeatedly. The result is a scrubby aspen timber bringing most of its characteristic species, or possibly the complete absence of timber with the introduction of a prairie flora closely allied to that of the river bank at Peace point. The small patches of prairie, however, may be a perfectly normal growth in this area. There are several hills with small patches of clayey soils which have long been used as garden spots, and the prairies are found on such of these spots as are undisturbed.

### Changes Caused by Burning and Clearing

The writer has studied no newly burned areas in the lowlands. General observations indicate that the changes resulting from fire do not differ from those in the upland, discussed elsewhere. The timbered areas are most affected and return to their normal state very soon or by the introduction of stages involving much deciduous woods, chiefly *Populus tremuloides* according to the nature of the fire.

The cutting of the *Calamagrostis* meadow around the Government Dog Camp on lake Mamawi has simply given the miscellaneous group of plants normally found scattered along the willow margins a chance to spread abundantly. The camp has not been established long enough for the introduction of other species.

Primary sp.: *Potentilla Anserina*  
 Secondary spp.: *Urtica gracilis*  
                   *Rumex mexicanus*  
                   *Anemone canadensis*  
                   *Geum macrophyllum* var. *perincisum*  
                   *Mentha canadensis* var. *glabrata*  
                   *Physostegia parviflora*  
                   *Achillea sibirica*  
                   *Aster junceus*  
                   *Erigeron philadelphicus*  
                   *Solidago canadensis*

The repeated cutting of the sloughs at the Hay Camp has introduced many changes in the meadow vegetation. Large areas have been dominated by the tickle-grass *Agrostis scabra* which is of very little value as hay. After a few years the meadows have to be abandoned and new ones cut,

but the writer has no data as to the length of time required for the original condition to return. A study of the extensive haying areas along the Quatre Fourches would afford the information, since they have been used for many years by the people of Chipewyan. The following species grow in more or less profusion in the Hay Camp meadow along with the tickle-grass.

*Poa pratensis*  
*Beckmannia Syzigachne*  
*Flumina festucacea*  
*Calamagrostis canadensis*  
*Polygonum aviculare*  
*Rumex occidentalis*  
*Chenopodium album*  
*Stellaria longifolia*  
*Ranunculus Macounii*  
*Neslia paniculata*  
*Brassica arvensis*  
*Potentilla norvegica* var. *hirsuta*  
*Geum macrophyllum* var. *perincisum*  
*Galium trifidum*  
*Achillea Millefolium*  
*A. sibirica*  
*Aster Lindleyanus*  
*Erigeron acris* var. *asteroides*  
*E. philadelphicus*  
*Senecio vulgaris*  
*S. eremophilus*  
*S. indecorus*  
*S. pauperculus*  
*Cirsium Drummondii*

It will be readily noted that the cutting here has had much the same effect as that at the Dog Camp, that is, the spread of "weedy" species from slough margins. With these are mixed, in all sorts of combinations, the normal vegetation of the sloughs. A few, such as the mustards, are obviously foreign introductions to the region.

In the Hay Camp clearing the smart-weeds *Polygonum aviculare*, lamb's quarters *Chenopodium album*, and more introduced mustards *Thlaspi arvense*, *Capsella Bursa-pastoris*, and *Camelina sativa*, have become common weeds. A small patch of alsike clover *Trifolium hybridum* has been planted and appears to be doing well. One of the most abundant weeds at the camp is a common species of open woods and prairies throughout the region, *Mertensia paniculata*.

### Summary

The appended diagram, Figure 15, summarizes the foregoing treatment of the types of vegetation in the lowland areas of the Athabaska-Peace Delta region. It indicates the general trend in the development of mesophytic forests upon the various types of open ground being produced here by the ordinary physiographic processes.



## ANNOTATED LIST OF FLOWERING PLANTS AND FERNS

So far as is known at present the Wood Buffalo Park area was entirely denuded of its flora during the Pleistocene glaciation, so that the present cover has migrated into the region and established itself since that time.<sup>1</sup> This new flora consists of elements from widely separated regions and may be roughly separated into two groups of species. The first consists of the wide-ranging plants known throughout the Canadian forest; the second is made up of species from the mountains and plains of the western and interior parts of the continent.

The larger part of the flora is made up of species in the first of these groups. The major trees are *Picea glauca*, *P. mariana*, *Pinus Banksiana*, *Populus tremuloides*, *P. tacamahacca*, and *Betula papyrifera* var. *neoalaskana*. With the exception of *Pinus Banksiana*, which reaches its greatest northwestward extension in the Athabaska-Great Slave Lake region, these species range from Newfoundland to Alaska. Among the herbs, *Carex tenuiflora* and *Glyceria grandis* illustrate the same wide range. The chief variation in this group is a sub-arctic tendency in exposed situations such as high, rocky, and sandy hills or cold bogs.

The mountain and plain elements may be divided into three groups. The first consists of species widely distributed from western Yukon or Alaska southward in the Cordilleran region and eastward in the Great Plains. It is represented in Wood Buffalo park by such plants as *Bromus Pumpellianus*, *Stipa comata*, *Elymus innovatus*, *Carex obtusata*, *C. Rossii*, *Salix lasiandra*, *Trientalis europaea* var. *arctica*, and many others. A second group is made up of plants from more southern mountain and interior plain districts. It may be illustrated by *Poa arida*, *Spartina gracilis*, *Fluminia festucea*, *Agropyron Smithi* var. *molle*, and *Salix lutea*. The third group is of species from the western mountains that also range eastward to Ontario and New York, and is illustrated by *Carex Richardsonii* and *C. trichocarpa* var. *aristata*.

In addition to these major elements, certain marginal floras should be mentioned. A distinguishing feature of nearly all of the heavily timbered areas is the absence of many species that are usually found in the richer parts of the Canadian forest (53). The causes of this are thought to be the relatively short time available since much of the country was drained of its post-Glacial lakes, and the retarding action of the severe climate upon the development of soils. This rare or entirely absent element in the flora includes such species as *Abies balsamea*, *Cinna latifolia*, *Circaea alpina*, *Thelypteris Dryopteris*, *T. spinulosa*, *Streptopus roseus*, *Habenaria orbiculata*, and many others. It is of considerable interest that the first three of these have now been found in the upper delta of Athabaska river, which appears to be at the present northern margin of their range. A second marginal element is found at the eastern edge of the Caribou Mountain plateau, and includes species of the Cordilleran region such as *Pinus contorta* var. *latifolia*, *Arctagrostis arundinacea*, *Carex loliacea*, and *Thalictrum sparsiflorum*.

<sup>1</sup> See also the writer's treatment of this matter in "The Distribution and Affinities of the Vegetation of the Athabasca-Great Slave Lake Region; *Rhodora* xxxii, p. 198 (1930).

Source materials for the following list of the vascular flora have consisted mainly of the writer's own collections. Most of these were made during the summers of 1928-29-30, and a considerable number of records for the Peace-Athabaska Delta region are derived from collections made in the summers of 1926-27. There are, in all, 2,246 field numbers, involving 10,057 specimens. Mr. John Russell, D.L.S., has kindly loaned a small collection made by him in the northern area of the park during the summer of 1926. Seventy-eight numbers from this collection, including 76 species, have been examined by the writer and added to the list. About a dozen specimens were presented to the writer by Mrs. Conibear of Fort Smith, and have been noted accordingly. It is believed that these collections include nearly all the flowering plants and ferns known to grow in the region at the present time, but with continued exploration the list should increase considerably, since the writer makes no pretence of having formulated a complete flora. A few unverified records, less than half a dozen, have been included, with accompanying notes on their sources, and a few may be added as the further study of earlier collections is made. This number is bound to be small, however, since very few travellers have ever entered the interior country, and have not collected the less conspicuous species. Unless otherwise indicated, the numbers cited in the list are the writer's.

Most of the collections are from that part of the park area that lies south of the 60th parallel. A few, however, come from neighbouring districts and may be duplicated with regard to habitat within the area. Plants from the eastern edge of the Caribou Mountain plateau were obtained just outside the western boundary of the park, but could probably be duplicated a little farther to the northward where the plateau extends east of the boundary. A number of records are from Fort Smith and vicinity, and from lower Slave River district, both of which are east and northeast of the boundary, but they have been included for the light they may throw upon problems of distribution. Fort Smith and the Smith Portage area lie on a westward extension of the Precambrian rocks which make up the country east of Slave river, and accordingly have a somewhat more boreal flora. This is related to that of various uplands and granite hills in the interior or in upper Slave River district.

The following notes will serve to explain the localities cited in the list, the order in which they are here given being similar to that used in the citations. It should be understood that the figures for longitude and latitude are approximate, and locate only in a general way the centres from which field work was carried on.

- (1) *Reed Portage, Upper Embarras River, Lat. 58° 28', Long. 111° 32'.*

A woodland trail about  $\frac{3}{4}$  mile long between Embarras river, near the point where it leaves the Athabaska, and the head of Cree (Mamawi) creek. Reed's trading post is at the upper end of it, and has been for some years a stopping place on the winter trail between McMurray and Chipewyan. This trail leads over the portage, thence through the creek and across lake Mamawi.

- (2) *Cree (Mamawi) Creek*, Lat.  $58^{\circ} 29'$ , Long.  $111^{\circ} 30'$ .

Cree creek, called Mamawi creek on very recent maps, is an abandoned channel in the western part of the Athabaska delta. It is about 14 miles long and has no appreciable current. It has long been used as a short route between Chipewyan and Athabaska river.

- (3) *Lower Delta of Athabaska River*, Lat.  $58^{\circ} 36' 30''$ , Long.  $111^{\circ} 5' 30''$ .

A mud, sand, and driftwood deposit near the lakeward end of Embaras river, in Athabaska delta.

- (4) *East Shore of Lake Mamawi*, Lat.  $58^{\circ} 35'$ , Long.  $111^{\circ} 22'$ .

A delta lowland area composed of mud flats, marshes, and low granite knolls. A few willow clumps grow on the higher bars. The presence of the granite hills, with occasional small clay deposits on them, leads to a mixture of the sub-arctic flora that prevails to the eastward, with a few plants peculiar to the dry prairies.

- (5) *Hay (Prairie) River*, Lat.  $58^{\circ} 37'$ , Long.  $111^{\circ} 44'$ .

A short, sluggish stream which consists of several channels, and carries the water from lake Claire to lake Mamawi through an expanse of delta lowland.

- (6) *Along Quatre Fourches River*, Lat.  $58^{\circ} 40'$ , Long.  $111^{\circ} 20'$ ; and Lat.  $58^{\circ} 22'$ , Long.  $111^{\circ} 35'$ .

The Quatre Fourches is a short stream flowing between Peace river and lakes Athabaska and Mamawi. Near the Peace its banks are well wooded, but near the lakes it flows through low delta flats. There are several granite hills along its banks which introduce a somewhat more boreal element to the local flora. Most of the collections are from two localities, one near the forks, just above lake Athabaska, and the other near Peace river. A few are from the delta deposit in lake Athabaska. As noted elsewhere, the Quatre Fourches, at times when the Peace is low, reverses its current and flows away from the lake.

- (7) *30th Base Line District, Slave River*, Lat.  $59^{\circ} 7'$ , Long.  $111^{\circ} 27'$ .

Collections here are from the vicinity of the point at which the 30th base line crosses Slave river. Part of the material is from a large island flood-plain, and part from the bank of the river itself or from abandoned channel sloughs nearby.

- (8) *Murdock Creek District*, Lat.  $59^{\circ} 14'$ , Long.  $111^{\circ} 34'$ .

Murdock creek flows with a sluggish current through a very crooked channel more or less parallel to Slave river, into which it finally empties. Most of the collections are from sloughs near it.

- (9) *Government Hay Camp District, Slave River*, Lat.  $59^{\circ} 31'$ , Long.  $111^{\circ} 28'$ .

This area is along Slave river about 27 miles above Fitzgerald. Collections are from the neighbouring hay meadow sloughs, from adjacent uplands just north and west of the camp, from occasional granite knolls, and from the river bank itself.



- (10) *Near Heart (Raup) Lake*, Lat.  $59^{\circ} 41'$ , Long.  $111^{\circ} 56'$ .

Heart lake, called Raup lake on very recent maps, is in the Salt Plain region, about 16 miles southwest of Fitzgerald. The collections recorded here are from timbered ridges and prairies about 2 miles south and east of the lake.

- (11) *Fort Smith*, Lat.  $60^{\circ} 00' 30''$ , Long.  $111^{\circ} 53'$ .

Collections recorded thus are from the bank of the Slave river, from the village itself, and from nearby sloughs and upland woods. A few numbers are from the Smith Portage road near its eastern end, and from the vicinity of upper Smith rapids near Fitzgerald.

- (12) *Near Mission Farm*, Lat.  $59^{\circ} 57' 30''$ , Long.  $112^{\circ} 17'$ .

This area is along Salt river about 20 miles by road southwest of Fort Smith. The Roman Catholic Mission maintained a farm there for many years, raising cattle and hardy grains. The collections recorded are from the Salt Plains between the farm and the brine springs, which lie at the base of the Salt Mountain escarpment.

- (13) *Salt Mountain*, Lat.  $59^{\circ} 53'$ , Long.  $112^{\circ} 23'$ .

Salt mountain is a limestone escarpment overlooking the Salt Plains to the southwest of Mission Farm. The collections are from the timbered upland.

- (14) *Pine Lake District*, Lat.  $59^{\circ} 34'$ , Long.  $112^{\circ} 15'$ .

Most of the collections thus recorded were obtained within a radius of 5 miles of the lake, in sloughs, meadows, upland timber, and on lake shores.

- (15) *Observation Ridge, About 10 Miles South of Pine Lake*, Lat.  $59^{\circ} 27'$ , Long.  $112^{\circ} 20'$ .

A few numbers collected at this place are from a burned-over muskeg and gravel ridge area. It is a camping site on the pack trail between Pine lake and Peace point.

- (16) *Round Lake, About 18 Miles South of Pine Lake*, Lat.  $59^{\circ} 20'$ , Long.  $112^{\circ} 23'$ .

This is a small sink-hole pond along the trail between Pine lake and Peace point. It has a fluctuating water-level and a sandy margin. A nearly complete collection of its marginal vegetation was made.

- (17) *Peace Point*, Lat.  $59^{\circ} 7'$ , Long.  $112^{\circ} 26'$ .

Peace point is at a bend in Peace river where the bank consists of gypsum cliffs on the top of which is a semi-open prairie area. A short distance back from the river is an older bank, likewise composed of gypsum. The whole area is spotted with sink-holes, some of which are dry, whereas others contain sloughs. Collections are from the prairies, the older and more recent river banks, and from local flood-plain deposits on the lower side of the point. The spot has been a favourite camp site and meeting ground for generations of Indians and white men.

- (18) *Sink-hole Slough, 16 Miles East of Moose Lake*, Lat.  $59^{\circ} 30' 20''$ , Long.  $112^{\circ} 43' 30''$ .

This is a large sink-hole with sandy banks and a stream running into a pond at its lowest part. A wide variation in habitats occurs, from dry, unstable, sandy slopes to wet sloughs. The distance from Moose lake is by the pack trail that leads to Pine lake.

- (19) *Moose (Eight) Lake*, Lat.  $59^{\circ} 36'$ , Long.  $113^{\circ} 7'$ .

The position given here is approximately that of the ranger station about  $1\frac{1}{2}$  miles from the eastern end of the lake. The collections are from various habitats within a radius of 5 miles from this point. Moose lake is known as Eight lake on the most recent maps.

- (20) *Indian Graveyard, Peace River*, Lat.  $58^{\circ} 42' 30''$ , Long.  $113^{\circ} 51'$ .

The collections are from the woods along the river, from various abandoned channel sloughs in the vicinity, and from a nearby poplar bluff. The locality is about 6 miles east of the western boundary of the park, and about 150 miles (by the river) above the Slave. It is a popular Indian rendezvous, at the southern end of a pack trail that leads around the base of Caribou mountains to the Jackfish Lake country.

- (21) *Base of Eastern Slope of Caribou Mountains*, Lat.  $58^{\circ} 57'$ , Long.  $113^{\circ} 55'$ ; and Lat.  $58^{\circ} 51'$ , Long.  $113^{\circ} 57'$ .

The collections are from two localities, as noted. One is about 11 miles north of the Peace and the other is about 18 miles. Woods and semi-open prairies make up most of the habitats.

- (22) *Eastern Edge of Caribou Mountain Plateau*, Lat.  $58^{\circ} 54'$ , Long.  $114^{\circ} 9'$ ; and Lat.  $58^{\circ} 51'$ , Long.  $114^{\circ} 9'$ .

Most of the collections are from the first of the two localities cited, and are from upland timber and muskeg areas. Both places are reached from the 11-mile prairie district, and are just west of the western boundary of the park.

- (23) *Ninishith Hills*, Lat.  $59^{\circ} 45'$ , Long.  $113^{\circ} 7'$ .

The locality given here is approximately that at which Little Buffalo river cuts through the range of hills.

- (24) *Lower Slave River*.

The few collections recorded thus are mainly from the banks of the stream not far below Grande Detour, about 60 miles below Fort Smith.

- (25) Localities cited by Russell:

*Little Buffalo River*: mainly that part of the river between Lobstick creek, west of Salt River settlement, and Nyarling river.

*Sass Creek, Bear, Clewi, and Nyarling Rivers*: all western tributaries of the Little Buffalo, draining the northern area of the park. The Nyarling forms part of the northern boundary of the park.

Terms of frequency, such as *rare*, *occasional*, *common*, and *abundant*, are self explanatory. For further notes upon the relative abundance of many species reference should be made to the general description of the vegetation given elsewhere by the writer. Terms descriptive of habitats also need little explanation, but a few notes will make for clarity. *Upland* denotes all of the area above the recent flood-plain and delta deposits of the main rivers, and includes the rocky hills in the *lowland* flood-plains also. *Rich woods* usually denotes a spruce timber with a thick mat of mosses and very little undergrowth. *Muskeg timber* is the black spruce forest that develops in old muskegs. *Open woods* refers to the upland, park-like, jackpine or poplar timber that is so common in the area. *Slough* and *wet meadow* are used rather interchangeably to denote a wet depression covered with sedges and grasses. A *muskeg* is an undrained depression whose cover consists largely of mosses, of which *Sphagnum* is the commonest.

The few notes on poisonous plants are derived largely from Dr. L. H. Pammel's exhaustive manual (46). A few notes upon this subject and also upon the edible qualities of certain species are from James R. Anderson's studies in British Columbia (1).

The order and definition of families is that presented in Engler and Gilg's "Syllabus der Pflanzenfamilien" (9th and 10th editions), and the arrangement of genera, although generally in accord with the same work, has been changed somewhat in the Gramineae and Cruciferae. The order used in the Gramineae is taken from Hitchcock's "Genera of Grasses of the United States" (69) which has been widely accepted among students of the group. Lack of uniformity in the organization of the difficult group of the Cruciferae has led the writer to use that of Gray's Manual, one of the more commonly known texts. So far as possible, the International Rules of Botanical Nomenclature have been followed in the selection of names, and only those synonyms have been included that will make the list usable with standard manuals such as Rydberg's "Flora of the Rocky Mountains and Adjacent Plains," Britton and Brown's "Illustrated Flora of the Northern United States and Canada," and "Gray's New Manual of Botany" (7th edition). References to recent treatments of certain species or groups of species are given whenever they are available. The writer has made no extensive effort to obtain local common names, and those given have been selected from the standard manuals because of their wide usage in other regions.

Many persons have been of assistance in the preparation of the list. The writer is most indebted to Professor M. L. Fernald of Harvard University, who has given freely of his time and extensive knowledge of northern floras. In several groups, such as *Potamogeton*, *Carex*, *Draba*, *Erigeron*, *Antennaria*, *Arnica*, and *Taraxacum*, he has made many of the determinations of difficult species, and has kindly checked the entire list for nomenclatorial errors. Dr. O. E. Jennings, of the University of Pittsburgh, has lent much encouragement and assistance, particularly in the earlier stages of the work. Thanks are due also to Dr. J. H. Schaffner, of Ohio State University, who has checked the 1926-27 collections of *Equisetum*; to Dr. F. W. Pennell, of the Academy of Natural Sciences, Philadelphia, who has verified the determinations of the Scrophulariaceae; to the late Mr. K. K.

Mackenzie, of New York, and Professor A. S. Hitchcock, of the United States Department of Agriculture, who have checked over, respectively, the 1926-27 collections of *Carex* and the Gramineae; to Mr. C. A. Weatherby, of Gray Herbarium, who has checked all of the ferns and fern allies; and to Dr. I. M. Johnston, of the Arnold Arboretum, who has verified the determinations of the few specimens of Boraginaceae.

## OPHIOGLOSSACEAE

**Botrychium Lunaria** (L.) Sw. MOONWORT.

Occasional in upland aspen woods and in small prairie openings. Young shoots were found in Pine Lake district June 22, immature sporangia July 3, and fruiting plants July 9.

Pine Lake district, No. 1452.

## POLYPODIACEAE

**Woodsia ilvensis** (L.) R.Br. RUSTY WOODSIA.

Common in crevices on granite hills in the Athabaska-Peace delta and along upper Slave river. Found in fruit July 9 and August 15.

Along Quatre Fourches river, No. 8; Government Hay Camp, Slave river, No. 1450.

**W. oregana** D.C. Eat.

Apparently a rare fern in the region. Found thus far only in a moist ravine on a granite hill in the Athabaska-Peace delta.

East shore of lake Mamawi, No. 1453-a.

**Cystopteris fragilis** (L.) Bernh. *Filix fragilis* (L.) Gilib. BRITTLE FERN.

Common in shaded rock crevices, reaching greatest size and abundance in moist ravines. Found fruiting July 19 and August 8.

Limestone sink-hole at Peace point, No. 1454; east shore of lake Mamawi, No. 1453.

**Pteretis nodulosa** (Michx.) Nieuw. *Onoclea Struthiopteris* Am. auth., not Hoffm. *Matteuccia Struthiopteris* Am. auth., not Todaro. See Rhod. xvii, 164 (1915). OSTRICH FERN.

Common in woods along lower Athabaska river, but not found elsewhere in Wood Buffalo park. Collected thus far only in sterile condition.

Reed portage, upper Embarras river, No. 1448.

**Cryptogramma crispa** (L.) R.Br., var. *acrostichoides* (R.Br.) C. B. Clarke. *C. acrostichoides* R.Br. PARSLEY FERN.

Common in crevices on the granite hills along upper Slave river. Fruiting abundantly in August.

Government Hay Camp district, Slave river, No. 1451.

**Polypodium virginianum** L. See Rhod. xxiv, 125 (1922). COMMON POLYPODY.

Common in crevices on granite hills in the Athabaska-Peace delta and along upper Slave river. Found in fruit June 9 to August 16.

East shore of lake Mamawi, No. 1456; along Quatre Fourches river, No. 10; Government Hay Camp district, Slave river, No. 1455.

## EQUISETACEAE

**Equisetum arvense** L. COMMON HORSETAIL.

Common in woods and thickets throughout the area, occupying a great variety of habitats. Fertile stems observed June 18 in the gorge of Little Buffalo river, and June 20 in Pine Lake district.

Along Quatre Fourches river, No. 45; 30th base line district, Slave river, Nos. 55, 58, 62, 66; Government Hay Camp district, Slave river, Nos. 1481, 1488; Fort Smith, No. 63; Pine Lake district, Nos. 1482, 1489, 1490; Peace point, No. 1480; sink-hole 16 miles east of Moose lake, No. 1483; Moose (Eight) Lake district, Nos. 1484, 1485, 1486, 1487.

**E. pratense** Ehrh. GOOSEGRASS.

Abundant in the poplar and poplar-spruce woods on river flood-plains throughout the area. In such situations along Slave and lower Peace rivers it forms a dense cover on the forest floor. In its early, succulent stages it is eaten with apparent relish by grazing horses. Observed in fruit June 9 to 20.

Along Quatre Fourches river, No. 45; 30th base line district, Slave river, Nos. 44, 47; Government Hay Camp district, Slave river, No. 1497; Fort Smith, No. 43; Pine Lake district, No. 1493; near Round lake, about 18 miles south of Pine lake, No. 1494; Peace point, No. 1495; Moose (Eight) Lake district, Nos. 1496, 1498; base of eastern slope of Caribou mountains, No. 1492.

**E. sylvaticum** L., var. **pauciramosum** Milde. See Rhod. xx, 129 (1918). WOODLAND HORSETAIL.

Common in rich spruce woods on the uplands, and in semi-open prairies at the base of Caribou mountains. Not collected in the lowland forests. Fruiting cones nearly all gone by the last week in June.

Moose (Eight) Lake district, No. 1462; base of eastern slope of Caribou mountains, Nos. 1457, 1459, 1460; eastern edge of Caribou Mountain plateau, No. 1458.

**E. palustre** L. MARSH HORSETAIL.

Common on very low mud bars along the rivers, where it has a trailing habit and colonizes areas that are submerged in flood times. Observed in fruit in late June and early August.

Government Hay Camp district, Slave river, No. 1470; lower Slave river, No. 40.

**E. limosum** L. *E. fluviatile* L. See Rhod. xxiii, 43 (1921). SWAMP HORSETAIL.

Abundant on the slough margins of lakes and ponds, and on the muddy shores of river flood-plains. Fruiting cones observed in late June and the first half of July.

Lower delta of Athabaska river, No. 33; east shore of lake Mamawi, No. 1473; Government Hay Camp district, Slave river, Nos. 1478, 1479; Fort Smith, No. 31; Pine Lake district, No. 1477; sink-hole 16 miles east of Moose lake, No. 1471; Moose (Eight) Lake district, Nos. 1475, 1476; Indian graveyard, Peace river, No. 1472; lower Slave river, Nos. 25, 26.

**E. prealtum** Raf. *E. robustum* A.Br. *E. hyemale* L., var. *robustum* (A.Br.) A. A. Eat.  
SCOURING RUSH.

Common on the higher parts of sand-bars along the main rivers, and in open sandy places on the uplands. Observed in fruit along upper Slave river June 14, but collected elsewhere only in sterile condition. Known to be poisonous to cattle and horses, especially when eaten in its mature stages.

Along Peace river near the Slave, No. 74; 30th base line district, Slave river, No. 73; Peace point, No. 1500; sink-hole slough 16 miles east of Moose lake, No. 1499.

**E. variegatum** Schleich. NORTHERN SCOURING RUSH.

Apparently rare in Wood Buffalo park, and confined to sandy lake shores. Fruiting stems collected July 6.

Pine lake, No. 1463.

**E. scirpoides** Michx.

Abundant in timbered muskegs throughout the area. In many places it makes a large part of the ground cover beneath the black spruces. Found in fruit between June 20 and August 6.

Pine Lake district, Nos. 1467, 1468; Moose (Eight) Lake district, No. 1469; base of eastern slope of Caribou mountains, Nos. 1465, 1466.

#### LYCOPODIACEAE

**Lycopodium annotinum** L. See Rhod. xvii, 123 (1915). STIFF CLUB-MOSS.

Occasional in rich spruce woods where it grows in a deep mat of mosses. Fruiting cones just beginning to form on July 1 in Pine Lake district, and maturing on the slopes of Caribou mountains July 12.

Pine Lake district, No. 1501; eastern slope of Caribou mountains, No. 1502.

**L. complanatum** L. GROUND CEDAR.

Common in dry, usually jackpine, woods on the uplands. In the older pine forests it sometimes forms dense mats which exclude nearly all other plants. Fruiting cones just beginning to form in the latter half of June, about  $\frac{3}{4}$  inch long July 5, and maturing in late July.

Pine Lake district, Nos. 1504, 1505; Salt mountain, No. 1507; near sink-hole 16 miles east of Moose lake, No. 1506; eastern edge of Caribou Mountain plateau, No. 1503.

#### PINACEAE

**Picea glauca** Voss. *P. canadensis* B.S.P., not Link. *P. alba* Link. See Rhod. xvii, 59-62 (1915). CANADA, or WHITE SPRUCE.

The predominating forest tree throughout Wood Buffalo park. It reaches its best development on the banks of the main rivers and upon the better-drained soils of the uplands. Seventy-five foot trees, 2 feet in diameter at the base, are common in the lowlands, and larger ones, 3 feet or more in diameter, occur in localized areas in the country between Pine Lake district and Caribou mountains. A 75-foot tree measured at the Government Hay Camp was 110 years old. The uses of the Canada spruce

are legion. It supplies abundant firewood and a light, easily worked lumber. The Indians have for generations used its readily split wood for the frame-work of their canoes, its long fibrous roots for sewing and binding their birch-bark canoes and utensils, and its gum for making water-tight seams. Trappers, traders, and missionaries found the straight-boled trees ready material for building cabins, and in later times have established sawmills for the preparation of a local lumber supply.

Along Quatre Fourches river, No. 103; 30th base line district, Slave river, No. 102; Government Hay Camp, Slave river, No. 1526; Fort Smith, No. 100; Peace point, No. 1525; Moose (Eight) Lake district, Nos. 1527, 1528, 1529.

**P. mariana** (Mill.) B.S.P. *P. nigra* Link. BLACK, or BOG SPRUCE.

The most abundant tree in muskeg timber, where it forms dense stands. It is rarely observed more than 5 or 6 inches in diameter, and is most commonly smaller than this. In Caribou mountains it is associated with *Pinus contorta* var. *latifolia* on clay hill tops.

Moose (Eight) Lake district, Nos. 1523, 1524; eastern edge of Caribou Mountain plateau, No. 1522.

**Abies balsamea** (L.) Mill. BALSAM FIR.

Rare in Wood Buffalo park, and apparently confined to the upper delta of Athabaska river. It has been reported in the gorge of Little Buffalo river (17), but the report has not been confirmed.

Reed portage, upper Embarras river, No. 1521.

**Larix laricina** (Du Roi) Koch. *L. americana* Michx. TAMARACK, LARCH.

Common in muskegs throughout the area. The tamarack plays only a secondary part in the muskeg timber, and rarely exceeds 8 to 10 inches in diameter. It does not appear to be flourishing, and dead trees are very commonly seen, although the cause of this has not been determined.

Pine Lake district, No. 1520; Moose (Eight) Lake district, Nos. 1518, 1519; base of eastern slope of Caribou mountains, No. 1517; Clewi river, Russell, No. 27.

**Pinus contorta** Loudon, var. *latifolia* Engelm. *P. Murrayana* Balf. *P. contorta* var. *Murrayana* (Balf.) Engelm. LODGEPOLE PINE.

Rare in Wood Buffalo park, and apparently confined to the Caribou mountains, where it is associated with black spruce on clay hill tops.

Eastern edge of Caribou Mountain plateau, Nos. 1508, 1509.

**P. Banksiana** Lamb. *P. divaricata* of auth. JACK, or BANKSIAN PINE.

Abundant on dry sand-plains and on sand and rock hills throughout the area. The open, park-like timber of jackpine is characteristic of large tracts on the uplands. The trees were producing enormous quantities of pollen between the middle and last of June, 1928.

Near Heart (Raup) lake, No. 1512; Pine Lake district, No. 1511; Moose (Eight) Lake district, No. 1510.

**Juniperus communis** L., var. **montana** Ait. *J. sibirica* Burgsd. DWARF JUNIPER.

Common on dry, rocky hills along upper Slave river and on jackpine ridges along Bear river. In fruit about mid-August.

Government Hay Camp district, Slave river, No. 1516; Bear river, *Russell*, No. 38.

**J. horizontalis** Moench. *Sabina horizontalis* (Moench.) Rydb. CREEPING JUNIPER.

Common on dry prairies and rocky hills. Collected in fruit during late August.

Near Heart (Raup) lake, Nos. 1513, 1514; Fort Smith, No. 121; near Mission Farm, No. 1515; Little Buffalo and Bear rivers, *Russell*, No. 34.

#### TYPHACEAE

**Typha latifolia** L. CAT-TAIL.

Common on the shores of lakes and ponds, where its stout rootstocks are colonizing shallow water. In flower in late July and in fruit by mid-August. Muskrats feed extensively on the rootstocks.

Cree (Mamawi) creek, No. 1530; lower delta of Athabaska river, No. 126; Murdock Creek district, No. 1533; near Heart (Raup) lake, No. 1532; Moose (Eight) Lake district, No. 1531.

#### SPARGANIACEAE

**Sparganium eurycarpum** Engelm. See Rhod. xxiv, 26 (1922). BROAD-FRUITED BUR-REED.

Common at the margins of ponds and slow streams in Athabaska-Peace delta. Young shoots were collected in mid-June, immature fruits in late July, and fully mature fruits August 15.

Cree (Mamawi) creek, No. 1540; 30th base line district, Slave river, No. 128; Murdock Creek district, No. 1541.

**S. multipedunculatum** (Morong) Rydb. See Rhod. xxvii, 190 (1925).

The commonest bur-reed in the park area. It is most abundant at the margins of lakes, sloughs, and slow streams. Collected in flower during the last week in July, and in fruit during the third week in August.

Cree (Mamawi) creek, No. 1535; Murdock Creek district, No. 1536; Moose (Eight) lake, Nos. 1537, 1538.

**S. angustifolium** Michx. See Rhod. xxiv, 26 (1922). NARROW-LEAVED BUR-REED.

Occasional in ponds and slow streams. Flowers collected in late July and immature fruits August 1.

Murdock creek, No. 1544; Pine Lake district, No. 1543; Indian graveyard, Peace river, No. 1542.

**S. minimum** Fries.

Apparently rare in Wood Buffalo park, and found only at the margin of an upland muskeg pond. In flower July 9.

Pine Lake district, No. 1539.



## POTAMOGETONACEAE

**Potamogeton gramineus** L., var. **graminifolius** Fries. *P. heterophyllus* of most recent Am. auth., not Schreb. See Rhod. xxiii, 189 (1921). PONDWEED.

Common in shallow lakes and slough ponds, and abundant in the lower deltas of Athabaska and Peace rivers. Collected in fruit during late July and the first three weeks of August.

East shore of lake Mamawi, No. 1548; Murdock Creek district, No. 1546; Fort Smith, No. 135; Moose (Eight) Lake district, No. 1545; Indian graveyard, Peace river, No. 1547.

**P. praelongus** Wulf.

Common in the deeper water off-shore in relatively shallow lakes. Fruiting in mid-August.

Murdock Creek district, No. 1572; Moose (Eight) lake, Nos. 1571, 1570.

**P. Richardsonii** (A. Bennett) Rydb.

Abundant in shallow lakes and slough ponds throughout Wood Buffalo park. In lake Mamawi it is associated with *P. vaginatus* in the great patches of weed that clog the broad expanse of shallow water. Flower buds collected June 16, flowers June 26, and mature fruits from late July to the third week in August.

Lake Mamawi, No. 1551; 30th base line district, Slave river, No. 134; Murdock Creek district, No. 1556; Pine Lake district, Nos. 1557, 1559; Moose (Eight) Lake district, Nos. 1553, 1554, 1555, 1560; sink-hole 16 miles east of Moose lake, No. 1552; Indian graveyard, Peace river, No. 1558.

**P. zosteriformis** Fernald. See Mem. Gray Herb. iii, 36-40 (1932).

Apparently common in shallow, marshy lakes and slough ponds. Fruiting specimens collected in late July and early August.

Murdock Creek district, No. 1565; Moose (Eight) lake, Nos. 1566, 1567.

**P. Friesii** Rupr.

Apparently common in shallow lakes and slough ponds. Fruiting in late July.

Murdock Cree district, No. 1564; Moose (Eight) lake, No. 1563.

**P. pusillus** L., var. **polyphyllus** Morong.

Collected, thus far, only in an abandoned stream channel in the Athabaska delta. In fruit in mid-August.

Cree (Mamawi) creek, No. 1569.

**P. panormitanus** Biv.

Probably common on the shallow marshy shores of lakes.

Moose (Eight) lake, No. 1568.

**P. foliosus** Raf. var. **Macellus** Fernald. See Mem. Gray Herb. iii, 46-51 (1932).

Common in shallow lakes and ponds. Collected in fruit during the third week in August.

30th base line district, Slave river, No. 132; sink-hole 16 miles east of Moose lake, No. 1561; Moose (Eight) lake, No. 1562.

**P. vaginatus** Turcz. See Rhod. xviii, 131 (1916), and xx, 191 (1918).

Common in shallow marshy lakes, and abundant in the open shallow water of lake Mamawi, where, with *P. Richardsonii*, it forms most of the large patches of weed. Flowers collected June 26 and fruits in mid-August.

Lake Mamawi, No. 1549; Pine Lake district, No. 1550.

**P. filiformis** Pers., var. **borealis** (Raf.) St. John. See Rhod. xviii, 134 (1916).

Common on sandy bottoms of shallow lake margins. Immature fruits collected July 3, and mature ones August 14.

Pine lake, Nos. 1573, 1575; Moose (Eight) lake, No. 1574.

**P. filiformis** Pers., var. **Macounii** Morong. See Rhod. xviii, 136 (1916).

Probably common in shallow lakes and slow streams. Found growing in the noticeably brackish water of Salt river. Immature fruits collected June 26.

Near Heart (Raup) lake, No. 1577; Pine Lake district, No. 1576.

**P. pectinatus** L.

Probably common in shallow lakes that have sand or gravel bottoms. Fruiting specimens collected in mid-August.

Moose (Eight) lake, No. 1578.

#### NAJADACEAE

**Najas flexilis** (Willd.) Rostk. and Schmidt. NAIAD.

Occasional on shallow sandy margins of lakes. Collected in fruit August 14.

Moose (Eight) lake, No. 1579.

#### SCHEUCHZERIAACEAE

**Triglochin maritimum** L. ARROW GRASS.

Common in semi-alkaline muskegs, sloughs, and wet prairies, and abundant in saline flats on the Salt Plains. Flowers found between mid-June and mid-July, and mature fruits during the first half of August.

Government Hay Camp district, Slave river, No. 1586; near Heart (Raup) lake, No. 1585; near Mission Farm, No. 1582; Pine Lake district, No. 1584; Moose (Eight) Lake district, No. 1583; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 10.

**T. palustre** L. MARSH ARROW GRASS.

Occasional in wet meadows on the upland. Observed in flower July 14, immature fruit July 25, and mature fruit during the third week in August.

Along the trail between the Heart Lake district and Fitzgerald, No. 1580; near Round lake, about 18 miles south of Pine lake, No. 1581.

## ALISMACEAE

**Sagittaria cuneata** Sheldon. *S. arifolia* Nutt. ARROW-LEAF, or ARROW-HEAD.

Occasional in the shallow ponds and slow streams in the upland districts, and common to similar situations in the lowlands. Sometimes found on mud flats where it has normal fleshy leaves, and at other times in deep water where its leaves are long and ribbon-like, reaching to the surface. Flowers in July and fruits in late August.

Cree (Mamawi) creek, No. 1587; lower delta of Athabaska river, No. 393; Murdock Creek district, Nos. 1589, 1591; sink-hole 16 miles east of Moose lake, No. 1590; Indian graveyard, Peace river, No. 1588; Sass creek, Russell, No. 24.

## GRAMINEAE

**Bromus ciliatus** L. BROME-GRASS.

Common, but apparently limited to prairie openings and open places along Peace river. Young spikelets collected July 17, and flowers August 1.

Indian graveyard, Peace river, No. 1671; base of eastern slope of Caribou mountains, No. 1670.

**B. Pumpehianus** Schribn.

A common grass of dry prairies and ridges throughout the upland sections of the park. It becomes abundant in cabin clearings and everywhere serves as an important element in the natural forage. Young spikelets appear in the last week of June, and flowers during July. When in flower its large yellow anthers and purplish glumes and lemmas make a striking appearance.

Fort Smith, No. 204; Pine Lake district, Nos. 1675, 1677; Peace point, Nos. 1673, 1676; Moose (Eight) Lake district, No. 1674; base of eastern slope of Caribou mountains, No. 1672.

**Festuca saximontana** Rydb. SHEEP'S FESCUE.

Occasional in the driest parts of the upland prairies, on dry sand ridges, and in the more sterile crevices on granite hills. Very young panicles formed in late June, flowers during July, and fruit in the middle part of August.

East shore of lake Mamawi, No. 1669; near Heart (Raup) lake, No. 1667; Fort Smith, No. 168; base of eastern slope of Caribou mountains, No. 1668.

**Glyceria striata** (Lam.) Hitchc. *G. nervata* (Willd.) Trin. of auth. See Proc. Biol. Soc. Wash., xli, 157 (1928), and Rhod. xxxi, 47 (1929).

Apparently rare in the park area and confined to the rich woods in the upper Athabaska delta. In fruit in mid-August.

Reed portage, upper Embarras river, No. 1620.

**G. grandis** Wats. *Panicularia grandis* Nash. REED MEADOW-GRASS.

Common in wet meadows along upper Slave river. It is usually found in the wetter, central parts of the sloughs, where it often forms pure stands, readily distinguished in early August by the mass of purple made by its large panicles. It has good forage value, but is usually so local and in-

accessible that it becomes of little importance. Young spikelets are formed early in July, and fruit in late July and the first half of August.

Murdock Creek district, No. 1616; Government Hay Camp district, Slave river, No. 1610.

**G. pulchella** (Nash) K.Sch. *Panicularia pulchella* Nash.

Common in sloughs and wet meadows, mainly in the upland sections of the park. Flowering and fruiting similar to the last.

Lower delta of Athabaska river, No. 200; Government Hay Camp district, Slave river, No. 1611; Peace point, No. 1617; Moose (Eight) Lake district, Nos. 1614, 1615; base of eastern slope of Caribou mountains, Nos. 1612, 1613; along Little Buffalo river, *Russell*, No. 44.

**G. borealis** Nash. (Batchelor). *Panicularia borealis* Nash. NORTHERN MANNA-GRASS.

Occasional in wet sloughs throughout the region. In flower in mid-July and early August, and in fruit during the third week in August.

Lower delta of Athabaska river, No. 202; Government Hay Camp, Slave river No. 1618; sink-hole 16 miles east of Moose lake, No. 1619.

**Puccinellia Nuttalliana** (Nutt.) Wats. and Coult. *P. airoides* (Schultes) Hitchc. ALKALI-GRASS.

Found only in the Athabaska River delta and at the margins of saline flats on the Salt Plains. In the latter situation it is a dominant species in continuous bands around the barren flats, and is said to be very attractive to grazing stock. Young flowers collected July 11, and fruit August 19.

Lower delta of Athabaska river, No. 199; near Heart (Raup) lake, No. 1784.

**Fluminea festucacea** (Willd.) Hitchc. *Scolochloa festucacea* (Willd.) Link.

A common species in wet meadows and at lake margins throughout the area. It forms nearly pure stands in local areas, and occupies situations of widely varying degrees of wetness. On the margins of Moose lake it grows in 3 to 4 feet of water and is one of the first colonizers on the marshy shore. It occupies similar situations in the outer deltas of Peace and Athabaska rivers, but in the hay meadow sloughs such as occur at the Government Hay Camp it is growing in relatively dry places, where it adds substantially to the hay crop. Collected in flower in late July, and in fruit during the third week in August.

Cree (Mamawi) creek, No. 1601; east shore of lake Mamawi, No. 1600; Murdock Creek district, No. 1599; Government Hay Camp district, Slave river, No. 1604; near Heart (Raup) lake, No. 1602; Moose (Eight) lake, No. 1603.

**Poa pratensis** L. JUNE-GRASS, KENTUCKY BLUE-GRASS.

A common grass of damp meadows, prairies, and open woods throughout Wood Buffalo park. In many parts of the prairies at the eastern base of Caribou mountains it becomes very abundant and shares dominance with *Calamagrostis canadensis*. It is one of the most important range grasses in the district. Young spikelets are formed in the latter third of June and flowering continues through most of July. Fruits appear in late July and in August.

East shore of lake Mamawi, No. 1715; 30th base line district, Slave river, No. 146; Murdock Creek district, No. 1717; Government Hay Camp district, Slave river, Nos. 1721, 1726; near Heart (Raup) lake, No. 1722; Fort Smith, Nos. 149, 152; Pine Lake district, Nos. 1718, 1720, 1723, 1724, 1729; Peace point, Nos. 1719, 1727, 1728; sink-hole 16 miles east of Moose lake, No. 1733; Moose (Eight) Lake district, Nos. 1730, 1731, 1732, 1734, 1735; base of eastern slope of Caribou mountains, Nos. 1714, 1716; eastern edge of Caribou Mountain plateau, No. 1713.

*P. COMPRESSA* L. CANADA BLUE-GRASS.

Collected only at Fort Smith, where it is probably introduced. Fort Smith, No. 142.

*P. palustris* L. *P. triflora* of auth. See Rhod. xviii, 235 (1916). FOWL MEADOW-GRASS.

Common in wet sloughs throughout the area. Early flowering culms were found eaten by the buffalo in the latter part of June. Flowers occur through July, and fruit in August.

Lower delta of Athabaska river, Nos. 143, 144; east shore of lake Mamawi, Nos. 1707, 1710; Pine Lake district, No. 1711; Indian graveyard, Peace river, Nos. 1708, 1709.

*P. glauca* Vahl. SPEAR-GRASS.

Common on dry, sandy banks and ridges, and in dry crevices on rocky hills throughout the region. Also found in the driest prairies and in sandy buffalo wallows. Not abundant enough to contribute much to the range. Young spikelets collected in the latter part of June, flowers during July, and fruit in August.

East shore of lake Mamawi, Nos. 1745, 1746, 1747; Government Hay Camp district, Slave river, No. 1743; Fort Smith, No. 160; Pine Lake district, Nos. 1739, 1740, 1742; Moose (Eight) Lake district, Nos. 1736, 1737; Peace point, Nos. 1738, 1741; base of eastern slope of Caribou mountains, No. 1744.

*P. arida* Vasey.

Apparently occasional, and limited to the drier parts of the Salt Plain prairies. Old flowers collected August 20.

Near Heart (Raup) lake, No. 1712.

*P. glaucifolia* Scribn. and Williams.

Apparently rare in the park area, and found thus far only in dry soils on granite hills in the Athabaska-Peace delta. In fruit August 9.

East shore of lake Mamawi, No. 1748.

*Distichlis stricta* (Torr.) Rydb. See Rhod. xxvii, 67 (1925). SALT-GRASS.

Common on saline flats and prairies in the Salt Plain regions. Flowers collected August 20.

Near Heart (Raup) lake, No. 1794.

**Phragmites communis** Trin. var. **Berlandieri** (Fournier) Fern. See Rhod. xxxiv, 211 (1932). REED-GRASS.

Common in parts of the Peace-Athabaska Delta region where it grows on marshy shores with its culms overhanging the sluggish streams. Found fruiting in late August.

Delta of Athabaska river, No. 1706.

**Schizachne purpurascens** (Torr.) Swallen. *Avena striata* Michx. *Bromelica striata* (Michx.) Farwell. *Melica purpurascens* (Torr.) Hitchc. PURPLE OATS.

Common in open poplar woods and prairies throughout the upland districts. Its tender leaves and culms add substantially to the forage during the summer months, and make up a large part of the naturally scant feed in the open woods. In some parts of the prairies it becomes abundant and dominates the turf over local areas, thus being one of the more important range grasses. Young flowers are formed the last third of June or early in July, and fruits in the latter part of July and August.

Near Heart (Raup) lake, No. 1592; Pine Lake district, Nos. 1595, 1597, 1598; Peace point, No. 1596; base of eastern slope of Caribou mountains, Nos. 1593, 1594.

**Agropyron Smithii** Rydb., var. **molle** (Scribn. and Smith) Jones.

Apparently rare in Wood Buffalo park, and collected only on drier parts of the Peace Point prairie. In flower July 17.

Peace point, No. 1822.

**A. trachycaulum** (Link) Malte var. **typicum** Fern. *A. tenerum* Vasey. See Rhod. xxxv, 161-82 (1933) and xxxvi, 417 (1934) for treatment of this and the following. SLENDER WHEAT-GRASS, WESTERN RYE-GRASS.

A common grass of open woods, semi-open prairies, and the drier parts of meadow sloughs throughout the region. It supplies excellent forage in considerable quantities. Found in early flowering stages from the middle to the last of July, and in fruit during the third week in August.

East shore of lake Mamawi, Nos. 1818, 1819; Government Hay Camp district, Slave river, Nos. 1810, 1811; near Heart (Raup) lake, No. 1812; Round lake, about 18 miles south of Pine lake, No. 1817; Peace point, Nos. 1814, 1815, 1816, 1821; sink-hole 16 miles east of Moose lake, No. 1813; Moose (Eight) Lake district, Nos. 1808, 1809; Indian graveyard, Peace river, No. 1820; base of eastern slope of Caribou mountains, No. 1823.

**A. trachycaulum** (Link) Malte var. **unilaterale** (Vasey) Malte. *A. Richardsonii* (Trin.) Schrad.

Common on upland semi-open prairies and in the drier parts of meadow sloughs. Young spikelets just forming during the third week in July, and flowering during the middle part of August.

Government Hay Camp district, Slave river, Nos. 1797, 1798; near Heart (Raup) lake, No. 1799; Moose (Eight) Lake district, No. 1796; Peace point, Nos. 1800, 1801; base of eastern slope of Caribou mountains, No. 1805.

**Elymus innovatus** Beal. WILD RYE.

A common grass of dry upland woods and prairies. It is the primary herbaceous species in the scant ground cover of the vast tracts of upland aspen woods, and as such is one of the most important sources of forage in the summer feeding grounds of the buffalo. It does not make a thick turf, but its long slender leaves and culms appear rather early in the season, before the semi-open prairies have had time to produce much new green material, so that it helps to tide the herds over the difficult spring feeding period. Young spikelets are produced during the last week in June, and the plants are in full flower during July. Fruit is matured in the latter half of August.

Government Hay Camp district, Slave river, Nos. 1651, 1658; Fort Smith, Nos. 183, 185; Pine Lake district, Nos. 1654, 1655, 1656; Peace point, No. 1657; Moose (Eight) Lake district, Nos. 1646, 1652, 1653, 1659; Indian graveyard, Peace river, No. 1647; base of eastern slope of Caribou mountains, Nos. 1649, 1650; eastern edge of Caribou Mountain plateau, No. 1648.

**E. Macounii** Vasey.

Known in the park area only from the following specimen.  
Salt River region, Camsell, No. 92018.

**Hordeum jubatum** L. SQUIRREL-TAIL GRASS.

A common grass of prairie slough margins and cabin clearings. It becomes abundant on the edges of shallow salt flat depressions in the Salt Plains, where broad bands of it are made especially noticeable by its waving, plume-like heads. In the early stages of growth it furnishes considerable forage, but when the fruits begin to mature the long barbed awns become embedded in the tender flesh about the mouths and noses of grazing stock and often cause sores. Young inflorescences are produced early in July, and fruit in late July or August.

East shore of lake Mamawi, No. 1630; near Heart (Raup) lake, No. 1631; Pine Lake district, No. 1633; Peace point, No. 1634; sink-hole 16 miles east of Moose lake, No. 1632; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 14.

**H. vulgare** L. CULTIVATED BARLEY.

Found only where it has escaped from cultivation. Successfully grown at various places such as the Mission Farm, southwest of Fort Smith. Fruits mature during the first half of August.

Government Hay Camp, Slave river, No. 1635.

**Koeleria cristata** (L.) Pers. JUNE-GRASS.

One of the dominant grasses in the drier prairies on the uplands, and an important source of forage. Collected in flower during mid-July, and with immature fruit the third week in August.

Near Heart (Raup) lake, No. 1681; Peace point, Nos. 1680, 1682; base of eastern slope of Caribou mountains, Nos. 1678, 1679.



**Trisetum spicatum** (L.) Richter, var. **molle** (Michx.) Beal. *T. subspicatum* (L.) Beauv., var. *molle* Gray. See Rhod. xviii (1916), and xxx, 239 (1928). DOWNY OAT-GRASS.

Occasional in dry upland woods. Young spikelets produced late in June, and flowers during early July.

Pine Lake district, Nos. 1700, 1701; eastern edge of Caribou Mountain plateau, No. 1699.

**Sphenopholis pallens** (Spreng.) Scribn. SHINING PRAIRIE-GRASS.

Occasional on sandy shores of lakes and streams. Young spikelets collected in early July and flowers during the third week in July.

Pine lake, No. 1825; Peace point, No. 1824.

**Avena Hookeri** Scribn. HOOKER'S OAT.

Apparent rare in the park, though rather common on the drier parts of the Peace Point prairie. In fruit August 2.

Peace point, No. 1636.

**A. FATUA** L., var. **GLABRATA** Peterm. WILD OATS.

Found only in the hayfield at the Government Hay Camp, where it is introduced. In fruit August 4.

Government Hay Camp, Slave river, No. 1638.

**A. SATIVA** L. CULTIVATED OATS.

Successfully cultivated in Fort Smith, at the Mission Farm along Salt river, and at the Government Hay Camp. Fruits mature in early August.

Government Hay Camp, Slave river, No. 1637.

**Deschampsia caespitosa** (L.) Beauv., var. **glauca** (Hartm.) Lindm. *Aira caespitosa* L. See Rhod. xxviii, 154 (1926). TUFTED HAIR-GRASS.

Common about the margins of wet sloughs and on damp, muddy shores. In flower during the last part of July and the first three weeks of August. Fruit matured in late August.

Delta of Quatre Fourches river, No. 216; Murdock Creek district, No. 1662; Government Hay Camp district, Slave river, Nos. 1660, 1664; near Heart (Raup) lake, Nos. 1661, 1666; Peace point, No. 1665; Moose (Eight) Lake district, No. 1663.

**Danthonia intermedia** Vasey. WILD OAT-GRASS.

Occasional in dry upland prairies where it adds to the forage, but not to such an extent as to be important. In flower during the third week in July, and in fruit the third week in August.

Near Heart (Raup) lake, No. 1683; Peace point, Nos. 1684, 1685.

**Calamagrostis purpurascens** R.Br. ALPINE REED-GRASS.

Common on dry, sandy ridges throughout the upland. Collected in flower July 13, and in immature fruit August 17. Very young spikelets appear during the last week in June.

Fort Smith, No. 260; Moose (Eight) Lake district, Nos. 1768, 1769.

**C. montanensis** Scribn. MONTANA REED-GRASS.

Apparently rare in the park area, and confined to the drier parts of prairies. In flower July 19.

Peace point, No. 1770.

**C. canadensis** (Michx.) Nutt. See Rhod. xxiv, 122 (1922). BLUE-JOINT.

This species, with its variety *robusta*, is probably the most important source of wild hay and forage that the region affords. It is abundant in the moister parts of the upland semi-open prairies, at the willow margins of the extensive abandoned channel sloughs of the river bottoms, and on the wide expanses of meadow in the lower delta districts. In the upland prairies and river deltas it predominates over thousands of acres, to the exclusion of nearly all other vegetation. The inhabitants of Chipewyan have for many years made hay in the Quatre Fourches division of the Peace delta, utilizing the rich growth of this grass. In the same region it is one of the most valuable sources of autumn and winter forage for the buffalo. Young spikelets appear in late June, and flowers during July and early August.

East shore of lake Mamawi, Nos. 1755, 1756, 1757; Government Hay Camp district, Slave river, Nos. 1751, 1753; Moose (Eight) Lake district, Nos. 1749, 1750, 1752; Indian graveyard, Peace river, No. 1759; base of eastern slope of Caribou mountains, Nos. 1754, 1758; lower Slave river, Nos. 231, 232.

**C. canadensis** (Michx.) Nutt., var. **robusta** Vasey. See Rhod. xxiv, 122 (1922), and xxxii, 42 (1930). BLUE-JOINT.

Similar to the species in distribution and habits.

Round lake, about 18 miles south of Pine lake, No. 1762; Peace point, No. 1761; Moose (Eight) Lake district, Nos. 1763, 1764; base of eastern slope of Caribou mountains, Nos. 1760, 1765, 1766; eastern edge of Caribou Mountain plateau, No. 1767.

**C. inexpansa** A. Gray, var. **brevior** (Vasey) Stebbins. See Rhod. xxxii, 50 (1930). REED-GRASS.

The writer's material shows wide variation in the size and form of the inflorescence, and may contain more than one variety of *C. inexpansa*. Also, part of it is separable only with difficulty from *C. neglecta*.

Common in semi-open prairies and on the slough margins of lakes and ponds. It is abundant on the Salt Plain prairies near Heart lake, where it shares dominance over large areas with *Juncus balticus*. It is of note that though it is so common on that part of the upland that lies east of Jackfish river, it is not found at all in the prairies at the base of Caribou mountains. In regions where it is abundant it is a valuable forage grass. Early flowers appear in mid-July, and fruits in late August.

Murdock Creek district, Nos. 1777, 1778; Government Hay Camp district, Slave river, No. 1773; Peace point, Nos. 1771, 1772; near Heart (Raup) lake, Nos. 1774, 1775; sink-hole 16 miles east of Moose lake, No. 1783; Moose (Eight) Lake district, Nos. 1776, 1779, 1780, 1781, 1782.

**Agrostis scabra** Willd. See Rhod. xxxv, 207-12 (1933). HAIR-GRASS, or TICKLE-GRASS.

Common in prairie openings and the drier parts of meadow sloughs. In the meadow at the Government Hay Camp, where the wild hay has been cut from the same plots for several consecutive years, this species becomes a predominating grass, greatly reducing the value of the hay. In flower from the middle to the last of July and sometimes later. Fruiting in August.

East shore of lake Mamawi, Nos. 1624, 1625; Murdock Creek district, No. 1627; Government Hay Camp, Slave river, No. 1626; near Heart (Raup) lake, No. 1621; Round lake, about 18 miles south of Pine lake, No. 1628; sink-hole 16 miles east of Moose lake, No. 1629; base of eastern slope of Caribou mountains, Nos. 1622, 1623; Clewi river, *Russell*, No. 17.

**Cinna latifolia** (Trev.) Griseb. WOODLAND REED-GRASS.

Rare in Wood Buffalo park, and apparently confined to the deep woods in the upper Athabaska delta. Fruits immature in mid-August.

Reed portage, upper Embarras river, No. 1827.

**Arctagrostis arundinacea** (Trin.) Beal.

Rare in this region, and apparently confined to Caribou mountains, where it inhabits wet muskegs. Collected in flower July 12.

Eastern edge of Caribou Mountain plateau, No. 1826.

**Alopecurus aequalis** Sobol. *A. aristulatus* Michx. *A. geniculatus* L., var. *aristulatus* (Michx.) Torr. MEADOW FOXTAIL.

Occasional in a variety of habitats, but usually found on muddy shores and in semi-dry sloughs. Rather common in clearings and buffalo wallows. Young flowers observed June 22, flowers during July, and both flowers and fruit during the first two weeks of August.

Reed portage, upper Embarras river, No. 1607; lower delta of Athabaska river, No. 187; east shore of lake Mamawi, No. 1605; Government Hay Camp district, Slave river, No. 1606; Fort Smith, No. 188; Pine Lake district, No. 1608; sink-hole 16 miles east of Moose lake, No. 1609; Sass creek, *Russell*, No. 73.

**Phleum alpinum** L. MOUNTAIN TIMOTHY.

Occasional, and found only in the river lowlands. In flower during the first half of August.

Reed portage, upper Embarras river, No. 1790; Government Hay Camp district, Slave river, No. 1791.

**P. PRATENSE** L. TIMOTHY.

Introduced in settlements and cabin clearings. Young flowers observed in early July.

Pine Lake district, No. 1792.

**Muhlenbergia Richardsonii** (Trin.) Rydb. See Bull. Tor. Bot. Club, xxxii. 600 (1905).

Collected only at the margins of saline flats on the Salt Plains. In fruit August 19.

Near Heart (Raup) lake, No. 1793.

**Oryzopsis asperifolia** Michx. MOUNTAIN RICE.

Occasional in the upland aspen woodlands. Makes good feed, but is not common enough to be of importance. Immature fruits collected July 3, and mature ones later in the month.

Pine Lake district, Nos. 1787, 1788.

**O. pungens** (Torr.) Hitchc.

Occasional in dry, upland woods. Flowers collected June 9 and 17, and fruits in early July.

Along Quatre Fourches river, No. 227; Pine Lake district, Nos. 1785, 1786.

**Stipa comata** Trin. and Rupr. DEVIL'S DARNING-NEEDLE, PORCUPINE-GRASS.

Common on the driest parts of the Peace Point prairie, but not found elsewhere in the park. It supplies good forage, but its barbed, twisted awns become a nuisance in late summer by working their way into clothing and into the fur and flesh of animals. In young fruit July 17.

Peace point, No. 1686.

**S. comata** Trin. and Rupr., var. **intermedia** Scribn.

Collected only in a bit of clayey prairie on a granite hill in the Peace delta, where it was fruiting in early August.

East shore of lake Mamawi, No. 1687.

**S. Richardsonii** Link. FEATHER-GRASS.

Collected only in the Peace Point prairie, where it is fairly common. In fruit early in August.

Peace point, No. 1688.

**Beckmannia Syzigachne** (Steud.) Fernald. *B. erucaeformis* Am. auth., not Host. *B. baicalensis* (W. Kuznetzow) Hultén. See Rhod. xxx, 27 (1928). SLOUGH-GRASS.

A characteristic grass of wet pond margins in meadow sloughs, and of low-lying delta deposits. In semi-dry sloughs it often forms pure stands, making a certain amount of forage, but these areas of abundance are usually quite small. Collected in flower during the latter half of July, and in fruit during August. Its fruits have begun to fall off by August 12.

East shore of lake Mamawi, Nos. 1639, 1640; along Quatre Fourches river, No. 194; Murdock Creek district, No. 1643; Government Hay Camp district, Slave river, No. 1644; Peace point, Nos. 1641, 1642; sink-hole 16 miles east of Moose lake, No. 1645; Sass creek, Russell, No. 20.

**Spartina gracilis** Trin. CORD-GRASS.

Apparently limited to semi-saline prairies on the Salt Plains, where it is fairly common; but on account of its roughness it probably adds little value to the forage. Collected in flower August 19.

Near Heart (Raup) lake, No. 1795; junction of Nyarling and Little Buffalo rivers, Russell, No. 62.

**Hierochloë odorata** (L.) Wahl. *Torresia odorata* (L.) Hitchc. VANILLA-GRASS.

Common in prairie openings and damp meadows throughout the upland districts, though not sufficiently abundant to afford much pasturage.

Its spikelets are among the earliest flowers of the spring. In full flower June 10, and immature fruit by the middle of July. Fruiting in late July and August.

Along Peace river, near the Slave, No. 173; Pine Lake district, Nos. 1689, 1691; Peace point, Nos. 1692, 1693; sink-hole 16 miles east of Moose lake, No. 1694; base of eastern slope of Caribou mountains, Nos. 1695, 1696, 1697, 1698; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 53.

***Phalaris arundinacea* L. REED CANARY-GRASS.**

Occasional in damp meadows in the upland districts, and common in lowland sloughs where its tall culms and broad leaves add substantially to the wild hay. Found in flower during the second week in July, and in fruit during late July and August.

Cree (Mamawi) creek, No. 1702; lower delta of Athabaska river, No. 198; east shore of lake Mamawi, No. 1703; sink-hole near Round lake, about 18 miles south of Pine lake, No. 1704; sink-hole 16 miles east of Moose lake, No. 1705.

CYPERACEAE

***Carex capitata* L.**

Apparently rare. Found thus far only in muskeg thickets along upper Salt river, near Pine lake. In flower June 20 and immature fruit July 9. Pine Lake district, Nos. 1866, 1867.

***C. gynocrates* Wormsk.**

Common in mossy muskeg timber and thickets in the upland districts. Found flowering in late June, and in fruit during July and August.

Pine Lake district, Nos. 1883, 1884; Moose (Eight) Lake district, No. 1882.

***C. stenophylla* Wahl.**

Apparently rare in the park area, and thus far collected only in a small patch of prairie on a granite knoll in the lower Peace delta. In fruit August 9.

East shore of lake Mamawi, No. 1958.

***C. Sartwellii* Dewey.**

Apparently rare in Wood Buffalo park, and found thus far only at the margin of a sink-hole slough on the Peace Point prairie. Collected with immature fruits July 21.

Peace point, No. 1915.

***C. siccata* Dewey.**

One of the commonest sedges of dry woods and prairies, where it probably makes a substantial addition to the natural forage. In local areas in the upland prairies it becomes very abundant. Observed in flower during the middle and last of June, and with fruit of varying degrees of maturity through July and August.

Government Hay Camp district, Slave river, No. 1936; Fort Smith, No. 297; near Mission Farm, No. 1932; Pine Lake district, Nos. 1924,

1930, 1931, 1938; Peace point, Nos. 1934, 1935; Moose (Eight) Lake district, No. 1937; Indian graveyard, Peace river, No. 1926; base of eastern slope of Caribou mountains, Nos. 1927, 1928, 1929.

**C. diandra** Schrank.

Abundant on the marshy shores of upland lakes and ponds, where it forms a zone of hummocky vegetation just back of the water's edge. Immature fruits found early in July, and mature ones through the first half of August.

Pine Lake district, Nos. 1869, 1870, 1874; Moose (Eight) Lake district, Nos. 1871, 1872, 1873.

**C. sychnocephala** Carey.

Apparently rare, and collected thus far only from a small sink-hole slough in the upland region. In flower July 14.

Round lake, about 18 miles south of Pine lake, No. 1868.

**C. Bebbii** Olney.

Found only in the upper delta districts of the main rivers, where it inhabits damp slough margins. Immature fruits collected late in July and mature ones in mid-August.

Reed portage, upper Embarras river, No. 1959; Indian graveyard, Peace river, No. 1960.

**C. tenera** Dewey.

Occasional on damp, upland slough margins. Immature fruit collected July 21, and mature fruit in August.

Peace point, No. 1943; sink-hole 16 miles east of Moose lake, No. 1944.

**C. praticola** Rydb. *C. pratensis* Drejer.

Common in prairie openings throughout the area. Found in various stages of flower and fruit during the latter part of July and August.

East shore of lake Mamawi, No. 1905; near Heart (Raup) lake, No. 1904; sink-hole 16 miles east of Moose lake, No. 1907; base of eastern slope of Caribou mountains, No. 1906.

**C. disperma** Dewey. *C. tenella* Schkuhr.

A diminutive but common sedge in upland muskeg thickets and sloughs throughout the region. Immature fruits collected in the first half of July, and mature ones during the latter part of July and August.

Pine Lake district, Nos. 1894, 1895; Moose (Eight) Lake district, Nos. 1891, 1893; base of eastern slope of Caribou mountains, Nos. 1890, 1892; eastern edge of Caribou Mountain plateau, No. 1889; Clewi river, Russell, No. 98.

**C. tenuiflora** Wahl.

Apparently rare in the park area, and limited to cold upland bogs. Immature fruit collected July 9.

Pine Lake district, No. 1950.

**C. loliacea** L.

Rare, and so far as is known, confined to muskegs on the upper slopes of Caribou mountains. Collected in fruit July 11.

Eastern edge of Caribou Mountain plateau, No. 1957.

**C. canescens** L., var. **subloliacea** Laestad.

Common on muskeg pond margins in the upland districts, where its tussocks of pale foliage are conspicuous. Found in flower and immature fruit from late June to mid-July, and in fruit during August.

Pine Lake district, No. 1899; Moose (Eight) Lake district, No. 1900; base of eastern slope of Caribou mountains, Nos. 1902, 1903; eastern edge of Caribou Mountain plateau, No. 1901.

**C. brunnescens** Poir., var. **sphaerostachya** (Tuckerm.) Kükenth. See Rhod. xxviii, 163 (1926).

Occasional at upland muskeg slough margins. Flowers in late June and fruits in early August.

Moose (Eight) Lake district, No. 1896; base of eastern slope of Caribou mountains, No. 1898; eastern edge of Caribou Mountain plateau, No. 1897.

**C. arcta** Boott.

Common in wet thickets on the upland. Found in various stages of flower and fruit during July and August.

Near Round lake, about 18 miles south of Pine lake, No. 1952; sink-hole 16 miles east of Moose lake, No. 1953; base of eastern slope of Caribou mountains, No. 1951.

**C. obtusata** Liljebl.

Abundant in the driest parts of the upland prairies, where it becomes one of the dominant species over local areas. Collected in fruit during the middle part of July.

Peace point, Nos. 1945, 1947; base of eastern slope of Caribou mountains, No. 1946.

**C. Rossii** Boott.

Apparently rare in this region, and found thus far only in dry, upland woods along Slave river. In fruit during the latter part of June.

Fort Smith, No. 326.

**C. concinna** R.Br.

Occasional in upland muskeg thickets. Found in flower during the latter half of June.

Salt mountain No. 1888; Pine Lake district, Nos. 1886, 1887.

**C. Richardsonii** R.Br.

Apparently rare in this region, and found thus far only in the dry upland woods along Slave river. In flower during the middle part of June.

Fort Smith, Nos. 303, 1885.

**C. aurea** Nutt.

Occasional on damp muddy or sandy shores in the upland districts. In flower in late June and early July; fruiting in August.

Fort Smith, No. 295; Pine Lake district, Nos. 1875, 1877; sink-hole 16 miles east of Moose lake, No. 1876.

**C. vaginata** Tausch.

Common in muskeg thickets throughout the upland districts. In flower during the latter part of June, and in fruit during late July and August.

Pine Lake district, Nos. 1918, 1920; Moose (Eight) Lake district, Nos. 1919, 1917; base of eastern slope of Caribou mountains, Nos. 1921, 1922.

**C. capillaris** L.

Common in muskeg thickets on the upland. In flower during late June and in fruit during July.

Pine Lake district, Nos. 1910, 1911, 1913; base of eastern slope of Caribou mountains, No. 1909.

**C. abbreviata** Prescott.

Apparently rare in Wood Buffalo park, and found only in a dry water-course in the prairies at the base of Caribou mountains. In fruit July 22.

Base of eastern slope of Caribou mountains, No. 1956.

**C. limosa** L.

Apparently rare, and found thus far only in cold, upland muskegs. Immature fruit collected July 9.

Pine Lake district, No. 1879.

**C. paupercula** Michx., var. **irrigua** (Wahl.) Fernald.

Common in wet muskegs, where it sometimes forms abundant stands in masses of *Sphagnum*. Immature fruit collected July 9, and mature fruit about the middle of July.

Pine Lake district, No. 1881; eastern edge of Caribou Mountain plateau, No. 1880.

**C. Buxbaumii** Wahl.

Occasional at the willow margins of upland prairie openings. Collected in fruit in mid-July and mid-August.

Near Heart (Raup) lake, No. 1949; near Round lake, about 18 miles south of Pine lake, No. 1948.

**C. VahlII Schkuhr**, var. **infernalisma** (Wahlenb.) Fernald. See Rhod. xxxv, 220-3, 398 (1933).

Apparently rare in the park area, and found thus far only in the southwestern part of the upland, where it grows in muskeg thickets and damp prairie margins. Immature fruits found July 12 and mature ones July 17.

Base of eastern slope of Caribou mountains, No. 1955; eastern edge of Caribou Mountain plateau, No. 1954.



**C. atratiformis** Britton.

Occasional in upland muskeg thickets. Immature fruit found July 11, and mature fruit during August.

Along trail about 10 miles southwest of Fitzgerald, No. 1942; Pine Lake district, No. 1941; Moose (Eight) Lake district, Nos. 1939, 1940.

**C. aquatilis** Wahl. WATER SEDGE.

One of the commonest sedges on wet sandy or marshy shores throughout the region, often forming broad bands of bright green around slough ponds. Its long, active rootstock makes it one of the most prominent colonizers in such habitats. It is occasionally eaten by the buffalo, probably for the most part in the early, succulent stages of its growth. Collected in flower during the first half of June, and in fruit during August.

East shore of lake Mamawi, No. 1841; along Quatre Fourches river, No. 338; Murdock Creek district, No. 1842; Government Hay Camp district, Slave river, Nos. 1847, 1848; near Heart (Raup) lake, No. 1849; Pine Lake district, Nos. 1843, 1845, 1846; sink-hole 16 miles east of Moose lake, No. 1854; Moose (Eight) Lake district, Nos. 1850, 1851, 1852, 1853; base of eastern slope of Caribou mountains, No. 1840.

**C. trichocarpa** Muhl., var. *aristata* (R.Br.) Bailey. *C. atherodes* Spreng. MEADOW SEDGE.

One of the most abundant sedges in Wood Buffalo park. Although it occurs in a variety of habitats throughout, ranging from lake shores where it stands in 4 feet of water, to nearly dry sloughs, it reaches its greatest abundance in the wet meadows of the lowland deltas and abandoned stream channels. In the latter situations it covers many square miles, in the aggregate, with a nearly pure stand, and has been for many years a source of wild hay. It also forms one of the most important sources of autumn and winter feed for the buffalo. It is probable that the small winter buds that occur at the base of the current year's growth of each plant, and often at the end of a decumbent stem or off-set, make an essential source of nutriment to these animals during the winter. Immature fruits have been collected from late June through July, and mature fruits during August. Over large areas in the lowland meadows the plants seldom produce flowers and fruit, apparently reproducing entirely by vegetative means. It is suggested that this may be due to continued "pruning" of the winter buds by the grazing buffalo.

Cree (Mamawi) creek, No. 1857; lower delta of Athabaska river, No. 317; east shore of lake Mamawi, No. 1858; Murdock Creek district, No. 1861; Government Hay Camp district, Slave river, Nos. 1860, 1862; Pine Lake district, No. 1864; near Round lake, about 18 miles south of Pine lake, No. 1859; Peace point, No. 1863; Moose (Eight) lake, No. 1865; base of eastern slope of Caribou mountains, Nos. 1855, 1856.

**C. rostrata** Stokes.

An extremely variable species found at the margin of nearly every slough pond in the region. It usually stands with the bases of the stalks in water, and forms bright green bands around the wetter parts of the sloughs. Usually found in flower during July and in fruit during August.

Cree (Mamawi) creek, No. 1828; Murdock Creek district, No. 1834; Government Hay Camp district, Slave river, Nos. 1830, 1838; Pine Lake

district, No. 1839; Round lake, about 18 miles south of Pine lake, No. 1837; Peace point, No. 1835; sink-hole 16 miles east of Moose lake, No. 1836; Moose (Eight) Lake district, Nos. 1831, 1832, 1833; Indian graveyard, Peace river, No. 1829; lower Slave river, Nos. 274, 277; lower Little Buffalo river, *Russell*, No. 22.

**C. retrorsa** Schwein.

Apparently rare in the park area. Found thus far only along Peace river just inside the western boundary, where it inhabits wet slough margins. Collected in flower July 31.

Indian graveyard, Peace river, No. 1961.

**Eleocharis palustris** (L.) R. and S. SPIKE-RUSH.

Abundant on marshy shores throughout the park area. It often forms nearly pure stands in the shallow water. Young flowers found June 6, and flowers throughout July and the first three weeks of August. Fruits are matured late in August.

Cree (Mamawi) creek, No. 1963; lower delta of Athabaska river, No. 381; along Quatre Fourches river, No. 380; east shore of lake Mamawi, No. 1964; 30th base line district, Slave river, No. 384; Murdock Creek district, Nos. 1968, 1969; near Heart (Raup) lake, No. 1966; Fort Smith, No. 383; Pine Lake district, No. 1970; Round lake, about 18 miles south of Pine lake, No. 1965; sink-hole 16 miles east of Moose lake, No. 1967; Moose (Eight) lake, Nos. 1962, 1971.

**E. calva** Torr. See Rhod. xxxi, 68 (1929).

Collected thus far only on the muddy shore of Slave river, where it was flowering August 12.

Government Hay Camp district, No. 1973.

**E. uniglumis** (Link) Schultes. See Rhod. xxxi, 71 (1929).

Apparently rare in the park area, and collected thus far only from the margin of a sink-hole pond on the upland. In fruit July 14.

Round lake, about 18 miles south of Pine lake, No. 1972.

**E. acicularis** (L.) R. and S.

Common on muddy slough margins and shores throughout the area. Collected in flower July 11 and during the first three weeks of August.

Lower delta of Athabaska river, No. 377; Government Hay Camp, Slave river, No. 1974; sink-hole 16 miles east of Moose lake, No. 1975; Moose (Eight) lake, No. 1976.

**Eriophorum opacum** (Björnstr.) Fernald. COTTON-GRASS.

Common in upland muskegs, where it flowers in the latter part of June and fruits in July and August.

Pine Lake district, Nos. 1984, 1985; Moose (Eight) Lake district, Nos. 1986, 1987; base of eastern slope of Caribou mountains, Nos. 1988, 1989.

**E. spissum** Fernald. *E. callitrix* of most Am. auth. See Rhod. xxvii, 208 (1925).

Apparently only occasional in cold upland muskegs. Fruiting specimens collected during the second week in July.

Pine Lake district, No. 1991; eastern edge of Caribou Mountain plateau, No. 1990.

**E. angustifolium** Roth.

Apparently rare in Wood Buffalo park, and collected thus far only from a cold bog near Pine lake. In fruit July 9.

Pine Lake district, No. 1983.

**Scirpus hudsonianus** (Michx.) Fernald. *Eriophorum alpinum* L. ALPINE COTTON-GRASS.

Apparently rare in the park area, and observed thus far only in a muskeg near Pine lake. Specimens collected there have unfortunately been lost.

**S. validus** Vahl. BULRUSH.

Abundant throughout the region on marshy lake shores, where it forms dark, bluish green bands which are very conspicuous. Found in flower during the latter part of June and the first half of July. Fruiting in August.

Cree (Mamawi) creek, No. 1980; lower delta of Athabaska river, No. 386; east shore of lake Mamawi, No. 1982; near Heart (Raup) lake, No. 1977; Pine Lake district, No. 1978; Moose (Eight) lake, No. 1979; base of eastern slope of Caribou mountains, No. 1981.

**S. paludosus** A. Nels.

Salt River region, *Camsell*, No. 92022.

#### ARACEAE

**Calla palustris** L. WILD CALLA, or WATER ARUM.

Occasional in the park area, and collected thus far only in the river flood-plain districts, where it flowers in late July.

Cree (Mamawi) creek, No. 1994; Murdock Creek district, No. 1993.

#### LEMNACEAE

**Lemna trisulca** L.

Apparently only occasional in the park area. It inhabits the still water of small slough ponds in the lowlands.

Murdock Creek district, No. 1995.

**L. minor** L. DUCKWEED.

Common in the quiet water of small slough ponds and lake margins throughout the region.

30th base line district, Slave river, No. 394a; Moose (Eight) lake, No. 1996.

## JUNCACEAE

**Juncus bufonius** L. TOAD RUSH.

Occasional on damp slough margins and in damp rock crevices. Collected in fruit in mid-July and early August.

East shore of lake Mamawi, No. 2009; Round lake, about 18 miles south of Pine lake, No. 2010.

**J. Vaseyi** Engelm.

Occasional in sandy, open places on the upland. Collected in fruit during the third week in August.

Along trail about 10 miles southwest of Fitzgerald, No. 1997; sink-hole 16 miles east of Moose lake, No. 1998.

**J. balticus** Willd. BALTIC RUSH.

Common on muddy and sandy shores in the river lowlands and in parts of the upland districts. The most prominent band of vegetation around the salt flats in the Salt Plain region is made up of this species accompanied by *Calamagrostis inexpansa* var. *brevior*. The rush probably makes very little contribution to the forage unless in its early, succulent stages of growth, when its young shoots are greedily eaten by grazing stock. Flower buds appear in mid-June, and fruits are matured in August.

Government Hay Camp district, Slave river, No. 2004; near Heart (Raup) lake, No. 2005; near Mission Farm, No. 2001; Pine Lake district, No. 2003; Peace point, No. 2002.

**J. filiformis** L. THREAD RUSH.

Apparently occasional in the park area, and collected thus far only from a sandy sink-hole prairie on the upland. In fruit August 20.

Sink-hole 16 miles east of Moose lake, No. 2008.

**J. nodosus** L.

Common on wet, sandy or muddy river banks in the lowland districts, and occasional in similar situations on the uplands. In flower in mid-July, and immature fruit in mid-August.

Lower delta of Athabaska river, No. 408; Government Hay Camp district, Slave river, No. 2007; Fort Smith, *Russell*, No. 28; sink-hole 16 miles east of Moose lake, No. 2006.

**J. alpinus** Vill.

Occasional on wet, sandy or muddy shores. Collected in flower during June.

Lower delta of Quatre Fourches river, No. 401; Pine Lake district, No. 2000.

**J. alpinus** Vill., var. *rariflorus* Hartm. *J. alpinus* var. *insignis* Fries. *J. Richardsonianus* Schultes.

Apparently occasional on muddy shores. Immature fruit collected in mid-August.

Government Hay Camp, Slave river, No. 1999.

## LILIACEAE

**Tofieldia glutinosa** (Michx.) Pers. FALSE ASPHODEL.

Apparently rare in Wood Buffalo park, and collected thus far only in a cold, upland muskeg. In flower July 12.

Observation ridge, about 10 miles south of Pine lake, No. 2011.

**Zygadenus elegans** Pursh. *Anticlea elegans* (Pursh) Rydb. POISON CAMAS.

Apparently rare in the park area, and known thus far only from a specimen found "on the top of the limestone cliffs" along Clewi river. In flower August 5. Both bulbs and leaves are poisonous.

Clewi river, *Russell*, No. 7.

**Allium Schoenoprasum** L., var. *sibiricum* (L.) Hartm. *A. sibiricum* L. WILD CHIVES, or WILD ONION.

Collected in Wood Buffalo park only on the Salt Plain prairies, where it is very common. In flower during late August.

Near Heart (Raup) lake, No. 2020.

**Smilacina stellata** (L.) Desf. *Vagnera stellata* (L.) Morong. FALSE SOLOMON'S SEAL.

Common in semi-open prairies throughout the area. It usually inhabits the drier soils in the openings. In flower during mid-June, and maturing its fruit by mid-July.

East shore of lake Mamawi, No. 2016; near Heart (Raup) lake, No. 2012; near Mission Farm, No. 2015; Peace point, Nos. 2013, 2014; base of eastern slope of Caribou mountains, No. 2017.

**S. trifolia** (L.) Desf. *Vagnera trifolia* (L.) Morong. THREE-LEAVED SOLOMON'S SEAL.

Apparently common in cold, upland muskegs, where it grows on hummocks of *Sphagnum* and other mosses. Collected in flower July 9, and with both flowers and mature fruits August 12.

Pine Lake district, No. 2018; Moose (Eight) Lake district, No. 2019.

**Maianthemum canadense** Desf., var. *interius* Fernald. *Unifolium canadense* (Desf.) Greene, var. *interius* (Fernald) House. See *Rhod.* xvi, 211 (1914). CANADIAN LILY-OF-THE-VALLEY.

Common in upland woods throughout the region. Found in bud early in June, but slow to produce flowers. In Pine Lake district it is not fully out until about July 1. Fruits are matured in late July and August.

Along Quatre Fourches river, No. 441; Fort Smith, No. 436; Pine Lake district, Nos. 2023, 2024; Moose (Eight) Lake district, No. 2025; base of eastern slope of Caribou mountains, No. 2027; eastern slope of Caribou mountains, No. 2026.

## IRIDACEAE

**Sisyrinchium angustifolium** Mill. BLUE-EYED GRASS.

The writer's collections show considerable variation in this species, and may prove, upon more intensive study, to contain more than one entity. Common in prairie openings throughout the upland districts. In dry, sandy sink-holes it becomes very abundant, and makes up a large part of the herbaceous cover. Collected in flower during late June and early July, and in immature fruit about mid-July. Fruit matures in August.

Near Heart (Raup) lake, No. 2031; Pine Lake district, Nos. 2033, 2034, 2035; Peace point, No. 2032; sink-hole 16 miles east of Moose lake, No. 2029; Moose (Eight) Lake district, No. 2030.

#### ORCHIDACEAE

**Cypripedium passerinum** Richards. See Trans. Roy. Soc., Canada, ser. iii, sec. v, pp. 163-172 (1929), for general treatment of this species. LADY'S SLIPPER.

Occasional in rather dry woodlands. Collected thus far within the park only on the shore of Pine lake, where it grows in large patches. It was in the height of its flowering period June 25, and well past it July 3.

Pine Lake district, No. 2044; lower Slave river, No. 469.

**Orchis rotundifolia** Pursh. ORCHIS.

Common in timbered muskegs throughout the upland districts. Observed in flower between June 16 and July 11. Immature fruits collected August 12.

Fort Smith, No. 475; Pine Lake district, Nos. 2049, 2050; Moose (Eight) Lake district, No. 2048; base of eastern slope of Caribou mountains, No. 2051.

**Habenaria viridis** (L.) R.Br., var. **bracteata** (Willd.) Grav. *Coeloglossum bracteatum* (Willd.) Parl.

Occasional in dry upland woods and thickets. Collected in flower between June 20 and July 19. Immature fruits observed July 25.

Pine Lake district, Nos. 2062, 2063; Peace point, Nos. 2064, 2065.

**H. hyperborea** (L.) R.Br. *Limnorchis hyperborea* (L.) Rydb. *L. viridiflora* (Cham.) Rydb. BOG ORCHID, or REIN ORCHID.

Rather common in muskegs throughout. Observed in flower during the latter part of June and until July 25.

Pine Lake district, Nos. 2059, 2061; Observation ridge, about 10 miles south of Pine lake, No. 2060; lower Slave river, No. 446.

**H. obtusata** (Pursh) Richards. *Lysiella obtusata* (Pursh) Rydb.

A common species in rich woods and timbered muskegs, and by far the commonest orchid in the region. In flower from about mid-June through most of July. Immature fruit collected August 11.

Fort Smith, No. 451; Pine Lake district, Nos. 2054, 2055, 2056; Moose (Eight) Lake district, No. 2053; base of eastern slope of Caribou mountains, Nos. 2052, 2058; eastern edge of Caribou Mountain plateau, No. 2057; lower Slave river, No. 449.

**Spiranthes Romanzoffiana** Cham. *Ibidium strictum* (Rydb.) House. LADIES' TRESSES.

Occasional in upland timbered muskegs throughout the area. Flower buds collected in mid-July and flowers in early August. Immature fruit collected August 17.

Government Hay Camp district, Slave river, No. 2073; near upper Smith rapids, No. 465; Observation ridge, about 10 miles south of Pine lake, No. 2074; Moose (Eight) Lake district, No. 2072; Little Buffalo river, *Russell*, No. 90.

**Goodyera repens** (L.) R.Br. var. **ophioides** Fernald. *Epipactis repens* (L.) Crantz var. *ophioides* (Fernald) A. A. Eaton. *Peramium ophioides* (Fernald) Rydb.  
RATTLESNAKE PLANTAIN.

Occasional in rich spruce woods, where it grows in the thick moss mat. Flower buds collected during the first and second weeks of July, and flowers in late July and early August.

Pine Lake district, No. 2069; Moose (Eight) Lake district, Nos. 2066, 2067, 2068; Indian graveyard, Peace river, No. 2071; eastern slope of Caribou mountains, No. 2070.

**Listera borealis** Morong. *Ophrys borealis* (Morong) Rydb. TWAYBLADE.

Occasional in timbered muskegs, where it has been collected in flower between June 16 and July 8.

Fort Smith, No. 460; Pine Lake district, Nos. 2041, 2042; along trail about 5 miles north of Indian graveyard, Peace river, No. 2043.

**Calypso bulbosa** (L.) Oakes. *C. borealis* Salisb. *Cytherea bulbosa* (L.) House.  
CALYPSO, or VENUS' SLIPPER.

Occasional in rich spruce forests on the upland, and common in a few localities. It flowers early in the season, from the first to the middle of June, but late flowers have been found June 26. The plants are in fruit about the middle of July.

Salt mountain, No. 2046; Pine Lake district, No. 2045; eastern edge of Caribou Mountain plateau, No. 2047.

**Corallorrhiza trifida** Chat. *C. Corallorrhiza* (L.) Karst. CORAL-ROOT.

Occasional in rich woods and timbered muskegs throughout the area. It is very often found growing singly, with no others of its kind anywhere near. Collected in flower from the middle to the last of June, and in fruit during late July and August.

East shore of lake Mamawi, No. 2037; Salt mountain, No. 2040; Pine Lake district, Nos. 2038, 2039; base of eastern slope of Caribou mountains, No. 2036.

#### SALICACEAE

**Populus tremuloides** Michx. WHITE POPLAR, TREMBLING ASPEN.

Abundant in dry, upland woods throughout Wood Buffalo park. Over vast areas that have been burned in times past the aspen forms nearly pure stands of large, straight trees, often reaching 2 feet in diameter. When the growth is young it is close and thicket-like, but in older timber there is an open, park-like aspect, in which young spruce and some balsam poplar appear. In the young forest the ground cover is exceedingly scanty, and there is only a thin mould of dead leaves, but in older timber there is an increasing growth of mat-forming mosses and a relatively abundant herbaceous flora consisting of grasses and many other plants suitable for forage. The aspen is an important source of firewood over much of the park area. Fruiting catkins were observed June 13 at Fort Smith, and at Pine lake, on June 21, the ripened catkins had nearly all fallen to the ground.

Along Quatre Fourches river, No. 486; 30th base line, Slave river, No. 482; Fort Smith, No. 489; Pine Lake district, Nos. 2076, 2079; Peace point, No. 2077; Moose (Eight) Lake district, No. 2078; base of eastern slope of Caribou mountains, No. 2075; Little Buffalo river, *Russell*, No. 23.

**P. tacamahacca** Mill. *P. balsamifera* DuRoi, not L. See Jour. Arn. Arb. x, 55 (1929).  
BALSAM, or BLACK POPLAR.

Abundant in the flood-plain forests where it forms nearly pure stands as the first tree in the flood-plain and delta successions. In older lowland timber it is mixed with spruce and later is entirely replaced by the latter. Throughout the upland districts it is associated with aspen *P. tremuloides* in burned-over country, where it usually appears in the transition timber between aspen and spruce. Trees 2 feet in diameter at the base are not uncommon. Along the main rivers the black poplar has been a source of fire-wood for trappers and for the wood-burning steamboats for many years. Fruiting catkins were collected between June 7 and June 24.

Along Quatre Fourches river, Nos. 493, 494; 30th base line, Slave river, No. 495; Fort Smith, No. 497; Pine Lake district, No. 2081; Moose (Eight) Lake district, No. 2080; base of eastern slope of Caribou mountains, No. 2082.

**Salix lasiandra** Benth. See Cont. Arn. Arboret. vi, 142-3 (1934). RED WILLOW.

Common in the lowland flood-plain and delta districts, where it grows at the margins of sloughs and on damp sand and mud bar deposits. Thus far it has been found occupying only the transition ground between the colonizing willows of bars and sloughs, and the more mesophytic species on higher areas. In the deltas it shares this role with *S. petiolaris*. Flowers collected June 14, and mature fruit August 10.

East shore of lake Mamawi, No. 2084; 30th base line district, Slave river, No. 560.

**S. interior** Rowlee var. **pedicellata** (Anders.) Ball. *S. linearifolia* Rydb. See Can. Field-Nat. xl, 175 (1926). SAND-BAR WILLOW.

Abundant on river sand-bars throughout the region. Pure stands of it in such situations are the first of the shrubby growths to appear on recently deposited soils, and make a conspicuous, pale-green bank of filmy foliage on low islands and local flood-plain deposits. In the lower deltas of the large streams it is largely replaced by slough-margin willows like *S. planifolia*. In flower during the first two weeks of June, and in fruit during July. Late fruiting catkins cling to the branches and may be collected as late as August 20.

Lower delta of Athabaska river, No. 566; east shore of lake Mamawi, No. 2086; along Quatre Fourches river, Nos. 564, 565; 30th base line district, Slave river, No. 563; Peace point, No. 2087.

**S. brachycarpa** Nutt. var. **antimima** (Schneider) Raup. See Rhod. xxxiii, 241-4 (1931).

Collected in this region only on the Salt Plains and in Caribou mountains. In the former region it is an important constituent of the thickets that margin the prairies, and in the latter it inhabits muskeg thick-



ets. Found in fruit on the Salt Plains August 19, and in the mountains July 11.

Near Heart (Raup) lake, No. 2139; eastern edge of Caribou Mountain plateau, No. 2140.

**S. MacCalliana** Rowlee.

Common in thickets on the Salt Plain, and occasional on marshy lake margins elsewhere on the upland. Immature fruit collected June 15, and mature fruit during the middle part of August.

Near Heart (Raup) lake, No. 2165; near Mission Farm, No. 2166; Moose (Eight) lake, No. 2164.

**S. glauca** L. See Rhod. xxxiii, 241-4 (1931).

Common throughout the upland districts, where it inhabits muskeg thickets and open muskeg timber, or the borders of rich woods. It varies widely in leaf-form and pubescence, and in the form and size of the shrub, but is not sufficiently variable to make from it more than a single specific entity. Flowering specimens of both sexes have been collected June 20, when they appeared to be at the height of their season. Male flowers persist through the first half of July. Fruits begin to mature in late June and early July, and may be collected in good condition during the third week in August.

Government Hay Camp district, Slave river, No. 2129; near Heart (Raup) lake, No. 2128; Pine Lake district, Nos. 2132, 2133, 2136, 2137, 2138; Moose (Eight) Lake district, Nos. 2130, 2131, 2134, 2135; base of eastern slope of Caribou mountains, No. 2126; eastern edge of Caribou Mountain plateau, No. 2127.

**S. lutea** Nutt. YELLOW WILLOW.

Abundant on the upper parts of local river flood-plain deposits, where it makes a transition stage between the sand-bar willows and the encroaching poplar timber. Its foliage has a bluish green cast which sets it off as a distinct band of vegetation on these areas. Flowers collected during the first week in June, and fruit during the latter half of June and early July.

Along Quatre Fourches river, Nos. 555, 558; 30th base line, Slave river, No. 554; Peace point, No. 2102; lower Slave river, No. 557.

**S. Farrae** Ball. See Cont. U.S. Nat. Herb. xxii, 321 (1921); Jour. Arn. Arboret. iii, 72 (1921); Univ. Calif. Pub. in Bot. xvii, 406-9 (1934).

Apparently rare in the region, and collected thus far only from a muskeg thicket in Caribou mountains. It had immature fruit July 11.

Eastern edge of Caribou Mountain plateau, No. 2085.

**S. myrtilifolia** Anders.

An abundant willow in muskeg thickets and muskeg timber throughout the region. In such situations it is either a low bush or a dwarfed, trailing shrub growing in the moss mat, but in semi-open prairies, where it is occasionally found, it sometimes grows to a height of 10 feet. Leaf characters are also extremely variable. Flowers appear during the second and third weeks of June, and fruits during the latter part of June and the first

half of July. Old fruiting catkins may be found clinging to the branches in August.

30th base line district, Slave river, No. 516; Pine Lake district, Nos. 2157, 2158, 2159, 2161, 2162; Moose (Eight) Lake district, Nos. 2156, 2160; base of eastern slope of Caribou mountains, Nos. 2151, 2153, 2154, 2155; eastern edge of Caribou Mountain plateau, No. 2152.

**S. pseudomonticola** Ball. See Cont. U.S. Nat. Herb. xxii, 321 (1921), and Jour. Arn. Arboret. iii, 73 (1921).

Occasional in the fringe of timber along upland lake shores. Known thus far in Wood Buffalo park from only two localities and from rather poor specimens. The species needs further study. Old fruits found during the first half of July.

Pine lake, Nos. 2104, 2105; Moose (Eight) lake, No. 2106.

**S. pyrifolia** Anders. *S. balsamifera* Barr. BALSAM WILLOW.

Apparently rare in Wood Buffalo park, and collected thus far only on the muskeg shore of an upland lake. Fruits beginning to mature June 25.

Base of eastern slope of Caribou mountains, No. 2083.

**S. candida** Fluegge. SAGE WILLOW.

Common in upland muskeg thickets where it has been collected with immature fruits in late June, and with mature fruits during July and the first half of August.

Near Heart (Raup) lake, No. 2089; Pine Lake district, Nos. 2090, 2091, 2092; Moose (Eight) Lake district, No. 2088; Lobstick creek, *Russell*, No. 11.

**S. Bebbiana** Sarg. *S. rostrata* Richards GRAY WILLOW.

Probably the most abundant willow in the region, commonly growing to a height of 15 or 20 feet, and having a stout trunk often 4 or 5 inches in diameter. An individual  $1\frac{1}{4}$  inches in diameter at the base and 9 feet high was twenty-five years old. It is the most important constituent of the small tree and shrub layer in nearly all the woodlands, becoming most abundant in young river bottom timber and in the upland aspen woods. In delta plains it makes nearly pure stands over vast areas between the meadow margins and the slowly encroaching poplar timber. In the upland semi-open country it borders many of the prairies. Dead, semi-dry branches and trunks found in older woods supply a rather inferior though commonly used firewood. Catkins in an immature fruiting condition have been collected from June 6 to 13. During the latter part of June and early July the air is full of the floating seeds of this species, and by the first week in July the catkins have begun to fall off.

East shore of lake Mamawi, Nos. 2107, 2108; along Quatre Fourches river, Nos. 540, 542; 30th base line district, Slave river, No. 539; Government Hay Camp district, Slave river, No. 2111; Fort Smith, Nos. 538, 2118; Pine Lake district, Nos. 2115, 2119, 2121; Round lake, about 18 miles south of Pine lake, No. 2114; Peace point, Nos. 2112, 2113; Moose (Eight) Lake district, Nos. 2116, 2117, 2122; base of eastern slope of Caribou mountains, Nos. 2109, 2110.

**S. pedicellaris** Pursh, var. *tenuescens* Fernald. See Rhod. xi, 162 (1909).

Apparently rare or only occasional in the park area, and collected thus far only in an upland muskeg thicket. In fruit July 9.

Pine Lake district, No. 2103.

**S. athabascensis** Raup. See Rhod. xxxii, 111 (1930).

Collected thus far only from its type locality, a muskeg thicket about 1 mile north of the Moose (Eight) Lake ranger station. In fruit August 17.

Moose (Eight) Lake district, No. 8129.

**S. petiolaris** Smith.

Common at slough margins and occasional at the edges of upland semi-open prairies. In fruit in mid-June.

East shore of lake Mamawi, Nos. 2123, 2124; 30th base line district, Slave river, Nos. 567, 569; Fort Smith, No. 568; Pine Lake district, No. 2125.

**S. planifolia** Pursh. *S. chlorophylla* Anders. See Jour. Arn. Arboret 1, 75 (1919).

Abundant at slough and prairie margins, and on local river flood-plains throughout the region. It is the pioneer, colonizing willow at the margin of nearly every wet meadow, and small bushes of it are usually found well out from the main mass of shrubbery that lines such places. Fruiting season apparently at its height from the middle to the last of June, but old fruiting catkins are often found clinging to the branches in August.

East shore of lake Mamawi, Nos. 2144, 2145, 2146; along Quatre Fourches river, No. 515; 30th base line district, Slave river, No. 513; Murdock Creek district, No. 2148; Pine Lake district, Nos. 2149, 2150; Moose (Eight) lake, No. 2147; base of eastern slope of Caribou mountains, No. 2142; eastern edge of Caribou Mountain plateau, No. 2143.

**S. Nelsonii** Ball.

This species may prove, upon further study, to be only a variety or form of *S. planifolia* Pursh. Schneider, in monographing North American willows, expressed this opinion very clearly (62). Occasional at slough margins. In fruit during the latter half of June.

Fort Smith, No. 514; Round lake, about 18 miles south of Pine lake, No. 2141.

**S. arbusculoides** Anders.

A common willow of muskeg and slough margins throughout the region. It also appears in the fringe of the timber that grows on local river flood-plain deposits. Although often a low bush, it sometimes grows to a height of 10 feet. Fruiting catkins collected from June 12 to the first week in July. A few old catkins often cling to the branches, and have been so collected in mid-August.

30th base line district, Slave river, No. 550; Government Hay Camp district, Slave river, No. 2097; Fort Smith, No. 2096; Pine Lake district, Nos. 2099, 2100; Peace point, No. 2098; Moose (Eight) Lake district, Nos. 2095, 2101; base of eastern slope of Caribou mountains, No. 2094; eastern edge of Caribou Mountain plateau, No. 2093.

## MYRICACEAE

**Myrica Gale** L. SWEET GALE.

Apparently rare or occasional in the park area, and thus far known only from "swamplands" in the northern district.

Clewí river, *Russell*, No. 51.

## BETULACEAE

**Betula papyrifera** Marsh. var. **neoalaskana** (Sarg.) Raup. See Cont. Arn. Arboret. vi, 152 (1934). WHITE BIRCH.

Common throughout the timbered areas, but abundant in only a few localities. Trees usually 6 to 10 inches in diameter, but occasionally 12 to 15 inches. One of the most useful trees the region affords. The bark has been used for generations by the Indians for the manufacture of canoes and many kinds of utensils. It is light, easily laced and sewn, and easily made waterproof. The wood is light and easily worked, and is the nearest approach to hardwood available. Found in flower during mid-June, and in fruit during July and August.

Along Quatre Fourches river, Nos. 601, 605; Government Hay Camp district, Slave river, No. 2181; Pine Lake district, No. 2182; Moose (Eight) Lake district, Nos. 2179, 2180; base of eastern slope of Caribou mountains, No. 2183; lower Slave river, No. 604.

**B. microphylla** Bunge. *B. fontinalis* Sarg.

Occasional in the park area, and collected thus far only on the shore of Pine lake and in a muskeg at the base of Caribou mountains. In fruit in the latter part of June and the first part of July.

Pine Lake district, No. 2177; base of eastern slope of Caribou mountains, No. 2178.

**B. pumila** L., var. **glandulifera** Regel. SWAMP BIRCH.

Apparently rare or only occasional in the park area, and collected thus far only in a single upland muskeg. Fruiting in mid-August.

Moose (Eight) Lake district, No. 2176.

**B. glandulosa** Michx. DWARF BIRCH.

Abundant in muskeg thickets throughout the upland, and in thickets between prairies on the Salt Plain. It is one of the most important elements in the muskeg shrub cover, and precedes the black spruce in the development of muskeg timber.

Near Heart (Raup) lake, No. 2173; Fort Smith, No. 579; Pine Lake district, No. 2171; base of eastern slope of Caribou mountains, No. 2174; eastern edge of Caribou Mountain plateau, No. 2175.

**Alnus crispa** (Ait.) Pursh. *A. alnobetula* Am. auth. BOG, or WOODLAND ALDER.

Abundant in upland woods, chiefly of the coniferous type. It is found both on dry, jackpine ridges and in deep, mossy, spruce woods. In both of these it makes up a large proportion of the scant undergrowth. The richest stands the writer has seen are on the upper slopes of Caribou mountains. Immature fruits are found in late June and early July, and mature ones in August. The plants appear to be in full flower during the second week in June.

Along Quatre Fourches river, No. 622; Government Hay Camp district, Slave river, No. 2186; Pine Lake district, No. 2185; eastern slope of Caribou mountains, No. 2184.

**A. incana** (L.) Moench. SPECKLED ALDER.

Abundant on lake shores and river banks throughout the region. Flowering period appears to be in the latter part of June and the first part of July. Fruiting cones are found in August.

Along Quatre Fourches river, Nos. 608, 612; 30th base line district, Slave river, No. 619; Government Hay Camp, Slave river, No. 2189; Pine Lake district, No. 2190; Moose (Eight) Lake district, Nos. 2187, 2188; base of eastern slope of Caribou mountains, No. 2191.

#### URTICACEAE

**Urtica gracilis** Ait. See Rhod. xxviii, 191 (1926). NETTLE.

Common in damp meadows and prairies and cabin clearings throughout the area. Flower buds collected June 16, flowers during late June and early July, and fruit in late July and August.

30th base line district, Slave river, No. 641; Government Hay Camp, Slave river, Nos. 2205, 2206; Round lake, about 18 miles south of Pine lake, No. 2203; Moose (Eight) Lake district, No. 2204; base of eastern slope of Caribou mountains, No. 2202; Clewi river, *Russell*, No. 13.

#### SANTALACEAE

**Comandra pallida** A.DC. BASTARD TOAD-FLAX.

Occasional on dry prairies and sandy hills. Collected in flower June 26, and with immature fruit during the third week in July.

Pine Lake district, No. 2201; Peace point, Nos. 2200, 2199.

**Geocaulon lividum** (Richards.) Fernald. *Comandra livida* Richards. See Rhod. xxx, 21 (1928). NORTHERN COMANDRA.

Common in woodlands throughout the region. Found in flower during the last three weeks of June and in early July. In fruit during July and August.

Along Quatre Fourches river, No. 644; Government Hay Camp district, Slave river, No. 2196; Fort Smith, No. 648; Pine Lake district, Nos. 2197, 2198; Moose (Eight) Lake district, Nos. 2194, 2195; base of eastern slope of Caribou mountains, No. 2193; eastern edge of Caribou Mountain plateau, No. 2192.

#### POLYGONACEAE

**Rumex occidentalis** S. Wats. WESTERN DOCK.

Common in wet sloughs throughout the area. Collected in flower during the latter half of July and with mature fruit about mid-August.

Murdock Creek district, No. 2214; Government Hay Camp district, Slave river, No. 2216; near Heart (Raup) lake, No. 2213; Peace point, No. 2215; sink-hole 16 miles east of Moose lake, No. 2212; Moose (Eight) Lake district, Nos. 2208, 2209, 2210, 2211; base of eastern slope of Caribou mountains, No. 2207.

**R. mexicanus** Meisn. WILLOW-LEAVED DOCK.

Common in damp meadows and sloughs throughout the area. Collected in flower from the middle to the last of July, and in fruit during the first half of August.

East shore of lake Mamawi, Nos. 2225, 2227; lower delta of Athabaska river, No. 670; near Round lake, about 18 miles south of Pine lake, No. 2224; Peace point, No. 2228; base of eastern slope of Caribou mountains, No. 2226.

**R. maritimus** L., var. **fueginus** (Phil.) Dusen. See Rhod. xvii, 73 (1915). GOLDEN DOCK.

Common in damp meadows and slough margins. In flower in mid-July and in fruit during the latter part of August.

Lower delta of Athabaska river, No. 673; Murdock Creek district, No. 2221; Government Hay Camp district, Slave river, Nos. 2220, 2222; near Heart (Raup) lake, No. 2219; sink-hole 16 miles east of Moose (Eight) lake, No. 2218; Moose (Eight) Lake district, Nos. 2217, 2223; Little Buffalo river, *Russell*, No. 29.

**Polygonum prolificum** (Small) B. L. Robinson.

Apparently rare or occasional, and confined to the Salt Plain region. Bulblets maturing when the specimens were collected August 19.

Near Heart (Raup) lake, No. 2229.

**P. aviculare** L. KNOTWEED.

Common in damp sloughs and rock crevices, and in cabin clearings throughout the lowlands. Occasional in the upland districts. It may be adventive, as suggested by its nearly complete limitation to the routes of travel. In flower during the last week in June, and in various stages of flower and fruit through July and August.

Reed portage, upper Embarras river, No. 2234; east shore of lake Mamawi, No. 2233; Government Hay Camp district, Slave river, No. 2232; Fort Smith, No. 658; sink-hole 16 miles east of Moose lake, No. 2235.

**P. viviparum** L. *Bistorta vivipara* (L.) S. F. Gray. BISTORT.

Apparently occasional in the park area, and collected thus far only in small meadow openings and muskegs. Collected with flowers and immature bulblets during the latter part of June and the first of July.

Pine Lake district, Nos. 2230, 2231.

**P. lapathifolium** L., var. **salicifolium** Sibth. *P. tomentosum* Schrank, var. *incanum* (Schmidt) Gürke. See Rhod. xxiii, 259 (1921).

Occasional on damp slough margins. Collected in flower in mid-July and early August, and with immature fruit August 20.

East shore of lake Mamawi, No. 2254; Round lake, about 18 miles south of Pine lake, No. 2253; sink-hole 16 miles east of Moose lake, No. 2252.

**P. natans** A. Eat., and forma **Hartwrightii** (Gray) Stanford. See Rhod. xxvii, 156 (1925). WATER SMARTWEED.

Common on lake and slough margins, and in sluggish streams throughout the area. The creeping mud plant with hairy leaves and stem, sometimes known as *P. Hartwrightii*, is clearly no more than a form of the aquatic one, if it should have even that much designation. Flowers appear in the latter part of July and in the first half of August. Fruits begin to mature about the middle of August.

Cree (Mamawi) creek, No. 2248; east shore of lake Mamawi, Nos. 2249, 2250; Murdock Creek district, Nos. 2241, 2242; Government Hay Camp district, Slave river, Nos. 2245, 2251; Fort Smith, No. 663; Pine Lake district, No. 2240; Round lake, about 18 miles south of Pine lake, No. 2244; Moose (Eight) Lake district, Nos. 2246, 2247; sink-hole 16 miles east of Moose lake, No. 2243.

**P. CONVULVULUS** L. *Bilderdykia Convolvulus* (L.) Dunn. BINDWEED.

Occasional in the settled districts, where it occupies dry cleared ground and is probably adventive. Found in the interior only at a much-frequented camp site. In early flower July 12, and with mature fruit in the early part of August.

East shore of lake Mamawi, Nos. 2237, 2239; Government Hay Camp, Slave river, No. 2236; Observation ridge, about 10 miles south of Pine lake, No. 2238.

#### CHENOPODIACEAE

**Chenopodium capitatum** (L.) Asch. *Blitum capitatum* L. STRAWBERRY BLIGHT.

Common in settlements, cabin clearings, buffalo wallows, burned areas, and on the banks of streams where the soil is disturbed by under-cutting. In flower during the latter part of June, and producing its fleshy, red spikes during July and August.

Government Hay Camp, Slave river, No. 2266; Fort Smith (Coll. Mrs. Conibear) No. 676; Pine Lake district, No. 2265; base of eastern slope of Caribou mountains, Nos. 2267, 2268; lower Slave river, No. 675; Little Buffalo river, Russell, No. 35.

**C. rubrum** L. RED GOOSEFOOT.

Apparently confined to the Salt Plains, where it is occasional. Collected with immature fruit August 19.

Near Heart (Raup) lake, No. 2264.

**C. album** L. LAMB'S QUARTERS, PIGWEED.

Abundant as a weed in settlements and cabin clearings throughout the region. In the interior upland it occasionally appears in damp, recently burned areas, and in damp sink-hole meadows. A common and excellent source of "greens" when in its immature stages of growth. Plants 4 to 6 inches high are available in the latter part of June or early July, and in lesser numbers later in the summer. Flowers usually occur during July, and fruits about mid-August.

East shore of lake Mamawi, Nos. 2269, 2270; Government Hay Camp, Slave river, Nos. 2274, 2276; Pine Lake district, No. 2272; Round lake, about 18 miles south of Pine lake, No. 2274; base of eastern slope of Caribou mountains, No. 2271.

**C. lanceolatum** Muhl. *C. album* L., var. *viride* (L.) Moq. GOOSEFOOT.

Occasional in Wood Buffalo park, and collected only in dry, upland prairie openings. In flower July 17, and fruit August 20.

Peace point, No. 2262; sink-hole 16 miles east of Moose lake, No. 2263.

**C. leptophyllum** Nutt. NARROW-LEAVED GOOSEFOOT.

Apparently only occasional, and confined to dry, semi-open prairies. Fruits immature August 9, and mature August 20.

East shore of lake Mamawi, No. 2278; sink-hole 16 miles east of Moose lake, No. 2277.

**Atriplex patula** L. See Rhod. xxiii, 262 (1921). ORACH.

Common in saline areas on the Salt Plains and along streams draining from them. This species and its variety *hastata* make up a variable group of plants that need further study. One form (No. 2256) has excessively enlarged bracts and large bract-like leaves in the inflorescence. Found with flowers during early August, and with immature fruit August 20.

Government Hay Camp district, Slave river, No. 2258; near Heart (Raup) lake, Nos. 2256, 2257.

**A. patula** L., var. *hastata* (L.) Gray.

Common in saline places in the Salt Plains districts. In flower August 19.

Near Heart (Raup) lake, No. 2255.

**Salicornia europaea** L. GLASSWORT, SAMPHIRE.

The writer has been unable to separate his material of this species from the European plant, although this is commonly done in America. Abundant at the margins of saline flats and brine springs in the Salt Plains. In late August it makes a conspicuous red band around the light-coloured, alkaline, barren areas. In fruit August 19.

Near Heart (Raup) lake, No. 2259; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 72(1).

**Suaeda depressa** (Pursh) S. Wats. *Dondia depressa* (Pursh) Britton. SEA BLIGHT.

Occasional or possibly common at the margins of saline flats on the Salt Plains. Found in fruit August 20.

Near Heart (Raup) lake, Nos. 2260, 2261.

#### CARYOPHYLLACEAE

**Stellaria longifolia** Muhl. *Alsine longifolia* (Muhl.) Britton. CHICKWEED.

Probably the most abundant chickweed in the region. It is to be seen in nearly every wet meadow, damp prairie, or muskeg, and is extremely variable in the form of its leaves and the size of its flowers. Flower buds



appear early in June and flowering continues through July. Fruits are matured in August.

East shore of lake Mamawi, No. 2303; along Quatre Fourches river, No. 722; 30th base line district, Slave river, Nos. 720, 721; Government Hay Camp district, Slave river, No. 2309; Fort Smith, Nos. 717, 723; Pine Lake district, Nos. 2311, 2312, 2313; Moose (Eight) Lake district, Nos. 2307, 2308, 2314; Indian graveyard, Peace river, No. 2304; base of eastern slope of Caribou mountains, Nos. 2300, 2301, 2305, 2306; eastern edge of Caribou Mountain plateau, No. 2302.

**S. longpipes** Goldie, var. **laeta** (Richards.) S. Wats. *Alsine laeta* (Richards.) Rydb.

Common in dry prairies and clearings, and in damp meadows, but occasionally found in sloughs and muskegs; largely limited to the upland districts. Extremely variable in leaf-form, growth-habit, and degree of glaucousness. Flowers from the middle of June to the latter part of July. Fruits mature in late July and the first half of August.

East shore of lake Mamawi, Nos. 2336, 2337; Fort Smith, No. 717; Pine Lake district, Nos. 2310, 2328, 2330, 2331, 2332, 2334; Peace point, No. 2333; sink-hole 16 miles east of Moose lake, No. 2335; base of eastern slope of Caribou mountains, Nos. 2338, 2339, 2340, 2341; lower Slave river, No. 710.

**S. borealis** Bigelow. *Alsine borealis* (Bigelow) Britton. See Rhod. xvi, 144 (1914).

Common in wet meadows and sloughs throughout the area. Found in flower during the latter part of June, and in various stages of flower and fruit through July and most of August.

Murdock Creek district, Nos. 2315, 2316; Fort Smith, No. 728; Pine Lake district, Nos. 2319, 2321, 2322; Round lake, about 18 miles south of Pine lake, No. 2320; sink-hole 16 miles east of Moose lake, No. 2317; Moose (Eight) Lake district, Nos. 2318, 2323.

**S. crassifolia** Ehrh. *Alsine crassifolia* (Ehrh.) Britton.

Occasional in upland muskeg sloughs. Collected in flower early in July and in fruit during August.

Pine Lake district, No. 2324; sink-hole 16 miles east of Moose lake, No. 2325; Moose (Eight) Lake district, Nos. 2326, 2327.

**Cerastium Beeringianum** Cham. and Schlecht. See Rhod. xxii, 169 (1920). MOUSE-EAR CHICKWEED.

Apparently rare or occasional in the area, and collected thus far only in a damp slough near Fort Smith. In flower June 23.

Fort Smith, No. 694.

**C. nutans** Raf.

Occasional on damp, sandy lake and slough margins, and in damp rock crevices. Also found in sandy buffalo wallows. Early flowers collected June 22, and fruit July 14.

East shore of lake Mamawi, No. 2296; Pine Lake district, Nos. 2297, 2298; Round lake, about 18 miles south of Pine lake, No. 2299.

**C. arvense L.**

Common in rather dry, upland prairie openings. Found in flower from mid-June to the latter part of July, and with a few late flowers August 20.

Near Heart (Raup) lake, No. 2290; near Mission Farm, No. 2293; Pine Lake district, Nos. 2291, 2294; base of eastern slope of Caribou mountains, No. 2295.

**Arenaria lateriflora L.** *Moehringia lateriflora* (L.) Fenzl. See Rhod. xix, 259 (1917).

Common in shady woods throughout the area. Collected in flower between the middle of June and the middle of July. Fruit probably matures in late July or early August, though none is found in the writer's collections.

East shore of lake Mamawi, No. 2286; 30th base line district, Slave river, Nos. 684, 685; Fort Smith, No. 683; Pine Lake district, Nos. 2280, 2281; Moose (Eight) Lake district, No. 2279; base of eastern slope of Caribou mountains, Nos. 2283, 2284; eastern edge of Caribou Mountain plateau, No. 2285.

**A. dawsonensis** Britton. *A. litorea* Fernald. See Mem. Am. Acad. xv, 279 (1925). SANDWORT.

Occasional in upland meadow openings and muskegs, and in rock crevices. Collected in flower June 20, and in fruit during August.

East shore of lake Mamawi, No. 2288; Pine Lake district, No. 2287; sink-hole 16 miles east of Moose lake, No. 2289.

**Spergularia salina** J. and C. Presl. *S. marina* Griseb. in Gray's Man., 7th ed. *Tissa salina* (Presl.) Greene. See Rhod. xii, 157 (1910). SAND SPURRY.

Common at the margins of saline flats and brine springs on the Salt Plains. Collected in fruit August 19-20.

Near Heart (Raup) lake, Nos. 2342, 2343; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 72(2).

**Lychnis Drummondii** (Hook.) S. Wats. *Wahlbergella Drummondii* (Hook.) Rydb. CAMPION.

Apparently rare in Wood Buffalo park, and collected thus far only in the driest upland prairies. In fruit July 17.

Peace point, No. 2344.

## NYMPHAEACEAE

**Nymphozanthus variegatus** (Engelm.) Fernald. *Nymphaea variegata* (Engelm.) G. S. Miller. See Rhod. xxi, 187 (1919). COW LILY, YELLOW WATER-LILY.

Abundant in shallow lakes, ponds, and sluggish streams. The most extensive growth thus far observed by the writer is at Moose (Eight) lake, where it forms a dense zone 100 feet or more wide along the marshy shores. Found in flower in the latter part of June and through July. Fruits mature during the latter part of August or later.

Cree (Mamawi) creek, No. 2350; Murdock Creek district, No. 2347; Pine Lake district, No. 2346; Moose (Eight) lake, Nos. 2348, 2349, 2351.

## CERATOPHYLLACEAE

**Ceratophyllum demersum** L. HORNWORT.

Apparently occasional in the park area, and collected thus far only in a lowland slough pond. The genus is badly in need of study in America, and may contain more than one species in the north. The rarity with which fertile plants are collected makes this very difficult. The writer's specimens were found with mature fruit July 28.

Murdock Creek district, No. 2345.

## RANUNCULACEAE

**Actaea rubra** (Ait.) Willd. BANEERRY.

Common in poplar or poplar-spruce woodlands throughout the area. There is a great variety in the colour of the berries, some of them maturing white, and others bright red. Flowers appear about the third week in June, and fruit during the latter half of July and August. The rootstock has a strongly purgative action, and the berries are known to be somewhat poisonous.

East shore of lake Mamawi, No. 2390; 30th base line, Slave river, No. 755; Government Hay Camp district, Slave river, Nos. 2394, 2398, 2399; near upper Smith rapids, No. 757; Fort Smith, No. 754; Pine Lake district, Nos. 2400, 2401; Moose (Eight) Lake district, Nos. 2395, 2396, 2397; Indian graveyard, Peace river, No. 2389; base of eastern slope of Caribou mountains, Nos. 2391, 2392, 2393.

**Aquilegia brevistyla** Hook. COLUMBINE.

Occasional in poplar woods, chiefly in the upland districts. Flowers observed from June 18 to July 11, when the fruiting follicles are well formed. Where it inhabits more damp areas the flowering period is a little longer. Mature fruit collected August 1.

Fort Smith, No. 760; Pine Lake district, No. 2429; Indian graveyard, Peace river, No. 2428; specimen of unknown locality, No. 2427.

**Delphinium scopulorum** Gray, var. **glaucum** Gray. LARKSPUR.

Common in upland clearings and open poplar woods, and abundant in some of the semi-open prairie districts. In the prairies at the base of Caribou mountains it grows to such size and numbers as to give a purple colour to large areas during its flowering season. A record plant measured 9 feet 3 inches in height, with a small part of the inflorescence still to be unfolded. Rare individuals have a tendency toward albinism. Young shoots have been observed as early as June 19, and flower buds from June 28 to July 7. The earliest flowers found thus far were on July 5, and flowering continues through most of July. Immature fruits are found in the last week of July, and mature ones in August. Known to be poisonous to cattle, producing stiffness, convulsions, and death.

Government Hay Camp district, Slave river, Nos. 2355, 2356; Pine Lake district, Nos. 2357, 2358; base of eastern slope of Caribou mountains, Nos. 2352, 2353; lower Slave river, *Russell*, No. 75.

**Anemone parviflora** Michx. NORTHERN ANEMONE.

Apparently rare or only occasional, and collected thus far only in upland muskeg timber, where it is in flower July 11.

Pine Lake district, No. 2421.

**A. multifida** Poir., var. **hudsoniana** DC. See Rhod. xix, 141 (1917). HUDSONIAN ANEMONE.

Common on upland dry ridges and prairies, and in rock crevices. Collected in flower from June 15 through the first week in July. Late flowers and immature fruit are found through the third week in July, and fruits in August.

Government Hay Camp district, Slave river, No. 2417; Fort Smith, No. 774; near Mission Farm, No. 2415; Pine Lake district, Nos. 2412, 2414, 2416, 2418; Peace point, Nos. 2419, 2420; Moose (Eight) Lake district, No. 2413.

**A. cylindrica** Gray.

Apparently occasional in Wood Buffalo park, and collected thus far only on the Peace Point prairie, where it is common. Late flowers and immature fruit collected July 17 to 21, and mature fruits observed August 2.

Peace point, Nos. 2409, 2410, 2411.

**A. canadensis** L. CANADIAN ANEMONE.

Common at slough margins and in prairies. New rosettes collected June 12, and flowers from July 14 to the first week in August. Fruits matured during the middle part of August.

East shore of lake Mamawi, Nos. 2424, 2426; 30th base line district, Slave river, No. 769; Round lake, about 18 miles south of Pine lake, No. 2423; Peace point, No. 2422; Indian graveyard, Peace river, No. 2425.

**Pulsatilla ludoviciana** (Nutt.) Heller. *Anemone patens* L., var. *Wolfgangiana* (Bess.) Koch. WILD CROCUS, PULSATILLA.

Common on dry, sandy or rocky ridges and in dry prairies throughout the region. It is one of the earliest flowers of the spring. Late flowers have been found June 13, but most of the plants are in fruit by that time. They apparently reach the height of their flowering in the latter part of May and the first week of June, although occasional flowers are to be found through the entire summer. The juice of the plant is very acrid, and when handled often causes irritation and blistering of the skin.

Along Quatre Fourches river, No. 765; Fort Smith, Nos. 766, 2403; Pine Lake district, Nos. 2404, 2405, 2406; Peace point, No. 2407.

**Ranunculus aquatilis** L., var. **capillaceus** DC. WHITE WATER BUTTERCUP.

Common in shallow lakes, ponds, and slow streams throughout the area, sometimes becoming a creeping mud plant. Found in flower from mid-June to mid-August, and with immature fruit August 14.

Cree (Mamawi) creek, No. 2370; 30th base line district, Slave river, No. 729; Moose (Eight) lake, No. 2369; Little Buffalo river, *Russell*, No. 91.

**R. Cymbalaria** Pursh. *Halerpestes Cymbalaria* (Pursh) Greene. SEA-SIDE BUTTERCUP.

Common on muddy slough and stream margins, particularly those of slightly saline nature, and found mainly in the lowland districts. Collected in flower June 23, and with both flowers and fruit July 12 and August 8.

Government Hay Camp district, Slave river, No. 2366; Fort Smith, No. 733; Little Buffalo river, *Russell*, No. 65.

**R. Purshii** Richards. YELLOW WATER BUTTERCUP.

Common in slough ponds throughout the area. Flowers collected during the third week in June and through most of the summer. Fruits are matured during July and August.

30th base line district, Slave river, No. 734; Murdock Creek district, No. 2377; Government Hay Camp district, Slave river, Nos. 2378, 2379; Pine Lake district, Nos. 2375, 2376; base of eastern slope of Caribou mountains, No. 2374.

**R. hyperboreus** Rottb. ARCTIC BUTTERCUP.

Apparently rare in Wood Buffalo park, and known thus far only from a single specimen collected in the Salt Plain prairies. In flower August 20. Near Heart (Raup) lake, No. 2368.

**R. lapponicus** L. LAPLAND BUTTERCUP.

Apparently rare in the region, and found thus far only on the Caribou Mountain plateau, where it grows in mossy muskeg thickets. Found with immature fruit July 12.

Eastern edge of Caribou Mountain plateau, No. 2359.

**R. rhomboideus** Goldie. PRAIRIE BUTTERCUP.

Apparently rare or occasional, and confined to the upland semi-open prairies. In flower and immature fruit June 17.

Pine Lake district, No. 2373.

**R. sceleratus** L. CELERY-LEAVED, OR CURSED BUTTERCUP.

Common on wet pond and lake shores. Found in flower from the latter part of June through the remainder of the summer. Mature fruits collected as early as June 26. Plants very acrid, the juice often causing a blistering of the skin.

Lower delta of Athabaska river, No. 746; 30th base line district, Slave river, No. 745; Murdock Creek district, No. 2386; Government Hay Camp district, Slave river, No. 2385; near Heart (Raup) lake, No. 2384; Pine Lake district, Nos. 2382, 2387; Moose (Eight) Lake district, Nos. 2380, 2381, 2383; base of eastern slope of Caribou mountains, No. 2388.

**R. abortivus** L. SMALL-FLOWERED BUTTERCUP.

Occasional, and apparently confined to upland muskegs. In flower June 20, and fruit July 19. Juice from leaves known to cause blistering.

Pine Lake district, No. 2372; base of eastern slope of Caribou mountains, No. 2371.

**R. tenellus** Nutt.

Apparently rare in the park area, and collected thus far only at a slough margin along Peace river just inside the western boundary. With flowers and fruit July 31.

Indian graveyard, Peace river, No. 2367.

**R. pennsylvanicus** L. f. BRISTLY BUTTERCUP.

Collected thus far only in the Peace-Athabaska delta, where it is common. Found in fruit July 11 and during the second week in August.

Lower delta of Athabaska river, No. 744; east shore of lake Mamawi, No. 2360.

**R. Macounii** Britton. MACOUN'S BUTTERCUP.

Common in damp sloughs throughout the region. Flowers collected during the latter part of June and the first three weeks of July. Fruit begins to mature about mid-July and continues through most of August. Occasional flowers are found in early August.

Government Hay Camp district, Slave river, Nos. 2363, 2365; Fort Smith, No. 741; Round lake, about 18 miles south of Pine lake, No. 2361; Peace point, No. 2364; sink-hole 16 miles east of Moose lake, No. 2362.

**R. ACRIS** L. FIELD BUTTERCUP.

Occasional in the region and apparently confined to the settled areas, where it is probably adventive. Collected in flower August 8, and with flowers and immature fruits August 18. The plants contain an acrid juice that has been known to cause blistering, vomiting, diarrhoea, and even death, in animals.

Fort Smith district, No. 747, and *Russell*, No. 30.

**Thalictrum sparsiflorum** Turcz. MOUNTAIN RUE.

Rare in the region, and known only from Caribou Mountain plateau, where it grows in muskegs. Collected in fruit July 12.

Eastern edge of Caribou Mountain plateau, No. 2435.

**T. venulosum** Trelease. MEADOW RUE.

Common in prairie openings and open poplar woods throughout the upland districts, and abundant in the prairies at the base of Caribou mountains. The height of the flowering season is in the latter part of June and early July. Fruit is formed in the latter half of July and early August, and is falling off by August 20.

Near Mission Farm, No. 2439; near Heart (Raup) lake, No. 2432; Pine Lake district, Nos. 2440, 2441; Round lake, about 18 miles south of Pine lake, No. 2436; Peace point, Nos. 2433, 2437; sink-hole 16 miles east of Moose lake, No. 2430; Moose (Eight) lake, No. 2431; base of eastern slope of Caribou mountains, Nos. 2434, 2442, 2443, 2444.

## PAPAVERACEAE

**Corydalis sempervirens** (L.) Pers. *Capnoides sempervirens* (L.) Borkh. PALE CORYDALIS.

Occasional in the park area, and collected thus far only in crevices on granite hills in the Peace delta and along the upper Slave river. In flower June 9, and with both flowers and fruit August 15.

Along Quatre Fourches river, No. 783; Government Hay Camp district, Slave river, No. 2443.

**C. aurea** Willd. *Capnoides aurea* (Willd.) Kuntze. GOLDEN CORYDALIS.

Common in cabin clearings and in the disturbed soil of river banks, but abundant in recently burned areas. It is one of the pioneer plants in the new brûlés. Collected in flower and immature fruit during the latter part of June, and in various stages of flowering and fruiting through the remainder of the summer.

Government Hay Camp district, Slave river, No. 2441; Pine Lake district, No. 2440; near sink-hole 16 miles east of Moose lake, No. 2442; base of eastern slope of Caribou mountains, Nos. 2438, 2439; lower Slave river, No. 781; Clewi river, *Russell*, No. 97.

## CRUCIFERAE

**Draba nemorosa** L. WHITLOW GRASS.

Common in dry prairies, clearings, and on sandy lake shores throughout the upland. A common weed of dry soils about the settlements, and an abundant inhabitant of ant hills and dry buffalo wallows. Found with flowers and fruit from the latter part of June through most of the summer.

Fort Smith, No. 808; Pine Lake district, Nos. 2446, 2449, 2450; sink-hole 16 miles east of Moose lake, No. 2447; base of eastern slope of Caribou mountains, Nos. 2444-a, 2445.

**THLASPI ARVENSE** L. PENNY-CRESS.

Occasional as an adventive weed in the settled areas. In fruit August 12.

Government Hay Camp, Slave river, No. 2454.

**Lepidium apetalum** Willd. PEPPER-GRASS, BIRD-SEED.

Occasional in dry prairie openings and old buffalo wallows in the upland districts. Collected with flowers and immature fruit June 22, and with mature fruit August 20.

Near Heart (Raup) lake, No. 2453; Pine Lake district, No. 2451; sink-hole 16 miles east of Moose lake, No. 2452.

**CAPELLA BURSA-PASTORIS** (L.) Medic. *Bursa Bursa-pastoris* (L.) Britton. SHEPHERD'S PURSE.

Adventive and common about the settlements. Collected with flowers and fruit June 23 and August 6.

Government Hay Camp, Slave river, No. 2462; Fort Smith, No. 797.

**CAMELINA SATIVA (L.) Crantz. FALSE FLAX.**

Adventive in the settled districts and in cabin clearings. Collected with flowers and maturing fruit July 8, and with all its pods mature August 6.

Government Hay Camp, Slave river, No. 2459; Pine Lake ranger station, No. 2460.

**NESLIA PANICULATA (L.) Desv. BALL MUSTARD.**

Adventive in settled districts. Found with flowers and immature fruit during the first week in August.

Government Hay Camp, Slave river, Nos. 2457, 2458.

**BRASSICA ARVENSIS (L.) Kuntze. *Sinapis arvensis* L. MUSTARD.**

Adventive in the settled districts. Flowers and young pods collected August 4. The seeds are commonly used medicinally as a stimulant or emetic. Other species in this family have somewhat the same qualities or are used in poultices as counter-irritants.

Government Hay Camp, Slave river, No. 2456.

**Sisymbrium salsuginosum** Pall.

Probably common in the Salt Plain prairies, the only region in which it has been found thus far. Collected with flowers and immature fruit June 15, and with flowers and mature fruit August 20.

Near Heart (Raup) lake, No. 2483; near Mission Farm, No. 2482.

**Descurainia Richardsonii** (Sweet) O. E. Schultz.

Probably occasional in clearings and prairies. Found with flowers and immature fruit July 6.

Pine Lake ranger station, No. 2463.

Specimens collected in upland prairies on July 5 are too young for definite determination.

Base of eastern slope of Caribou mountains, No. 2464.

**Erysimum cheiranthoides** L. *Cheirinia cheiranthoides* (L.) Link. WORM-SEED MUSTARD, TREACLE MUSTARD.

Common in open places on river banks and in cabin clearings throughout the area. In the prairies at the base of Caribou mountains it becomes very abundant, and its yellow flowers add much colour to the landscape. A predominating feature of the spring and early summer aspect of these prairies is the abundance of tall dead stalks of treacle mustard rising above the new green of the grasses. Early flowers appear about the middle of June, and immature fruit about the first week of July. Flowering is nearly over during the second and third weeks of August, and fruits are maturing in quantity.

East shore of lake Mamawi, No. 2471; Murdock Creek district, No. 2475; near Heart (Raup) lake, No. 2477; Fort Smith, No. 799; Pine Lake district, No. 2472; Round lake, about 18 miles south of Pine lake, No. 2476; Peace point, No. 2473; sink-hole 16 miles east of Moose lake, No. 2474; base of eastern slope of Caribou mountains, Nos. 2465, 2466, 2467, 2468, 2469, and 2470; lower Slave river, No. 798.



**E. parviflorum** Nutt.

Occasional and apparently confined to dry upland prairies. Found with flowers and immature fruit July 17, and with flowers and mature fruit August 20.

Near Heart (Raup) lake, No. 2478; Peace point, No. 2479.

**Rorippa obtusa** (Nutt.) Britton. *Radicula obtusa* (Nutt.) Greene.

Apparently rare, and found thus far only in a crevice on a granite hill in the Peace delta. Collected with flowers and maturing fruit August 16.

East shore of lake Mamawi, No. 2514.

**R. palustris** (L.) Bess., var. **glabrata** (Lunell) Victorin. See Jour. Bot. xlii, 225 (1924), and Cont. Lab. de Bot. Univ. Montreal, No. 17 (1930). WATER-CRESS, MARSH CRESS.

Common on the wet shores of lakes and sloughs throughout the park area. In some lowland sloughs it makes the predominating vegetation at the water's edge, where it is actively colonizing new areas by vegetative means. Flowers collected as early as June 16 and throughout the summer, whereas maturing fruit is not commonly found until late July or early August.

30th base line, Slave river, No. 800; Murdock Creek district, No. 2507; Government Hay Camp district, Slave river, Nos. 2506, 2509; Round lake, about 18 miles south of Pine lake, No. 2510; Peace point, No. 2508; sink-hole 16 miles east of Moose lake, No. 2511; Moose (Eight) Lake district, Nos. 2502, 2503, 2504, 2505; Indian graveyard, Peace river, No. 2513; base of eastern slope of Caribou mountains, No. 2512.

**R. palustris** (L.) Bess., var. **hispida** (Desv.) Rydb. *Radicula hispida* (Desv.) Britton; *R. palustris* (L.) Moench, var. *hispida* (Desv.) Robinson.

Apparently occasional in the area, and found thus far only in a wet prairie on the Salt Plains. In fruit August 20.

Near Heart (Raup) lake, No. 2501.

**Cardamine pennsylvanica** Muhl. BITTER CRESS.

Common in upland muskegs, where it was collected with flowers and immature fruit June 20 and July 11.

Pine Lake district, Nos. 2480, 2481.

**Arabis lyrata** L.

Occasional in upland meadows and on dry ridges. Collected with flowers and well-developed pods in mid-June and mid-July.

Near Mission Farm, No. 2484; Moose (Eight) Lake district, No. 2485.

**A. brachycarpa** (T. and G.) Britton.

Apparently rare, and known only from the following locality, where it had immature fruit June 26.

Pine Lake district, No. 2486.

**A. Drummondii** Gray. ROCK CRESS.

Occasional in upland prairies and open woods. Collected in flower June 15.

Near Mission Farm, No. 2487; Pine Lake district, No. 2488.

**A. retrofracta** Gray.

Occasional in dry prairies and upland woods, or on exposed sandy banks. In flower June 20, and maturing fruits during the first week in July.

Pine Lake district, Nos. 2489, 2491; Peace point, No. 2490.

**A. hirsuta** (L.) Scop. HAIRY ROCK CRESS.

Common in upland prairies and clearings. Found in flower during the latter half of June, and in fruit during the latter half of July and August.

Near Mission Farm, No. 2497; Pine Lake district, Nos. 2496, 2498, 2499; Peace point, No. 2500; sink-hole 16 miles east of Moose lake, No. 2495; base of eastern slope of Caribou mountains, Nos. 2492, 2493, 2494.

## DROSERACEAE

**Drosera rotundifolia** L. SUNDEW.

Apparently rare or occasional in the park area, and known thus far only from two specimens collected in an upland muskeg. Flowers were not quite out on July 9. Said to be poisonous to cattle.

Pine Lake district, No. 2515.

## SAXIFRAGACEAE

**Saxifraga tricuspidata** Rottb. *Leptasea tricuspidata* (Rottb.) HAW. SAXIFRAGE.

Common on granite hills in Athabaska-Peace delta and along upper Slave river. Collected in flower June 9, and with a few late flowers August 7-8. Fruit is matured in August and probably earlier.

East shore of lake Mamawi, No. 2568; along Quatre Fourches river, No. 826; Government Hay Camp district, Slave river, No. 2567.

**Heuchera Richardsonii** R.Br. See Rhod. xxxv, 111-19 (1933). ALUM ROOT.

Common on the granite hills in Athabaska-Peace delta, where new rosettes were found June 9, and late flowers and maturing fruit August 8-9.

Along Quatre Fourches river, No. 847; east shore of lake Mamawi, No. 2550.

**Mitella nuda** L. BISHOP'S CAP.

A common species of rich spruce or spruce-poplar woodlands and timbered muskegs throughout the region. It usually grows in a thick mat of mosses. Collected in flower in the latter half of June and the first half of July. Fruits are matured in late July and in August.

30th base line, Slave river, No. 815; Government Hay Camp district, Slave river, No. 2562; Pine Lake district, No. 2563; Peace point, No. 2561; Moose (Eight) Lake district, No. 2564; base of eastern slope of Caribou mountains, No. 2566; eastern edge of Caribou Mountain plateau, No. 2565; Little Buffalo river, *Russell*, No. 83.

**Chrysosplenium tetrandrum** Fries. GOLDEN SAXIFRAGE.

Rare or occasional in the park area, and found thus far only in a single upland muskeg. Collected with flowers and immature fruits June 20.

Pine Lake district, No. 2551.

**Parnassia multiseta** (Ledeb.) Fernald. *P. palustris* of auth. See Rhod. xxviii, 211 (1926). GRASS OF PARNASSUS.

Common in muskegs and willow slough margins throughout the region. Flower buds collected July 8, but the height of the flowering season is not reached before late July and early August. Fruits are mature in the latter part of August.

Government Hay Camp district, Slave river, Nos. 2553, 2554; along Smith Portage road, No. 842; Pine Lake district, No. 2559; Moose (Eight) Lake district, Nos. 2558, 2555, 2556, 2557; base of eastern slope of Caribou mountains, No. 2560; Little Buffalo river, *Russell*, 77 (2).

**P. montanensis** Fernald and Rydb.

Occasional in the park area, and collected thus far only at the willow margin of an upland slough. In flower July 17.

Base of eastern slope of Caribou mountains, No. 2552.

**Ribes oxycanthoides** L. NORTHERN GOOSEBERRY.

Common on rocky hills and in open woods and muskegs, but abundant in some of the semi-open prairies. The Indian name for the openings at the base of Caribou mountains is "Gooseberry Prairie," on account of the abundance of this species. Observed in flower June 12, and with immature fruit during late June and early July. The berries ripen in the latter part of July and in August.

East shore of lake Mamawi, No. 2537; 30th base line district, Slave river, No. 852; Government Hay Camp district, Slave river, No. 2542; near Heart (Raup) lake, No. 2541; Pine Lake district, No. 2538; Peace point, No. 2540; Moose (Eight) lake, No. 2539; base of eastern slope of Caribou mountains, Nos. 2532, 2533, 2534, 2535; Indian graveyard, Peace river, No. 2536; lower Slave river, No. 854.

**R. hudsonianum** Richards. NORTHERN BLACK CURRANT.

Common in rich woods and timbered muskegs throughout the region. Collected in flower during most of June, and with immature fruit early in July. Berries ripen in the latter part of July and August.

Along Quatre Fourches river, No. 860; 30th base line district, Slave river, Nos. 859, 862; Government Hay Camp, Slave river, No. 2525; Pine Lake district, No. 2526; Moose (Eight) Lake district, Nos. 2519, 2520, 2521, 2522, 2523, 2524; base of eastern slope of Caribou mountains, No. 2518; eastern edge of Caribou Mountain plateau, Nos. 2516, 2517.

**R. lacustre** (Pers.) Poir. *Limnobotrya lacustris* (Pers.) Rydb. SWAMP CURRANT.

Common in rich upland woods and timbered muskegs. Immature fruit collected during the second and third weeks in July, and ripe berries during mid-August. The ripe berries have a bitter taste.

Pine Lake district, No. 2549; Moose (Eight) Lake district, Nos. 2546, 2547, 2548; eastern slope of Caribou mountains, No. 2544; eastern edge of Caribou Mountain plateau, Nos. 2543, 2545.

**R. triste** Pall. WILD RED CURRANT.

Common in rich woods throughout the region. Found in flower during the middle part of June, and with mature fruits in mid-July.

Along Quatre Fourches river, No. 869; Pine Lake district, No. 2529; Peace point, No. 2527; Moose (Eight) Lake district, No. 2528; base of eastern slope of Caribou mountains, No. 2530.

## ROSACEAE

**Amelanchier florida** Lindl. See Rhod. xiv, 117 (1912). SASKATOON, or SERVICE BERRY.

A common shrub of dry woods, prairies, and river banks. In many places it produces an abundance of excellent fruit in late summer, and the berries have long been used as a constituent of pemmican. Flowers have been found from June 9 to the first week in July, but the height of the flowering season is in the latter half of June. Fruits are well formed during the latter half of July, but usually do not ripen until the first week in August.

East shore of lake Mamawi, No. 2654; along Quatre Fourches river, No. 927; Government Hay Camp district, Slave river, No. 2652; along upper Slave river, No. 928; Fort Smith, No. 930; Pine Lake district, Nos. 2648, 2650, 2651; Peace point, No. 2653; Moose (Eight) Lake district, Nos. 2645, 2646, 2647; Indian graveyard, Peace river, No. 2655; base of eastern slope of Caribou mountains, Nos. 2656, 2657.

**Rubus idaeus** L., var. **canadensis** Richards. See Rhod. xxi, 89 (1919). RED RASPBERRY.

The common red raspberry of the region, and an abundant source of wild fruit in late summer. The species is abundant in open woods, clearings, prairies, and on rocky hills. Flower buds appear in mid-June, and most of the flowers during the first half of July. Immature fruits have been seen July 18, and ripe ones in late July and in August.

East shore of lake Mamawi, No. 2635; 30th base line district, Slave river, Nos. 881, 887; Government Hay Camp district, Slave river, No. 2627; Fort Smith, No. 885; Pine Lake district, Nos. 2630, 2631; Peace point, No. 2628; Moose (Eight) Lake district, No. 2629; Indian graveyard, Peace river, No. 2634; base of eastern slope of Caribou mountains, Nos. 2632, 2633; lower Slave river, No. 882.

**R. idaeus** L., var. **strigosus** (Michx.) Maxim. See Rhod. xxi, 89 (1919).

Rare or occasional in Wood Buffalo park, and found thus far only in open woods at the base of Caribou mountains. In flower June 30.

Base of eastern slope of Caribou mountains, No. 2626.

**R. Chamaemorus** L. CLOUD, or MUSKEG BERRY, BAKED-APPLE BERRY.

Apparently rare or occasional in this region, and found thus far only in mossy muskegs in Caribou mountains. Immature fruit collected July 11-12.

Eastern edge of Caribou Mountain plateau, No. 2625. •

**R. pubescens** Raf. *R. triflorus* Richards. of Gray's Man., 7th ed. See Rhod. xi, 236 (1909). DWARF RASPBERRY.

Abundant in shady woodlands throughout the area. The height of its flowering season is about mid-June, but fruits do not mature until late

July or early August. The berries of this species are among the most delicious that the region affords, but they are comparatively small and do not ripen in sufficient numbers to be of much importance.

Along Quatre Fourches river, No. 880; Government Hay Camp, Slave river, No. 2619; Pine Lake district, Nos. 2617, 2621, 2623; Peace point, No. 2620; Moose (Eight) Lake district, Nos. 2622, 2624; Indian graveyard, Peace river, No. 2616; base of eastern slope of Caribou mountains, Nos. 2613, 2614, 2615.

**R. acaulis** Michx. *R. arcticus* L. var. *grandiflorus* Hook. ARCTIC RASPBERRY.

Abundant in rich woods and muskeg thickets throughout the region. Found in flower June 12, the height of the flowering season being in late June and early July. Nearly ripe fruits have been found July 18, and mature ones in late July and August.

30th base line district, Slave river, Nos. 871, 873; Government Hay Camp district, Slave river, Nos. 2638, 2639; Pine Lake district, Nos. 2636, 2637, 2640; Moose (Eight) Lake district, No. 2642; base of eastern slope of Caribou mountains, No. 2644; eastern edge of Caribou Mountain plateau, No. 2643; Little Buffalo river, *Russell*, No. 79.

**Fragaria glauca** (S. Wats.) Rydb. WILD STRAWBERRY.

Abundant in dry open woods, prairies, clearings, and on rocky hills. It flowers from the early part of June through most of the summer, but the height of the flowering season is in the last third of June. The earliest ripe berries found by the writer were on July 19, and they become common in the latter part of July and the first part of August.

East shore of lake Mamawi, No. 2609; along Quatre Fourches river, No. 974; 30th base line district, Slave river, No. 970; Government Hay Camp district, Slave river, No. 2606; Fort Smith, No. 969; near Mission Farm, No. 2604; Pine Lake district, Nos. 2601, 2602, 2603; Peace point, No. 2605; Moose (Eight) Lake district, No. 2607; base of eastern slope of Caribou mountains, No. 2608; Little Buffalo river, *Russell*, No. 37.

**F. vesca** L., var. *americana* Porter.

Occasional, and found thus far only in the flood-plain forests along lower Peace river, where it was in fruit July 18 and August 1.

Peace point, No. 2612; Indian graveyard, Peace river, No. 2611.

**Potentilla millegrana** Engelm. CINQUEFOIL.

Occasional in the park area, where it may be adventive. Found only along upper Slave river in old gardens and cabin clearings. In fruit August 12.

Government Hay Camp, Slave river, No. 2681.

**P. norvegica** L., var. *hirsuta* (Michx.) Lehm. *P. monspeliensis* of auth. See Bibl. Bot. xvi, Heft 71, 404 (1908).

Abundant in wet meadows, slough margins, prairies, cabin clearings, and rock crevices throughout the region. Early flowers are found about June 20, and the height of the flowering season is reached in late June and the first part of July. Fruits begin to mature in mid-July.

East shore of lake Mamawi, No. 2692; lower delta of Athabaska river, No. 963; Murdock Creek district, No. 2699; Government Hay Camp district, Slave river, Nos. 2698, 2701; Fort Smith, No. 966; Pine Lake district, Nos. 2700, 2702, 2703, 2704; Round lake, about 18 miles south of Pine lake, No. 2705; sink-hole 16 miles east of Moose lake, No. 2709; Moose (Eight) lake, Nos. 2706, 2707, 2708, 2710; Indian graveyard, Peace river, No. 2693; base of eastern slope of Caribou mountains, Nos. 2694, 2695, 2696, 2697.

**P. multifida L.**

Not found thus far in the park, but collected near Fort Smith by *Seton and Preble* in 1907, No. 78577 (Hb. Nat. Mus. Canada and Hb. N.Y. Bot. Gard.).

**P. pennsylvanica L.**

A common and highly variable species of dry prairies, sandy ridges, and rock hills. Found in flower in mid-July and in fruit during late July and August. The pubescence and cutting of the leaves are the most variable characters.

East shore of lake Mamawi, Nos. 2718, 2719; Government Hay Camp district, Slave river, No. 2711; near Heart (Raup) lake, No. 2712; Peace point, Nos. 2714, 2715, 2716; Moose (Eight) Lake district, No. 2713; base of eastern slope of Caribou mountains, No. 2717.

**P. pulcherrima Lehm.**

Apparently rare or occasional in the park area, and found thus far only in the driest parts of the prairies at the base of Caribou mountains. Found in flower July 22 and 24.

Base of eastern slope of Caribou mountains, No. 2687.

**P. Anserina L.** *Argentina Anserina* (L.) Rydb. SILVER WEED, GOOSE TANZY.

Abundant in damp meadows and the drier parts of slough margins. In some places its silvery leaves make a distinct band around such openings. New rosettes collected June 12, and flowers June 19. Flowering continues throughout the summer.

East shore of lake Mamawi, No. 2682; 30th base line district, Slave river, Nos. 944, 946; Government Hay Camp district, Slave river, No. 2683; Fort Smith, No. 943; Round lake, about 18 miles south of Pine lake, No. 2685; sink-hole 16 miles east of Moose lake No. 2686; along Nyarling river, *Russell*, No. 52.

**P. palustris (L.) Scop.** *Comarum palustre* L. MARSH CINQUEFOIL.

Common at the margins of slough and mossy muskeg ponds. Early flowers found during the second week in July, and both flowers and fruit early in August.

Pine Lake district, No. 2727; Moose (Eight) Lake district, Nos. 2726, 2728.

**P. tridentata** Ait. *Sibbaldiopsis tridentata* (Ait.) Rydb. THREE-TOOTHED CINQUEFOIL.

Occasional on dry, sandy ridges and granite hills. Collected in flower July 11, and in fruit August 15.

Government Hay Camp district, Slave river, No. 2729; Pine Lake district, No. 2730.

**P. fruticosa** L. *Dasiphora fruticosa* (L.) Rydb. SHRUBBY CINQUEFOIL.

A common muskeg shrub throughout the upland districts, and also found on sterile, stony ground. It sometimes grows in thickets where it makes up a large part of the muskeg cover, and at others is scattered through the timber. Early flowers found during the last third of June, and occasional ones through most of the summer. The height of the flowering season is probably about mid-July.

Near Heart (Raup) lake, No. 2721; Fort Smith, No. 961; Pine Lake district, Nos. 2722, 2723, 2725; Moose (Eight) Lake district, No. 2724; Little Buffalo river, *Russell*, No. 88.

**P. arguta** Pursh. *Drymocallis agrimonioides* (Pursh) Rydb.

Common in dry prairies and rock crevices. Found in flower early in July, and in fruit early in August.

East shore of lake Mamawi, No. 2690; Peace point, Nos. 2688, 2689; base of eastern slope of Caribou mountains, No. 2691.

**Geum macrophyllum** Willd., var. **perincisum** (Rydb.) Raup. *G. perincisum* Rydb. *G. oregonense* Rydb., not Scheutz. See *Rhod.* xxxiii, 176 (1931). AVENS.

Common in prairies and sloughs throughout the region, and occasionally found in open woods. New rosettes collected June 12, and young inflorescences during the last week in June. The height of the flowering season is in the first half of July, and fruits are matured in late July and in August.

30th base line district, Slave river, No. 923; Murdock Creek district, No. 2589; Government Hay Camp district, Slave river, No. 2591; Fort Smith district, Nos. 922, 925, 926; Pine Lake district, Nos. 2590, 2592; Peace point, No. 2588; sink-hole 16 miles east of Moose lake, No. 2593; Moose (Eight) Lake district, Nos. 2594, 2595, 2596; Indian graveyard, Peace river, No. 2597; base of eastern slope of Caribou mountains, Nos. 2598, 2599, 2600; lower Slave river, No. 924.

**G. strictum** Ait.

Common in dry prairies and occasional in cabin clearings. Collected in flower during late June and most of July. Fruits mature in early August.

East shore of lake Mamawi, No. 2579; Pine Lake ranger station, No. 2574; Indian graveyard, Peace river, No. 2580; base of eastern slope of Caribou mountains, Nos. 2575, 2576, 2577, 2578.

**G. triflorum** Pursh. *Sieversia triflora* (Pursh) R.Br. OLD MAN'S WHISKERS.

Common on dry upland prairies and rocky hills. Late flowers and immature fruiting heads collected June 15 and 25. Fruits are matured in July and early August. During the latter part of July the Peace Point prairie is coloured pink by the abundance of fruiting styles of this species.

Government Hay Camp district, Slave river, No. 2587; near Mission Farm, No. 2583; near Heart (Raup) lake, No. 2586; Peace point, Nos. 2584, 2585; base of eastern slope of Caribou mountains, Nos. 2581, 2582.

**Rosa acicularis** Lindl. WILD ROSE.

All of the roses of the *acicularis* group in this region are much in need of careful study. The writer has been unable, thus far, to make any definite division among them, although there are wide variations in stem, leaf, and fruit characters. The relationship of var. *Bourgeauiana* is not clear, since the shape of the mature fruit is so inconstant. On a granite hill at the east shore of lake Mamawi there is a form with very much elongated fruits that has also been placed in this species for the time being.

Abundant in woods, clearings, prairies, and on rocky hills throughout the park area. Flower buds have been found June 9 and 13, but the height of the flowering season occurs in late June and the first half of July. Immature fruits appear during the third week in July, and mature ones in August. The wild roses are among the most abundant and striking summer flowers in the region. The fleshy part of the fruit is often used for food.

Reed portage, upper Embarras river, No. 2660; east shore of lake Mamawi, Nos. 2658, 2659, 2667 (Nos. 2658, 2659, 2660 are specimens with much elongated fruits); along Quatre Fourches river, No. 905; 30th base line district, Slave river, No. 906; Government Hay Camp, Slave river, No. 2674; Fort Smith, No. 901; Pine Lake district, Nos. 2669, 2670; Peace point, Nos. 2676, 2677; Moose (Eight) Lake district, Nos. 2668, 2671, 2672, 2673, 2675; Indian graveyard, Peace river, No. 2666; base of eastern slope of Caribou mountains, Nos. 2661, 2665; eastern edge of Caribou Mountain plateau, Nos. 2663, 2664.

**R. Woodsii** Lindl. MEADOW ROSE.

Common on dry prairies and on rocky hills in the Peace delta. Collected with flowers and immature fruit July 17 to 19, and with mature fruit August 8.

East shore of lake Mamawi, No. 2680; Peace point, No. 2678; base of eastern slope of Caribou mountains, No. 2679.

**Prunus pennsylvanica** Lf. PIN CHERRY, SAND CHERRY.

Occasional in dry upland woods and on granite hills. Collected with old flowers and immature fruits June 20 to 22. Fruits had all disappeared August 15. The ripened fruit is edible and is said to make very good jelly.

Government Hay Camp district, Slave river, No. 2572; Pine Lake district, Nos. 2570, 2571.

LEGUMINOSAE

**Astragalus adsurgens** Pall. MILK VETCH.

Occasional on dry sand ridges and prairies. Collected in flower during mid-July.

Peace point, No. 2778; Moose (Eight) Lake district, No. 2779.



**A. hypoglottis** L. PURPLE MILK VETCH.

Common in semi-open prairies on the upland. Collected in flower June 15, and in fruit July 19 and August 3.

Near Mission Farm, No. 2768; Peace point, Nos. 2767, 2769; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 5.

**A. alpinus** L. *Tium alpinum* (L.) Rydb. ALPINE MILK VETCH.

Common in upland woods and prairies. Also found in burned areas and muskeg thickets. In flower during the latter half of June and early July. Mature fruit collected in the latter part of July and early August.

Near Heart (Raup) lake, No. 2775; Fort Smith, Nos. 994 (coll. *Mrs. Conibear*), 995; Pine Lake district, Nos. 2771, 2772, 2773, 2774; Moose (Eight) Lake district, No. 2770; base of eastern slope of Caribou mountains, Nos. 2776, 2777; Lobstick creek, *Russell*, No. 4.

**A. eucosmos** B. L. Robinson.

Rare or occasional, and collected thus far only on an island floodplain in upper Slave river. Young flowers were developing on June 18. 30th base line, Slave river, No. 991.

**A. frigidus** (L.) Gray, var. *americanus* (Hook.) S. Wats. *Phaca americana* (Hook.) Rydb. ARCTIC MILK VETCH, RATTLE-POD.

Common in open woods and muskeg thickets throughout the area. It is occasionally found in semi-open prairies, but is probably commonest in open aspen woods. Young plants not yet in flower collected June 20, and early flowers late in June and early in July. Immature fruits may be found in the latter half of July, and mature ones in early August.

Government Hay Camp district, Slave river, No. 2760; Pine Lake district, Nos. 2757, 2758; Peace point, Nos. 2759, 2761; Moose (Eight) Lake district, Nos. 2752, 2753, 2754, 2755, 2756; base of eastern slope of Caribou mountains, Nos. 2762, 2763, 2764, 2766; eastern edge of Caribou Mountain plateau, No. 2765.

**A. tenellus** Pursh. *Homalobus tenellus* (Pursh) Britton.

Apparently rare in Wood Buffalo park, and collected thus far only on the Peace Point prairie, where it had both flowers and fruit July 17 to 19. Peace point, Nos. 2780, 2781.

**Oxytropis splendens** Dougl. LOCOWEED.

A large part of the writer's material may possibly be placed in var. *Richardsonii*, but the value of this variety is rather doubtful when a large series of intergrading specimens is taken into consideration. Therefore, pending further study, they have been classified as above.

Common in dry upland prairie openings and on sandy ridges. Rosettes are just getting started in the middle part of June, and early flowers are formed during the second week in July. Flowering appears to be at its height in the latter half of July, and fruits are matured in mid-August and later. Other species of this genus are known to be poisonous to stock, causing the disorder known as "loco," but no definite records are available for the one here listed.

Near Heart (Raup) lake, No. 2735; Peace point, Nos. 2733, 2734; sink-hole 16 miles east of Moose lake, No. 2732; Moose (Eight) Lake district, Nos. 2736, 2737.

**Hedysarum alpinum** L., var. **americanum** Michx.

Common in upland open woods and prairies. Flower buds collected June 20 and mature fruit early in August. The height of the flowering season appears to be about mid-July.

Government Hay Camp district, Slave river, No. 2807; near Heart (Raup) lake, Nos. 2804, 2806; Pine Lake district, No. 2805; Peace point, No. 2803.

**H. Mackenzii** Richards.

Occasional in Wood Buffalo park. Found in woods and thickets in both upland and lowland areas. Flowers collected during the second and third weeks of June.

Along lower Peace river, near the Slave, No. 1005; 30th base line district, Slave river, No. 1004; Salt mountain, No. 2802.

**Vicia americana** Muhl. VETCH.

Abundant in cabin clearings, open woods, and prairies throughout the area. It makes a substantial contribution to the supply of natural feed. Early flowers appear in late June and early July, and fruit is mature in late July and August.

East shore of lake Mamawi, No. 2783; Government Hay Camp district, Slave river, Nos. 2796, 2798; near Heart (Raup) lake, No. 2795; Fort Smith, No. 1006; Pine Lake district, Nos. 2788, 2789, 2790; Round lake, about 18 miles south of Pine lake, No. 2800; Peace point, Nos. 2791, 2792, 2793; Moose (Eight) Lake district, Nos. 2787, 2797, 2799; Indian graveyard, Peace river, No. 2784; base of eastern slope of Caribou mountains, Nos. 2782, 2786; eastern edge of Caribou Mountain plateau, No. 2785; Little Buffalo river, *Russell*, No. 33; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 61.

**V. americana** Muhl., var. **angustifolia** Nees.

Occasionally found in sloughs and on sand ridges. It is probably only a form of the species. Young plants not yet in flower collected June 12, and with immature fruit July 13.

30th base line district, Slave river, No. 1010; Moose (Eight) Lake district, No. 2801; lower Slave river, No. 1009.

**Lathyrus ochroleucus** Hook. PEA-VINE, VETCHLING.

Abundant in prairies, clearings, and dry open woods. One of the most important sources of forage in the poplar woods that form part of the summer range of the buffalo. Young plants not yet in flower or with a few early flowers are well started during the second week in June, whereas mature fruits are not commonly found much before the first of August. The height of the flowering season is about the last of June and the first of July.

Along Quatre Fourches river, No. 989; 30th base line district, Slave river, No. 988; Government Hay Camp district, Slave river, No. 2745; Fort Smith, No. 986; Pine Lake district, Nos. 2746, 2748; Peace point, Nos. 2742, 2743, 2744; Moose (Eight) Lake district, Nos. 2747, 2750, 2751; Indian graveyard, Peace river, No. 2738; base of eastern slope of Caribou mountains, No. 2740; eastern edge of Caribou Mountain plateau, No. 2739; Little Buffalo river, *Russell*, No. 31.

## GERANIACEAE

**Geranium Bicknellii** Britton. CRANE'S-BILL, WILD GERANIUM.

Common in open upland woods, but abundant in recently burned areas. In new, blackened brûlé it is one of the first plants to get started, and grows rankly. In flower during the latter part of June and the first half of July. Fruits begin to mature about mid-July.

Along trail about 10 miles southwest of Fitzgerald, No. 2809; sink-hole 16 miles east of Moose lake, No. 2810; eastern slope of Caribou mountains, No. 2811.

## LINACEAE

**Linum Lewisii** Pursh. WILD BLUE FLAX.

Apparently occasional, and found thus far only in dry Salt Plain prairies. In fruit August 20.

Near Heart (Raup) lake, No. 2808.

## CALLITRICHACEAE

**Callitriche hermaphroditica** L. See *Rhod.* xxv, 211 (1923), and *Vierteljahrssch. Nat. Ges. Zür.*, 53<sup>4</sup> (1909) 548.

Common in ponds and slow streams throughout the area. Collected in fruit during the middle part of August.

Cree (Mamawi) creek, No. 2812; sink-hole 16 miles east of Moose lake No. 2813.

## EMPETRACEAE

**Empetrum nigrum** L. CROWBERRY.

Occasional in Wood Buffalo park, and confined to upland muskegs and rich woods.

Near Heart (Raup) lake, No. 2814; eastern edge of Caribou Mountain plateau, Nos. 2815, 2816.

## BALSAMINACEAE

**Impatiens Noli-tangere** L. JEWEL-WEED, TOUCH-ME-NOT.

Rydberg (42) places all American material here related in *I. occidentalis* Rydb. (43). The writer has compared his own specimens, as well as other American ones (including a duplicate of Rydberg's type of *I. occidentalis*) with a considerable number of Eurasian specimens of *I. Noli-tangere* in the Gray Herbarium, and can see no reason for separating them.

Collected thus far only in rich woods in the upper delta of Athabaska river. In flower August 15.

Reed portage, upper Embarras river, No. 2818.

**Impatiens** sp.

These specimens are too young to be identified, and although they are mere seedlings they have produced some cleistogamous flowers and fruits. All of the material (about seventy plants) came from a space about 10 inches in diameter, from about eighty seeds which still cling to the roots. Found in the moss mat of a timbered, upland muskeg.

Base of eastern slope of Caribou mountains, No. 2817.

## VIOLACEAE

**Viola nephrophylla** Greene.

Apparently rare, and collected thus far only in an upland sink-hole prairie. Found with flower and fruit August 20.

Sink-hole 16 miles east of Moose lake, No. 2830.

**V. rugulosa** Greene. CANADA VIOLET.

This material is scarcely separable from *V. canadensis*. There is a little more hairiness on the veins of the leaves than in *canadensis*, but the presence or absence of "underground stolons" seems of doubtful value in separating the two.

Common in open poplar woods on the upland. Collected in flower during the latter part of June, and with flowers and fruit in mid-July.

Peace point, No. 2828; base of eastern slope of Caribou mountains, Nos. 2826, 2827.

**V. adunca** J. E. Smith.

Common in upland semi-open prairies and rock crevices. Found in flower during the latter half of June and early July. Mature fruit collected in July and August.

East shore of lake Mamawi, No. 2824; Pine Lake district, Nos. 2820, 2822, 2823; sink-hole 16 miles east of Moose lake, No. 2819; base of eastern slope of Caribou mountains, No. 2829.

## ELAEAGNACEAE

**Elaeagnus argentea** Pursh. *E. commutata* Bernh. SILVER-BERRY, SILVER-BUSH.

Occasional on upland prairies and lake shores. Abundant along Salt river at Mission Farm. Collected in flower from mid-June through the first week of July. The ripe berries are edible.

Near Heart (Raup) lake, No. 2831; near Mission Farm, No. 2833; Pine lake, No. 2832.

**Shepherdia canadensis** (L.) Nutt. *Lepargyrea canadensis* (L.) Greene. BUFFALO-BERRY, BUCK-BRUSH.

A common shrub of woods and thickets throughout the area. Its berries are used by the Indians to make a drink. Mature fruit produced during July and August.

East shore of lake Mamawi, No. 2841; along Quatre Fourches river, No. 1035; 30th base line district, Slave river, No. 1036; Government Hay Camp district, Slave river, Nos. 2835, 2836; Fort Smith, No. 1034; Pine Lake district, Nos. 2837, 2838; Moose (Eight) Lake district, Nos. 2834, 2840; base of eastern slope of Caribou mountains, Nos. 2839, 2842; Bear river, *Russell*, No. 36.

## ONAGRACEAE

**Epilobium angustifolium** L. *Chamaenerion angustifolium* (L.) Scop. FIREWEED,  
WILLOW-HERB.

Abundant in open woods, clearings, prairies, and burned areas throughout the region. It appears very soon after clearing and burning, and supplies a blaze of colour to what would otherwise be a dreary aspect. Young shoots common during most of June, and buds late in June or early in July. The first flowers usually appear during the first week in July, but the height of the flowering season is in the latter part of July and early August. Poultices made from the rootstocks are said to have healing qualities.

Along Quatre Fourches river, No. 1066; 30th base line district, Slave river, No. 1065; Government Hay Camp, Slave river, No. 2862; Fort Smith, Nos. 1053 (coll. *Mrs. Conibear*), 1056; Moose (Eight) Lake district, No. 2861; base of eastern slope of Caribou mountains, Nos. 2858, 2859, 2860; Clewi river, *Russell*, No. 95.

**E. palustre** L.

Common in muskegs and wet meadows throughout the region. Collected in flower during most of July, and in fruit during August.

East shore of lake Mamawi, No. 2845; Murdock Creek district, No. 2855; near Heart (Raup) lake, No. 2853; Pine Lake district, No. 2852; Observation ridge, about 10 miles south of Pine lake, No. 2854; Moose (Eight) Lake district, Nos. 2851, 2856, 2857; Indian graveyard, Peace river, No. 2846; base of eastern slope of Caribou mountains, Nos. 2847, 2849, 2850; eastern edge of Caribou Mountain plateau, No. 2848; Little Buffalo river, *Russell*, No. 76.

**E. pa'ustre** L. var. **monticola** Haussk.

Occasional in lowland wet meadows. Collected in fruit August 2. Government Hay Camp district, Slave river, No. 2844.

**E. glandulosum** Lehm., var. **adenocaulon** (Haussk.) Fernald. *E. adenocaulon* Haussk. See *Rhod.* xx, 35 (1918).

Common in sloughs and wet meadows. Collected in flower during mid-July, and in fruit in August.

East shore of lake Mamawi, No. 2870; lower delta of Athabaska river, No. 1049; Murdock Creek district, No. 2863; Round lake, about 18 miles south of Pine lake, No. 2864; Moose (Eight) Lake district, Nos. 2865, 2866, 2867, 2868; Indian graveyard, Peace river, No. 2869; base of eastern slope of Caribou mountains, Nos. 2871, 2872.

**Circaea alpina** L. ENCHANTER'S NIGHTSHADE.

Rare in this region, and collected thus far only in the upper delta of Athabaska river. With immature fruit August 15.

Reed portage, upper Embarras river, No. 2843.

## HALORAGIDACEAE

**Myriophyllum exalbescens** Fernald. *M. spicatum* L. of auth. See Rhod. xxi, 120 (1919). WATER MILFOIL.

Abundant in the shallow water of slough ponds and sluggish streams. Collected with flowers during the first half of August, and with immature fruit August 15.

Cree (Mamawi) creek, No. 2882; Murdock Creek district, No. 2884; Moose (Eight) lake, Nos. 2883, 2885, 2886.

## HIPPURIDACEAE

**Hippuris vulgaris** L. MARE'S-TAIL.

Common in the shallow water on the shores of ponds and slow streams. Collected in flower in late June and late July. Fruits are matured in August.

Lower delta of Athabaska river, No. 1077; Murdock Creek district, Nos. 2877, 2878; Government Hay Camp district, Slave river, No. 2879; near Heart (Raup) lake, No. 2880; Pine Lake district, Nos. 2874, 2876; sink-hole 16 miles east of Moose lake, No. 2875; Moose (Eight) Lake district, No. 2881; base of eastern slope of Caribou mountains, No. 2873; Sass creek, *Russell*, No. 39.

## ARALIACEAE

**Aralia nudicaulis** L. WILD SARSAPARILLA.

Common in open (chiefly poplar) woods on the uplands, and in crevices on the granite hills. Flower buds collected June 9, and flowers June 22. Fruit matures in the latter part of July or in August.

Along Quatre Fourches river, No. 1082; Pine Lake district, No. 2888; Peace point, No. 2887; base of eastern slope of Caribou mountains, No. 2889.

## UMBELLIFERAE

**Cicuta occidentalis** Greene. WATER HEMLOCK, BEAVER POISON.

Occasional in wet meadows throughout the area, and common in a few places. New rosettes were collected June 12, flowers during July, and immature fruit in the first three weeks of August. The whole plant is very poisonous, especially the root which is occasionally taken for parsnip. It causes convulsions, and if eaten in quantity causes death.

Lower delta of Athabaska river, No. 1086; east shore of lake Mamawi, No. 2890; 30th base line district, Slave river, No. 1088; near Heart (Raup) lake, No. 2891; Moose (Eight) lake, No. 2892.

**C. bulbifera** L.

Apparently only occasional in the park area, although it is common on the marshy shores of Moose lake. In flower and with maturing bulblets during the first half of August. Very poisonous, producing disorders similar to those of *C. occidentalis*.

Moose (Eight) lake, Nos. 2893, 2894.

**Sium suave** Walt. *S. cicutaeifolium* Gmel. of auth. See Rhod. xvii, 131 (1915). WATER PARSNIP.

Common in wet meadows and marshy slough margins throughout the region. New rosettes were collected June 12 and 20. Flowers appear in the early part of July, and fruit in the latter part of August. Reported poisonous in some regions.

East shore of lake Mamawi, No. 2898; lower delta of Athabaska river, No. 1090; 30th base line district, Slave river, No. 1092; Murdock Creek district, No. 2902; near Heart (Raup) lake, No. 2903; Pine Lake district, No. 2901; sink-hole 16 miles east of Moose lake, No. 2905; Moose (Eight) Lake district, No. 2904; Indian graveyard, Peace river, No. 2899; base of eastern slope of Caribou mountains, No. 2900.

**Heracleum lanatum** Michx. COW PARSNIP.

Apparently only occasional in the park area, although it is common in parts of the prairies at the base of Caribou mountains. Collected with flowers and immature fruits during the middle part of July.

Base of eastern slope of Caribou mountains, Nos. 2895, 2896, 2897.

#### CORNACEAE

**Cornus canadensis** L. *Chamaepericlimenum canadense* (L.) Aschers. and Graebn. DWARF DOGWOOD, BUNCH-BERRY.

Abundant in open woods and common in the richer woods. It may be found flowering during most of June and July, but reaches its height about the first two weeks of July. The berries ripen and turn red about mid-August. The ripe berries are edible.

Along Quatre Fourches river, No. 1097; Government Hay Camp district, Slave river, No. 2916; Fort Smith, No. 1096; Pine Lake district, No. 2917; Moose (Eight) Lake district, Nos. 2918, 2919, 2920; base of eastern slope of Caribou mountains, No. 2914; eastern edge of Caribou Mountain plateau, No. 2915; Little Buffalo river, *Russell*, No. 70.

**C. stolonifera** Michx. *Svida* Opiz. RED "WILLOW," KINNIKINNIK.

Part of the material cited below, Nos. 2907 and 2908, may be referable to var. *Baileyi* (Coult. and Evans) Drescher.

Common on the high banks of streams and lakes throughout the area, and occasionally found at prairie margins. It reaches its greatest abundance in newly developed flood-plain timber. Young leaves and flower buds collected in early and middle June, the height of the flowering season being in late June and early July. Late flowers are often found in August. Fruits begin to mature in the latter part of July, and turn white about mid-August. Bears are very fond of the ripe berries. The bark, when peeled off, dried, and ground up, is a popular substitute for tobacco. Many users prefer a mixture with this "kinnikinnik" to straight tobacco.

East shore of lake Mamawi, No. 2910; along Quatre Fourches river, No. 1099; 30th base line district, Slave river, Nos. 1103, 1104; Government Hay Camp district, Slave river, No. 2909; near upper Smith rapids, No. 1101; Pine Lake district, No. 2906; Peace point, No. 2907; Moose (Eight) Lake district, No. 2908; Indian graveyard, Peace river, No. 2913; base of eastern slope of Caribou mountains, Nos. 2911, 2912.

## PYROLACEAE

**Moneses uniflora** (L.) Gray. ONE-FLOWERED SHIN-LEAF.

Common in upland timbered muskegs and very rich mossy woods. The height of its flowering season is about mid-July.

Near upper Smith rapids, No. 1105; Pine Lake district, Nos. 2961, 2962; Moose (Eight) Lake district, No. 2960; base of eastern slope of Caribou mountains, No. 2964; eastern edge of Caribou Mountain plateau, No. 2963; Little Buffalo river, *Russell*, No. 68.

**Pyrola secunda** L. *Ramischia secunda* (L.) Garcke.

Common in rich woods and timbered muskegs. Like other species of this genus, the height of its flowering period appears to be in the first two weeks of July, though a few flowers are found as late as August, when most of the fruit is maturing.

Government Hay Camp district, Slave river, Nos. 2926, 2927; Pine Lake district, No. 2921; Peace point, No. 2922; Moose (Eight) Lake district, Nos. 2923, 2924, 2925, 2928; Indian graveyard, Peace river, No. 2932; base of eastern slope of Caribou mountains, Nos. 2929, 2930; eastern edge of Caribou Mountain plateau, No. 2931; Little Buffalo river, *Russell*, No. 71.

**P. chlorantha** Sw. See Rhod. xxii, 49 (1920).

Common in woods throughout the upland districts, where it is in bud during mid-June, and at the height of its flowering season in the first half of July.

Pine Lake district, Nos. 2937, 2938, 2939; Peace point, No. 2936; Moose (Eight) Lake district, Nos. 2933, 2940; base of eastern slope of Caribou Mountain plateau, Nos. 2934, 2935.

**P. asarifolia** Michx.

Common in poplar and spruce woods throughout the region, and one of the most striking flowers. Fruit is matured in August. *Var. incarnata* has the same habitat and flowering period.

Along Quatre Fourches river, No. 1113; Government Hay Camp district, Slave river, No. 2946; near upper Smith rapids, No. 1114; Fort Smith, No. 1111; Pine Lake district, Nos. 2944, 2945; Moose (Eight) Lake district, Nos. 2941, 2942, 2943; base of eastern slope of Caribou mountains, Nos. 2947, 2948.

**P. asarifolia** Michx., *var. incarnata* (Fisch.) Fernald.

Common in the same range and habitat as the species, and in many cases not clearly distinguished from it.

Government Hay Camp district, Slave river, No. 2949; Salt mountain, No. 2959; Pine Lake district, Nos. 2954, 2955, 2956; Peace point, No. 2950; Moose (Eight) Lake district, Nos. 2951, 2952, 2953; base of eastern slope of Caribou mountains, Nos. 2958, 2959; Little Buffalo river, *Russell*, No. 84.

**Monoropa uniflora** L.

Not found by the writer in Wood Buffalo park, but collected somewhere along Slave river by *Miss E. Taylor* in 1892 (Hb. Nat. Mus. Canada and Hb. Gray).



## ERICACEAE

**Ledum groenlandicum** Oeder. LABRADOR TEA.

A common shrub in muskegs throughout the region. Its dried leaves have been used commonly to make a native tea. The height of its flowering season is in late June and early July. Fruit is matured in August.

Pine Lake district, No. 2982; Moose (Eight) Lake district, Nos. 2983, 2984, 2985; base of eastern slope of Caribou mountains, No. 2980; eastern edge of Caribou Mountain plateau, No. 2979; "Wood Buffalo Park," Russell, No. 56.

**L. palustre** L., var. **decumbens** Ait. NARROW-LEAVED LABRADOR TEA.

Apparently rare, and collected thus far only from a muskeg in Caribou mountains, where it had immature fruit in mid-July.

Eastern edge of Caribou Mountain plateau, No. 2986.

**Kalmia polifolia** Wang.

Reported in Fort Smith district, but not seen by the writer. Known on lake Athabaska and at Resolution.

**Andromeda polifolia** L. BOG ROSEMARY.

Rare or occasional in the park area, and collected thus far only from a single upland muskeg. It grows on open mossy hummocks, and had immature fruit July 9.

Pine Lake district, No. 2987.

**Chamaedaphne calyculata** (L.) Moench. CASSANDRA, LEATHER-LEAF.

Occasional in cold upland muskegs. Collected thus far only in Pine Lake district and in Caribou mountains, where it is a colonizing shrub in hummocks of *Sphagnum*. Immature fruit collected in mid-July.

Pine Lake district, No. 2977; eastern edge of Caribou Mountain plateau, No. 2978.

**Arctostaphylos Uva-ursi** (L.) Spreng. BEARBERRY, KINNIKINNIK.

Common on sandy and rocky hills, and in dry upland woods. Found in flower during most of June, and with green berries in July. Fruit is usually not matured until August. The dried leaves have been used as a substitute for tobacco.

East shore of lake Mamawi, Nos. 2999, 3000; along Quatre Fourches river, No. 1171; Pine Lake district, Nos. 2995, 2996; Peace point, No. 2994; Moose (Eight) Lake district, Nos. 2993, 2997; eastern edge of Caribou Mountain plateau, No. 2998.

**A. rubra** (Rehder and Wilson) Fernald. *A. alpina* (red-fruited form) Richards.  
*Mairainia alpina* (red-fruited form) Britton and Rydb. *Arctous* (Gray) Niedzu.  
 See Rhod. xvi, 32 (1914). ALPINE BEARBERRY.

Common in muskeg timber throughout the upland. The bright red berries are very tart in flavour. Fruit collected during July and August.

Pine Lake district, No. 2991; Moose (Eight) Lake district, Nos. 2990, 2992; base of eastern slope of Caribou mountains, Nos. 2988, 2989.

**Vaccinium canadense** Kalm. *Cyanococcus canadensis* (Richards.) Rydb. CANADA BLUEBERRY.

Occasional on granite hills and in dry upland woods. In a few localities it becomes abundant and produces small but delicious berries in large numbers. Collected in fruit during mid-August, when the berries appear to be at their best.

Government Hay Camp district, Slave river, No. 2965; near sink-hole 16 miles east of Moose lake, No. 2966.

**V. Vitis-idaea** L., var. **minus** Lodd. *Vitis-Idaea Vitis-Idaea* (L.) Britton. MOUNTAIN CRANBERRY.

Abundant in upland woods throughout the region. Collected in flower from mid-June to mid-July, and occasionally later. Fruits mature in August.

Along Quatre Fourches river, No. 1201; Fort Smith, No. 1194; Pine Lake district, Nos. 2970, 2971; Moose (Eight) Lake district, Nos. 2972, 2973, 2974; base of eastern slope of Caribou mountains, No. 2976; eastern edge of Caribou Mountain plateau, No. 2975.

**V. Oxyccoccus** L. *Oxyccoccus Oxyccoccus* (L.) MacM. SMALL CRANBERRY.

Common on *Sphagnum* hummocks in cold upland muskegs. Collected with flowers and immature fruit about mid-July. The berries are too small to be of importance.

Pine Lake district, No. 2967; Moose (Eight) Lake district, No. 2968; eastern edge of Caribou Mountain plateau, No. 2969.

#### PRIMULACEAE

**Primula incana** M. E. Jones. See Rhod. xxx, 59 (1928). PRIMROSE.

Common in damp meadows and prairies. Collected in flower in mid-June and in fruit in August. Occasional flowers are to be found even in the latter part of August.

Government Hay Camp district, Slave river, No. 3010; near Heart (Raup) lake, No. 3011; near Mission Farm, No. 3012; sink-hole 16 miles east of Moose lake, No. 3013.

**Androsace septentrionalis** L. See Mem. 126, No. 4, Biol. Ser., Dept. of Mines, Canada, 45 (1922).

Occasional on dry, sandy banks and granite hills. Collected with flowers and immature fruit during the latter half of June and early in July, and with mature fruit August 9.

Fort Smith, Nos. 1232, 3006; Pine Lake district, No. 3007; east shore of lake Mamawi, No. 3005.

**Dodecatheon pauciflorum** (Durand) Greene. SHOOTING STAR.

Abundant in semi-open prairies on the Salt Plains. At the height of its flowering period, about June 15, it turns the meadows purple with its abundance of blossoms. Fruit begins to mature early in July.

Near Mission Farm, No. 3001; junction of Nyarling and Little Buffalo rivers, Russell, No. 1.

**Lysimachia thyrsiflora** L. *Naumburgia thyrsiflora* (L.) Duby. TUFTED LOOSESTRIFE.

Occasional along upland creek banks, where it grows near the water's edge. Collected thus far only in the northern area, but observed by the writer along Little Buffalo river near Ninishith hills. Found in flower during the first half of July.

Sass creek, *Russell*, No. 26.

**Trientalis europaea** L., var. **arctica** (Fisch.) Ledeb. *T. arctica* Fisch. ARCTIC STAR FLOWER.

American material was considered to represent a distinct species, *T. arctica*, by Fischer (27), and is commonly so labelled. However, comparison with Eurasian specimens in the Gray Herbarium shows clearly that it is a mere regional variety, and very closely related to the species.

Abundant in rich woods at the base of Caribou mountains. The writer has seen it nowhere else in the park, but it was collected by Russell in the northern area, where he reports it "In woods, not common." The height of its flowering season is about the last of June.

Base of eastern slope of Caribou mountains, Nos. 3003, 3004; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 57 (the writer has not examined this specimen).

**Glaux maritima** L. SEA MILKWORT.

Abundant at the margins of barren saline flats and brine springs. Collected in flower June 15.

Near Heart (Raup) lake, No. 3009; near Mission Farm, No. 3008; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 72 (2).

#### GENTIANACEAE

**Gentiana elegans** A. Nels. *Anthopogon* Necker. FRINGED GENTIAN.

The writer's collections of this species are extremely variable in size and habit of growth. They closely resemble the general description of plants labelled *G. Macounii* Holm (45), but do not have hairs on the lower parts of the filaments. The entire group needs critical study and the Wood Buffalo Park material may prove to have some other identity, but for the time being it will be considered as above.

Abundant in the Salt Plain prairies, where it adds much colour to the early autumn landscape. The height of the flowering season appears to be in the first three weeks of August. It is occasionally found in both upland and lowland wet meadows, outside the Salt Plains.

Government Hay Camp district, Slave river, No. 3027; near Heart (Raup) lake, No. 3028; sink-hole slough 16 miles east of Moose lake, No. 3026; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 66.

**G. Amarella** L. *Amarella plebeia* (Cham.) Greene. See *Rhod.* xix, 149-51 (1917). GENTIAN.

Common to a variety of habitats—damp meadows, muskegs, and open timber. The first flowers appear during the last week of July, and fruit about the second or third week in August. Its purple flowers are inconspicuous but brightly coloured.

East shore of lake Mamawi, No. 3037; Government Hay Camp district, Slave river, Nos. 3032, 3033; near upper Smith rapids, No. 1238; sink-hole 16 miles east of Moose lake, No. 3030; Moose (Eight) Lake district, Nos. 3029, 3031; Indian graveyard, Peace river, No. 3036; base of eastern slope of Caribou mountains, Nos. 3034, 3035; Little Buffalo river, *Russell*, No. 45.

**Lomatogonium rotatum** (L.) Fries. *Pleurogyne rotata* (L.) Griseb. *P. fontana* A. Nels. See *Rhod.* xxi, 197 (1919). MARSH FELWORT.

Common in damp meadows and muskeg thickets in the Salt Plain region. Collected in flower during the first three weeks of August.

Near Heart (Raup) lake, No. 3040; Little Buffalo river, *Russell*, No. 93; Clewi river, *Russell*, No. 96.

**Menyanthes trifoliata** (L.) See *Rhod.* xxxi, 195 (1929). BUCKBEAN.

The writer has been unable to distinguish the variety *minor* Michx. in the limited collections at hand. Further material and study, therefore, may alter the present determination.

Common on mossy shores of upland muskeg ponds, where it is a pioneer plant in the quaking bogs. Collected with late flowers and immature fruit July 9. Suspected of being poisonous.

Pine Lake district, No. 3039; Moose (Eight) lake, No. 3038.

#### APOCYNACEAE

**Apocynum androsaemifolium** L. DOGBANE.

Collected thus far only at Fort Smith. Said to be poisonous to stock. A serviceable fibre has been made from the stems.

Fort Smith, No. 1239 (*Mrs. Conibear* coll.).

**A. sibiricum** Ait. *A. hypericifolium* Jacq. *A. cannabinum* L. var. *hypericifolium* (Ait.) Gray. INDIAN HEMP.

Collected thus far only on the gypsum cliffs at Peace point, where it was in flower in late July and early August.

Peace point, No. 3025.

#### POLEMONIACEAE

**Collomia linearis** Nutt. *Gilia linearis* (Nutt.) Gray.

Occasional in the driest parts of the prairies at the base of Caribou mountains and in a small prairie opening on a granite hill in the Peace delta. Collected in flower during the third week in July, and in fruit early in August.

East shore of lake Mamawi, No. 3023; base of eastern slope of Caribou mountains, Nos. 3022, 3024.

#### HYDROPHYLLACEAE

**Phacelia Franklinii** (R.Br.) Gray. SCORPION-WEED.

Common in openings and clearings throughout the upland districts. It becomes abundant in recently burned areas, where it is a "fireweed" with *Geranium Bicknellii* and *Dracocephalum parviflorum*. Its flowering period begins about June 20, and continues through most of July. Most of the fruit is set by August 20.

Pine Lake district, Nos. 3015, 3016, 3017, 3018, 3019, 3021; sink-hole 16 miles east of Moose lake, No. 3020; base of eastern slope of Caribou mountains, No. 3014.

## BORAGINACEAE

**Lappula Redowskii** (Hornem.) Greene, var. **occidentalis** (S. Wats.) Rydb. STICKSEED.

Apparently rare in the region, and collected thus far only in an upland sink-hole prairie opening. In fruit (with a few flowers) August 20.

Sink-hole 16 miles east of Moose lake, No. 3199.

**Hackelia deflexa** (Wahl.) Opiz, var. **americana** (Gray) Fernald and Johnston. *Lappula americana* (Gray) Rydb. *Hackelia deflexa* (Wahl.) Opiz of Am. auth. See Rhod. xxvi, 124 (1924).

Apparently rare or occasional in Wood Buffalo park, and collected thus far only in a cabin clearing along upper Slave river. With fruit and a few flowers July 25.

30th base line district, Slave river, No. 3200.

**Mertensia paniculata** (Ait.) Don. LUNGWORT, BLUE BELLS.

A common species of open woods, cabin clearings, and parts of the semi-open prairies. Its showy blossoms give considerable colour to the prairies at the base of Caribou mountains when the flowering season is at its height, about the last of June and early July. Fruits are matured in August.

Along Quatre Fourches river, No. 1244; Government Hay Camp, Slave river, Nos. 3208, 3209; Peace point, No. 3207; Moose (Eight) Lake district, Nos. 3210, 3211, 3212; base of eastern slope of Caribou mountains, Nos. 3201, 3202, 3203, 3204.

## LABIATAE

**Scutellaria epilobiifolia** Hamilton. *S. galericulata* Am. auth., not L. See Rhod. xxiii, 86 (1921). SCULLCAP.

Common in wet meadows throughout the region. Flowers collected in mid-July and August 10. Fruits begin to mature about the first of August.

East shore of lake Mamawi, No. 3186; Murdock Creek district, No. 3191; Government Hay Camp district, Slave river, No. 3190; near Heart (Raup) lake, No. 3189; near Round lake, about 18 miles south of Pine lake, No. 3192; Moose (Eight) Lake district, Nos. 3187, 3188; Sass creek, Russell, No. 16.

**Dracocephalum parviflorum** Nutt. *Moldavica parviflora* (Nutt.) Britton. DRAGON HEAD.

Common in dry upland openings and clearings, and abundant as a "fireweed" in recently burned areas. Collected in flower from mid-July to late August. Fruit begins to mature about the third week in August.

Along trail about 10 miles southwest of Fitzgerald, No. 3194; Pine Lake district, No. 3193; sink-hole 16 miles east of Moose lake, No. 3195; Moose (Eight) Lake district, No. 3196; base of eastern slope of Caribou mountains, No. 3197.

**Physostegia parviflora** Nutt. *Dracocephalum Nuttallii* Britton. FALSE DRAGON HEAD.

Common on delta and local river flood-plain deposits, where it occupies willow slough margins and low mud flats. Collected in flower late in July and early in August. Immature fruits found August 9.

East shore of lake Mamawi, No. 3183; Murdock Creek district, No. 3184; Government Hay Camp district, Slave river, No. 3185.

**Stachys scopulorum** Greene. HEDGE NETTLE.

Common in prairies and at the drier margins of sloughs. Young shoots are found late in June or early in July. The first flowers appear about July 10, and fruits being to mature late in July and early in August.

Lower delta of Athabaska river, No. 1248; east shore of lake Mamawi, No. 3170; Murdock Creek district, No. 3181; Government Hay Camp district, Slave river, Nos. 3178, 3180; near Heart (Raup) lake, No. 3179; Pine Lake district, No. 3175; Round lake, about 18 miles south of Pine lake, No. 3176; Peace point, Nos. 3177, 3182; sink-hole 16 miles east of Moose lake, No. 3174; base of eastern slope of Caribou mountains, Nos. 3171, 3172, 3173; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 67.

**Monarda mollis** L., var. *menthaefolia* Fernald. See *Rhod.* iii, 15 (1901). WILD BERGAMOT, HORSE MINT.

Collected thus far only on the Peace Point prairie, where it was in flower July 17.

Peace point, No. 3160.

**Mentha canadensis** L., var. *glabrata* (Benth.) Fernald. CANADA MINT.

The common mint of sloughs, wet meadows, and stream margins throughout the region. The height of its flowering season appears to be about mid-July, and fruit is matured in August.

Lower delta of Athabaska river, No. 1247; east shore of lake Mamawi, No. 3168; Murdock Creek district, No. 3164; Government Hay Camp district, Slave river, No. 3163; Pine Lake district, No. 3161; Round lake, about 18 miles south of Pine lake, No. 3162; Peace point, Nos. 3165, 3166; sink-hole 16 miles east of Moose lake, No. 3167; Indian graveyard, Peace river, No. 3169; "Wood Buffalo park," *Russell*, No. 99.

#### SCROPHULARIACEAE

**Veronica scutellata** L. MARSH SPEEDWELL.

Common in wet sloughs, chiefly in or near the lowland districts. Found in flower June 23, and with both flowers and fruit July 21.

Government Hay Camp district, Slave river, No. 3148; Fort Smith, No. 1252; Peace point, No. 3149.

**V. peregrina** L., var. *xalapensis* (HBK.) Pennell. *V. xalapensis* HBK. See *Torreyia* xix, 167 (1919). SPEEDWELL.

Occasional in dry prairie openings and rock crevices. Fruits mature in August, although occasional flowers may be found as late as August 20. Reported poisonous.

East shore of lake Mamawi, No. 3146; sink-hole 16 miles east of Moose lake, No. 3147.

**Castilleja Raupii** Pennell. See Proc. Acad. Nat. Sci. Phila. lxxxvi, 528-31 (1934).  
INDIAN PAINT-BRUSH.

Occasional in open upland woods, but found commonly at the willow margins of streams and wet meadows. Early flowers have been found in mid-June, but the height of the flowering season does not come until late June and early July. Mature fruit has been collected in the second week of August.

30th base line district, Slave river, No. 1258; Fort Smith, No. 1261; Pine Lake district, Nos. 3153, 3154, 3155, 3156, 3157; Moose (Eight) Lake district, Nos. 3150, 3158, 3159; base of eastern slope of Caribou mountains, Nos. 3151, 3152; lower Slave river, No. 1262.

**Rhinanthus Kyrollae** Chab.

Apparently rare or only occasional in the region, and collected thus far only at the willow margin of a prairie about 6 miles north of Peace river, near the base of Caribou mountains. In both flower and fruit July 28.

Base of eastern slope of Caribou mountains, No. 3145-a.

**Orthocarpus luteus** Nutt.

Rare, and found thus far only in dry prairies. Peace point, No. 4394 (1932).

**Pedicularis labradorica** Houtlyn. See Rhod. xxxiii, 193 (1931). LOUSEWORT.

Apparently limited to muskegs in Caribou mountains, where it is common, and found in flower July 11-12.

Eastern edge of Caribou Mountain plateau, No. 3145.

LENTIBULARIACEAE

**Utricularia vulgaris** L. GREAT BLADDERWORT.

Abundant in shallow lakes and sluggish streams throughout the region. Collected in flower from the second week in July to the second week in August.

Cree (Mamawi) creek, No. 3139; Pine Lake district, Nos. 3140, 3141; near Round lake, about 18 miles south of Pine lake, No. 3142; Moose (Eight) lake, Nos. 3143, 3144; Grande Detour portage, lower Slave river, Russell, No. 74.

**U. minor** L. SMALL BLADDERWORT.

Probably common in shallow lakes throughout the area, but collected thus far only from Moose lake, where it was in a sterile condition August 5.

Moose (Eight) lake, No. 3138.

PLANTAGINACEAE

**Plantago major** L., var. *asiatica* (L.) Decne. COMMON PLANTAIN.

Common on river banks and in damp, sandy meadows on the uplands. New rosettes collected in mid-June, and flower buds June 23. Flowers and immature fruits collected July 14, and mature fruits in August.

Reed portage, upper Embarras river, No. 3132; 30th base line district, Slave river, No. 1295; Murdock Creek district, No. 3134; Government Hay Camp district, Slave river, No. 3135; Fort Smith, No. 1294; Round lake, about 18 miles south of Pine lake, No. 3136; Peace point, No. 3133; sink-hole 16 miles east of Moose lake, No. 3137.

**P. eriopoda** Torr. SALINE PLANTAIN.

Common in saline parts of the Salt Plain prairies. Collected in flower June 15 and in fruit August 19.

Near Heart (Raup) lake, No. 3129; near Mission Farm, No. 3130.

**P. oliganthos** R. and S. SEASIDE PLANTAIN.

Probably common on the saline flats in the Salt Plain district, but collected from only one locality. In fruit August 20.

Near Heart (Raup) lake, No. 3131.

RUBIACEAE

**Galium boreale** L. NORTHERN BEDSTRAW.

Abundant in dry, open woods, prairies, and clearings. Young shoots collected as early as June 9, and buds June 13. The first flowers appear about the last of June, and fruits are matured in August.

East shore of lake Mamawi, No. 3112; along Quatre Fourches river, No. 1303; 30th base line district, Slave river, No. 1302; Government Hay Camp district, Slave river, Nos. 3107, 3108; near Heart (Raup) lake, Nos. 3099, 3104; Fort Smith, No. 1304; near Mission Farm, No. 3103; Pine Lake district, Nos. 3100, 3101, 3102; Peace point, Nos. 3105, 3106; Moose (Eight) Lake district, Nos. 3109, 3110, 3111; Indian graveyard, Peace river, No. 3113; base of eastern slope of Caribou mountains, Nos. 3114, 3115; junction of Nyarling and Little Buffalo rivers, *Russell*, No. 55.

**G. trifidum** L. SMALL BEDSTRAW.

The writer's collections of this species are fairly uniform with the exception of No. 3116, obtained in a slough at the Indian graveyard, Peace river. This material is without flower or fruit, but has the general appearance of *G. Brandegei* Gray. It was growing in water, however, and may be only a form of *G. trifidum* with expanded leaves.

Abundant in sloughs and damp meadows throughout the area. Flowers collected June 23, and through July. A few flowers remain in August, but fruits begin to mature in late July.

Murdock Creek district, No. 3128; Government Hay Camp district, Slave river, Nos. 3122, 3126; Fort Smith, No. 1300; Pine Lake district, Nos. 3119, 3120, 3127; Round lake, about 18 miles south of Pine lake, No. 3121; sink-hole 16 miles east of Moose lake, No. 3125; Moose (Eight) Lake district, Nos. 3123, 3124; Indian graveyard, Peace river, Nos. 3116, 3117; base of eastern slope of Caribou mountains, No. 3118; Little Buffalo river, *Russell*, No. 86.

**G. triflorum** Michx. SWEET-SCENTED BEDSTRAW.

Rare in Wood Buffalo park, and collected thus far only in the Athabaska-Peace delta. In a late fruiting condition August 15.

Reed portage, upper Embarras river, No. 3098; along Quatre Fourches river, No. 1301.



## CAPRIFOLIACEAE

**Viburnum pauciflorum** Raf. MOOSEBERRY, HIGH-BUSH CRANBERRY.

Abundant in open woodlands throughout the region. In late July and in August it bears an abundance of bright red berries, which, although they have rather large seeds and are somewhat tart, make excellent pies. The height of the flowering season is in the latter half of June.

East shore of lake Mamawi, No. 3084; along Quatre Fourches river, No. 1327; 30th base line district, Slave river, No. 1322; Government Hay Camp district, Slave river, No. 3081; Fort Smith, No. 1324; Pine Lake district, Nos. 3080, 3083; Peace point, No. 3082; Moose (Eight) Lake district, Nos. 3077, 3078, 3079; Indian graveyard, Peace river, No. 3085; base of eastern slope of Caribou mountains, No. 3087; eastern slope of Caribou Mountain plateau, No. 3086.

**Symphoricarpos occidentalis** Hook. WOLFBERRY.

Abundant in the dried parts of the upland semi-open prairies. It flowers during the latter half of July and the first half of August.

East shore of lake Mamawi, No. 3061; Government Hay Camp district, Slave river, No. 3064; Round lake, about 18 miles south of Pine lake, No. 3066; Peace point, Nos. 3065, 3067; base of eastern slope of Caribou mountains, Nos. 3062, 3063.

**S. albus** (L.) Blake, var. **pauciflorus** (Robbins) Blake. *S. pauciflorus* (Robbins) Britton. *S. racemosus* Michx., var. *pauciflorus* Robbins. SNOWBERRY.

Abundant in open woods, chiefly poplar, and common in semi-open prairies. Flower buds appear about the first of July and immature fruit late in July. Fruit is matured during the first half of August.

East shore of lake Mamawi, Nos. 3075, 3076; Government Hay Camp district, Slave river, No. 3072; near Heart (Raup) lake, No. 3068; Fort Smith, No. 1320; near Mission Farm, No. 3070; Pine Lake district, No. 3071; Peace point, No. 3069; Indian graveyard, Peace river, No. 3074; base of eastern slope of Caribou mountains, No. 3073; Little Buffalo river, *Russell*, No. 102.

**S. vaccinoides** Rydb.

This material is not in flower or fruit, and is, therefore, of somewhat doubtful identity. It is placed in this species on the strength of its acute or nearly acute leaves.

Collected thus far only on a granite hill in the Peace delta.

Along Quatre Fourches river, No. 1321.

**Linnaea borealis** L., var. **americana** (Forbes) Rehder. *L. americana* Forbes. TWIN-FLOWER.

Abundant in shady woodlands throughout the region. Its flowering season begins in the latter part of June and reaches its height in the first half of July. Fruits are mature in August.

Along Quatre Fourches river, No. 1307; Government Hay Camp district, Slave river, No. 3053; Fort Smith, No. 1311; Pine Lake district, Nos. 3054, 3055, 3057, 3058; Peace point, No. 3056; Moose (Eight) Lake district,

No. 3052; base of eastern slope of Caribou mountains, No. 3060; eastern edge of Caribou Mountain plateau, No. 3059; Little Buffalo river, *Russell*, No. 69.

***Lonicera glaucescens* Rydb. HONEYSUCKLE.**

Common in open woods (chiefly poplar) on the upland. Buds appear about mid-June, and flowers in the last third of June. Immature fruits appear about the last week of July, and mature ones in August.

East shore of lake Mamawi, No. 3088; Fort Smith, No. 1318; Pine Lake district, No. 3095; Peace point, No. 3093; Moose (Eight) Lake district, Nos. 3091, 3092, 3096; base of eastern slope of Caribou mountains, Nos. 3089, 3090.

VALERIANACEAE

***Valeriana septentrionalis* Rydb. *V. sylvatica* Banks.**

Occasional in upland muskeg thickets. Collected in flower and immature fruit during the last third of June.

Pine Lake district, Nos. 3050, 3051.

CAMPANULACEAE

***Campanula rotundifolia* L. BELL-FLOWER, BLUEBELL.**

Common in upland open woods and in the drier parts of the semi-open prairies. It is a characteristic species, also, of the granite hills. Seedlings are found both early and late in June, and buds during the first week in July. The height of the flowering season is in the latter half of July.

East shore of lake Mamawi, No. 3048; along Quatre Fourches river, No. 1331; Government Hay Camp district, Slave river, No. 3045; near Heart (Raup) lake, No. 3046; Pine Lake district, Nos. 3041, 3042; Peace point, Nos. 3043, 3044; base of eastern slope of Caribou mountains, No. 3047; Little Buffalo river, *Russell*, No. 89.

COMPOSITAE

***Grindelia perennis* A. Nels. See Ann. Mo. Bot. Gard. xxi, 485-8 (1934). RESIN-WEED, GUM-PLANT.**

Common on the Salt Plain prairies, where it was collected in flower August 19-20. Used medicinally for catarrhal disorders.

Near Heart (Raup) lake, Nos. 3287, 3288.

***Solidago multiradiata* Ait., var. *scopulorum* Gray. GOLDENROD.**

Common in clearings and in damp woods and thickets. In flower from about mid-July to about mid-August.

Government Hay Camp district, Slave river, Nos. 3265, 3266; near Heart (Raup) lake, No. 3264; Pine Lake district, No. 3267; Moose (Eight) Lake district, No. 3268; base of eastern slope of Caribou mountains, Nos. 3269, 3270, 3272, 3273, 3274; eastern edge of Caribou Mountain plateau, No. 3271.

**S. oreophila** Rydb.

Common in dry prairies, clearings, and on rocky hills throughout the upland districts. Flowers appear in late June or early July, and continue until late in August.

Government Hay Camp district, Slave river, No. 3255; near Heart (Raup) lake, No. 3256; Fort Smith, No. 1367 (*Mrs. Conibear* coll.); Pine Lake district, Nos. 3258, 3259; Peace point, Nos. 3254, 3257; Moose (Eight) Lake district, Nos. 3260, 3261; Indian graveyard, Peace river, No. 3262; Little Buffalo river, *Russell*, No. 46.

**S. canadensis** L. CANADA GOLDENROD.

Common in clearings, open woods, and prairies throughout the region. It becomes abundant in the prairies at the base of Caribou mountains. Flower buds collected in late June and the first half of July. The flowering period begins about the third week in July and lasts through most of August.

East shore of lake Mamawi, No. 3275; Government Hay Camp district, Slave river, Nos. 3280, 3282; near Heart (Raup) lake, No. 3281; Peace point, No. 3283; Moose (Eight) Lake district, Nos. 3284, 3285, 3286; Indian graveyard, Peace river, No. 3276; base of eastern slope of Caribou mountains, Nos. 3277, 3278, 3279; lower Slave river, No. 1357.

**S. graminifolia** (L.) Salisb., var. **camporum** (Greene) Fernald. *Euthamia camporum* Greene. See *Rhod.* xvii, 12 (1915).

Collected thus far only in the Hay (Prairie) River district of the Peace-Athabaska delta, where it was common and in flower August 18.

Hay (Prairie) river, near east shore of lake Claire, No. 3263.

**Aster conspicuus** Lindl. ROUGH ASTER.

Common in poplar woods on the eastern slopes of Caribou mountains, and on a poplar bluff near the Indian graveyard, Peace river. Flower buds collected July 12, and flowers July 23 and 31.

Indian graveyard, Peace river, No. 3237; eastern slope of Caribou mountains, Nos. 3235, 3236.

**A. modestus** Lindl.

Apparently rare in the park area, and found thus far only in the upper delta of Athabaska river. In flower August 15.

Reed portage, upper Embarras river, No. 3213.

**A. Lindleyanus** T. and G.

Probably the commonest aster in the region. It is abundant in open woods and clearings throughout, and occasional in semi-open places. Rosettes have been observed late in June, and buds in the latter part of July. The first flowers appear late in July, and reach their prime during the first half of August.

Reed portage, upper Embarras river, No. 3239; Government Hay Camp district, Slave river, Nos. 3245, 3246, 3248, 3249; near Heart (Raup) lake, No. 3247; near upper Smith rapids, No. 1354; Fort Smith, No. 1353 (*Mrs. Conibear* coll.); Pine Lake district, No. 3243; Peace point, No. 3244; Moose (Eight) Lake district, Nos. 3250, 3251, 3252, 3253; Indian graveyard, Peace river, No. 3240; base of eastern slope of Caribou mountains, Nos. 3241, 3242.

**A. Lindleyanus** T. and G., var. **comatus** Fernald.

This variety has been found in only one locality, a poplar bluff along Peace river just inside the western boundary of the park. In flower August 1. Indian graveyard, Peace river, No. 3238.

**A. laevis** L., var. **Geyeri** Gray.

Occasional in the driest upland prairies. First flowers appear in the last week of July, and flowering continues at least through the first half of August.

East shore of lake Mamawi, Nos. 3233, 3234; base of eastern slope of Caribou mountains, No. 3232.

**A. ericoides** L. *A. multiflorus* Ait. See Rhod. xxviii, 65 (1926) and xxxii, 136-40 (1930).

Common in dry prairies and in the drier parts of lowland hay meadows. Specimens collected July 17 were not yet in flower. Flowers appear in August.

Government Hay Camp district, Slave river, No. 3227; near Heart (Raup) lake, Nos. 3228, 3229; Peace point, No. 3230; Little Buffalo river near Lobstick creek, *Russell*, No. 2.

**A. junceus** Ait.

One of the commonest asters in the region. It is abundant on stream banks and in wet meadows, and is in flower during the latter part of July and in August.

East shore of lake Mamawi, Nos. 3217, 3218, 3219; Murdock Creek district, No. 3221; Government Hay Camp district, Slave river, Nos. 3220, 3223; near Heart (Raup) lake, No. 3222; near upper Smith rapids, No. 1351; Moose (Eight) Lake district, Nos. 3224, 3225, 3226; Little Buffalo river, *Russell*, Nos. 42, 78.

**A. puniceus** L.

Found thus far only in clearings and wet meadows in the river lowlands, where it is common. It flowers in late July and in August.

Reed portage, upper Embarras river, No. 3214; Murdock Creek district, No. 3215; Government Hay Camp district, Slave river, No. 3216.

**A. pauciflorus** Nutt.

Probably common on the Salt Plains, where it was found in flower August 19.

Near Heart (Raup) lake, No. 3231.

**Erigeron glabellus** Nutt. DAISY FLEABANE.

Occasional in the driest parts of upland semi-open prairies. Found flowering in the latter half of June and early August.

Peace point, Nos. 3313, 3314; base of eastern slope of Caribou mountains, No. 3312.

**E. hyssopifolius** Michx.

Occasional in the damp soil of upland thickets and river flood-plains. Found in flower during the latter half of June and most of July.

30th base line district, Slave river, No. 1349; Pine Lake district, No. 3292; near Round lake, about 18 miles south of Pine lake, No. 3291; Little Buffalo river, *Russell*, No. 81.

**E. philadelphicus** L.

Common in damp meadows and on river flood-plains. Flower buds found in mid-June, and flowers during July and August. Fruit begins to mature about the first of August.

East shore of lake Mamawi, No. 3308; 30th base line district, Slave river, No. 1342; Government Hay Camp district, Slave river, No. 3311; near Heart (Raup) lake, No. 3310; Peace point, No. 3309; lower Slave river, No. 1344.

**E. ramosus** (Walt.) B.S.P.

Apparently rare or occasional in the region, and found thus far only on a mud bar along Slave river. With flowers and fruit August 14.

Government Hay Camp district, Slave river, No. 3306.

**E. canadensis** L. *Leptilon canadense* (L.) Britton. HORSEWEED.

Found in a dwarfed condition on a granite hill in Peace River delta. In fruit August 7.

East shore of lake Mamawi, No. 3307.

**E. acris** L., var *asteroides* (Andrz.) DC. *E. droebachensis* Muell. See Rhod. xii, 225 (1910). FLEABANE.

Common in clearings and at the margins of meadow sloughs and streams. In flower during the latter part of July and in August. Found in fruit in mid-August.

Reed portage, upper Embarras river, No. 3300; Government Hay Camp, Slave river, Nos. 3296, 3297; near upper Smith rapids, No. 1345; Peace point, No. 3295; Moose (Eight) Lake district, Nos. 3293, 3294; Indian graveyard, Peace river, Nos. 3298, 3299.

**E. acris** L., var. *arcuans* Fernald. See Rhod. xxviii, 236 (1926). SWAMP FLEABANE.

Common in muskegs and at wet slough margins. In flower from mid-July to mid-August.

Observation ridge, about 10 miles south of Pine lake, No. 3301; Moose (Eight) Lake district, Nos. 3303, 3302; Indian graveyard, Peace river, No. 3305; base of eastern slope of Caribou mountains, No. 3304; Little Buffalo river, *Russell*, No. 77(1).

**E. lonchophyllus** Hook.

Occasional in semi-open prairies and clearings. Found in flower in mid-July and mid-August.

Near Heart (Raup) lake, No. 3289; Observation ridge, about 10 miles south of Pine lake, No. 3290.

***Antennaria pulcherrima* (Hook.) Greene.**

Apparently rare, and collected only along the Pine Lake-Peace Point trail. In flower July 14.

Near Round lake, about 18 miles south of Pine lake, No. 3322.

***A. rosea* (D. C. Eat.) Greene.**

Common in dry woods and prairies. Collected in flower during late June and early July.

Fort Smith, No. 1379; Pine Lake district, No. 3325; lower Slave river, No. 1380.

***A. nitida* Greene.**

Common on dry prairies and on rocky hills. Collected in flower during the latter part of July, and in fruit during the first half of August. Occasional flowers occur in mid-August.

East shore of lake Mamawi, No. 3317; Government Hay Camp district, Slave river, No. 3320; near Heart (Raup) lake, No. 3319; Peace point, Nos. 3316, 3318; sink-hole 16 miles east of Moose lake, No. 3321.

***A. oxyphylla* Greene.**

Rare or only occasional in the park area, and collected thus far only in upland aspen woods near Fort Smith. With young flowers June 23.

Fort Smith, No. 1375.

***A. campestris* Rydb.**

Occasional, or possibly common, in the upland prairies. In flower June 17.

Pine Lake district, No. 3323.

***A. petaloidea* Fernald.**

Rare or occasional, and known thus far only from a single collection in upland jackpine woods. In flower and immature fruit July 5.

Pine Lake district, No. 3324.

***A. canadensis* Greene.**

Probably common in upland semi-open prairies, though it has been collected from only one locality. In flower June 15.

Near Mission Farm, No. 3326.

***Gnaphalium uliginosum* L. CUDWEED.**

Apparently rare, and known only from a single specimen collected in a sandy upland sink-hole. In flower July 14.

Round lake, about 18 miles south of Pine lake, No. 3315.

***Bidens cernua* L. BEGGAR-TICKS, BUR MARIGOLD.**

Common on the marshy shores of ponds and lakes. In flower during late July and the first half of August. Immature fruit August 15.

Reed portage, upper Embarras river, No. 3327; Murdock Creek district, No. 3328; shore of Moose (Eight) lake, Nos. 3330, 3329, 3331.

*Achillea sibirica* Ledeb. *A. multiflora* Hook. See Rhod. xxxi, 219 (1929).

A common species of delta slough margins and newly formed local river flood-plains. Buds and young flowers have been found July 18, and the height of the flowering season appears to be late July and early August. Young shoots appear early in June.

East shore of lake Mamawi, No. 3368; 30th base line district, Slave river, No. 1403; Murdock Creek district, No. 3371; Government Hay Camp district, Slave river, No. 3370; Peace point, No. 3372; base of eastern slope of Caribou mountains, No. 3369.

**A. Millefolium L.** COMMON YARROW, WHITE-TOP.

Although the writer's material shows considerable variation, he has been unable to make a definite separation of it into more than one species. It includes forms that show many gradations between *A. Millefolium* and *A. lanulosa* Nutt., in the characters commonly used to separate these two. Consequently, until further critical study has been made it is thought best to determine it as above.

A common species of prairies, damp meadows, and clearings throughout the area. Flower buds appear about mid-June, and the first flowers about July 1. Flowering continues through the middle part of August.

East shore of lake Mamawi, No. 3345; Government Hay Camp district, Slave river, Nos. 3353, 3357, 3358; near Heart (Raup) lake, Nos. 3352, 3354; Fort Smith, Nos. 1398, 1399 (*Mrs. Conibear* coll.); near Mission Farm, No. 3360; Pine Lake district, No. 3359; Peace point, Nos. 3355, 3356; sink-hole 16 miles east of Moose lake, No. 3362; Moose (Eight) Lake district, Nos. 3361, 3363, 3364, 3365, 3366, 3367; Indian graveyard, Peace river, No. 3346; base of eastern slope of Caribou mountains, Nos. 3347, 3348, 3349, 3350, 3351; junction of Little Buffalo and Nyarling rivers, *Russell*, No. 8; Little Buffalo river near the 60th parallel, *Russell*, No. 85.

**Chrysanthemum Leucanthemum L.**, var. **pinnatifidum** Lecoq and Lamotte. OX-EYE DAISY.

Collected thus far only in an upland cabin clearing, where it is probably adventive. In flower July 6.

Pine Lake ranger station, No. 3344.

**Artemisia canadensis Michx.** CANADA WORMWOOD.

Occasional in dry prairies and on sandy banks. Flower buds collected early in July, and flowers in the latter part of August.

Near Heart (Raup) lake, No. 3338; Fort Smith, No. 1388 (*Mrs. Conibear* coll.); Pine Lake district, No. 3340; sink-hole 16 miles east of Moose lake, No. 3339.

**A. dracunculoides Pursh.** WORMWOOD.

Common in the drier parts of the semi-open prairies. Young flowers found in the latter part of July.

Peace point, Nos. 3333, 3334; base of eastern slope of Caribou mountains, No. 3332.

**A. biennis** Willd.

Occasional in clearings, meadows, and on stream banks. It flowers in the latter half of August.

Reed portage, upper Embarras river, No. 3343; near Heart (Raup) lake, No. 3341; sink-hole 16 miles east of Moose lake, No. 3342.

**A. frigida** Willd. PASTURE WORMWOOD.

Common on very dry prairies and on granite hills. Flower buds appear in the latter part of July, and flowers in August.

East shore of lake Mamawi, No. 3335; Peace point, Nos. 3336, 3337.

**Petasites palmatus** (Ait.) Gray. COLTSFOOT.

Common in open (chiefly poplar) woods throughout the upland. Flowering and fruiting stems found in late June and early July.

Fort Smith, No. 1435; Pine Lake district, Nos. 3403, 3404, 3405; Moose (Eight) Lake district, No. 3402; base of eastern slope of Caribou mountains, No. 3401; eastern edge of Caribou Mountain plateau, No. 3400.

**P. vitifolius** Greene.

Common in upland muskegs and wet meadows. Immature fruit collected June 20.

Near Heart (Raup) lake, Nos. 3406, 3407; Pine Lake district, No. 3408; Moose (Eight) Lake district, No. 3409; base of eastern slope of Caribou mountains, Nos. 3410, 3411.

**P. sagittatus** (Pursh) Gray.

Abundant in muskegs and wet meadows throughout the region. Flowering and fruiting stems collected during the latter half of June.

Government Hay Camp district, Slave river, No. 3415; near Heart (Raup) lake, No. 3413; near Mission Farm, No. 3416; Pine Lake district, No. 3414; Moose (Eight) Lake district, Nos. 3417, 3418, 3419; base of eastern slope of Caribou mountains, No. 3420; Clewi river, *Russell*, No. 15.

**Arnica rhizomata** A. Nels. ARNICA.

Common at the margins of some of the upland semi-open prairies. It usually grows around the willow clumps in such places, and flowers in the latter part of July.

Peace point, No. 3378; base of eastern slope of Caribou mountains, Nos. 3379, 3380, 3381, 3382.

**A. chionopappa** Fernald. See *Rhod.* xxxv, 336-7 (1933).

Common in dry upland woods and on rocky hills. Found in flower in the latter part of June and in July. Fruiting heads appear in August.

Government Hay Camp district, Slave river, No. 3377; Fort Smith, No. 1408; Pine Lake district, Nos. 3373, 3374, 3375; sink-hole 16 miles east of Moose lake, No. 3376; lower Slave river, No. 1409.

**Senecio cremophilus** Richards.

Collected thus far only in lowland clearings and hay meadows, where it is common. Found in flower during the first half of August.



Reed portage, upper Embarras river, No. 3391; Government Hay Camp, Slave river, Nos. 3392, 3393.

**S. indecorus** Greene. See Rhod. xxvi, 120 (1924). RAGWORT.

Common in lowland wet meadows and occasional at upland prairie margins. Flowers collected in the latter half of July and early August, and immature fruit in the first week in August.

Murdock Creek district, No. 3388; Government Hay Camp district, Slave river, No. 3387; Indian graveyard, Peace river, No. 3390; base of eastern slope of Caribou mountains, No. 3389.

**S. pauperculus** Michx. See Rhod. xxiii, 299 (1921).

Common in muskegs, rich woods, and damp meadows throughout the region. Found in flower from late June to about mid-August.

Murdock Creek district, No. 3398; Government Hay Camp district, Slave river, No. 3394; Pine Lake district, No. 3397; Moose (Eight) Lake district, Nos. 3395, 3396; base of eastern slope of Caribou mountains, No. 3399; lower Slave river, No. 1417.

**S. cymbalarioides** Nutt., var. **borealis** (T. and G.) Greenm. See Ann. Mis. Bot. Gard. iii, 177 (1916).

Occasional in dry upland woods. Collected in flower in the latter part of June, and with immature fruit July 14.

Fort Smith, Nos. 1424, 1429; Pine Lake district, No. 3386; Moose (Eight) Lake district, No. 3385.

**S. palustris** (L.) Hook.

Common in lowland sloughs and wet meadows. Found in flower from mid-June to the latter part of July. Immature fruit collected August 15.

Reed portage, upper Embarras river, No. 3383; lower delta of Athabaska river, No. 1420; 30th base line district, Slave river, No. 1419; Government Hay Camp district, Slave river, No. 3384; Little Buffalo river, Russell, No. 40.

**Cirsium Drummondii** T. and G. THISTLE.

Common in prairies and the drier parts of lowland wet meadows. Rosettes collected in mid-June, and late flowers and fruit the first week in August.

30th base line district, Slave river, No. 1437; Government Hay Camp district, Slave river, No. 3422; Peace point, No. 3421; Clewi river, Russell, No. 49.

**Hieracium canadense** Michx. HAWKWEED.

Common in upland open woods, and at the willow margins of prairies and sloughs. Flower buds observed in the first half of July, and the first flowers in late July and early August. Immature fruits appear in the first half of August.

East shore of lake Mamawi, No. 3432; Government Hay Camp district, Slave river, Nos. 3423, 3424; near Heart (Raup) lake, No. 3425; Fort Smith, No. 1442; sink-hole 16 miles east of Moose lake, No. 3427;

Moose (Eight) Lake district, Nos. 3426, 3428, 3429; Indian graveyard, Peace river, No. 3431; base of eastern slope of Caribou mountains, No. 3430.

**Taraxacum ceratophorum** (Ledeb.) DC. See Rhod. xxxv, 369-86 (1933) for a treatment of this and the following.

Occasional in open upland woods and clearings.

Pine Lake district, Nos. 3447, 3445, 3444, 3446; eastern slope of Caribou mountains, No. 3439.

**T. dumetorum** Greene.

Occasional in open woods, clearings, and prairies throughout the region.

Government Hay Camp, Slave river, No. 3441; Fort Smith, No. 1446; Pine Lake district, No. 3442; Peace point, No. 3443; base of eastern slope of Caribou mountains, Nos. 3437, 3438, 3440.

**Lactuca pulchella** (Pursh) DC. WILD BLUE LETTUCE.

Common in clearings and in the unstable soil of stream banks, chiefly in the lowlands. Found in flower from late June to mid-August.

Reed portage, upper Embarras river, No. 3433; Murdock creek, No. 3436; Government Hay Camp district, Slave river, No. 3434; Peace point, No. 3435; lower Slave river, No. 1444.

### *Summary of Plants Treated in this Catalogue*

—	Families	Genera	Species	Varieties and forms	Total number of different plants <sup>1</sup>
Pteridophyta.....	4	8	17	2	17
Gymnospermae.....	1	5	8	2	8
Monocotyledoneae.....	14	58	140	23	145
Archichlamydeae.....	30	79	172	25	177
Metachlamydeae.....	17	61	112	17	114
Totals.....	66	211	449	69	461

<sup>1</sup>There are fifty-seven species which are represented only by one or more varieties or forms. The figures for the total number of different plants are obtained by subtracting these species from the total numbers of species, varieties, or forms.

## REFERENCES CITED

1. Anderson, James R.: Trees and Shrubs, Food, Medicinal, and Poisonous Plants of British Columbia; Dept. of Ed., Victoria, B.C. (1925).
2. Back, George: Narrative of the Arctic Land Expedition to the Mouth of the Great Fish River and Along the Shores of the Arctic Ocean in the years 1833-34-35. London, John Murray (1836).
3. Ibid.
4. Burpee, Lawrence J.: The Search for the Western Sea, pp. 413-14. D. Appleton and Co., New York (1908).
5. Ibid., pp. 169-170.
6. Ibid., map facing p. 182.
7. Ibid., p. 416.
8. Cameron, A. E.: Post-Glacial Lakes in the Mackenzie River Basin, Northwest Territories, Canada; Jour. of Geol., vol. xxx, pp. 337-353 (1922).
9. Ibid., p. 345, contains an excellent photograph of the spring condition of the Salt Plains.
10. Ibid., p. 348.
11. Ibid., p. 351.
12. Ibid., p. 352.
13. Camsell, Charles: The Region South-west of Fort Smith, N.W.T.; Geol. Surv., Canada, Ann. Rept., vol. xv, pt. A, p. 151 (1903).
14. Ibid., p. 151.
15. Ibid., p. 155.
16. Ibid., p. 156.
17. Ibid., p. 159.
18. Ibid., p. 163.
19. Ibid., p. 165.
20. Camsell, Charles: Salt and Gypsum Deposits of the Region Between Peace and Slave Rivers; Geol. Surv., Canada, Sum. Rept. 1916, pp. 135-36.
21. Camsell, Charles, and Malcolm, Wyatt: The Mackenzie River Basin; Geol. Surv., Canada, Mem. 108, p. 19 (1921).
22. Ibid., p. 17.
23. Ibid., p. 107.
24. Dept. of the Interior, Canada, Top. Surv., National Topographic Series, Sheet Nos. 84P, 84I, 74M, 74L (1929-30).
25. Franklin, John: Narrative of a Journey to the Shores of the Polar Sea in the Years 1819-20-21-22. London, John Murray (1823).
26. ———: Narrative of a Second Expedition to the Polar Sea in the Years 1825-6-7, etc. London, John Murray (1828).
27. Fl. Bor.-Am., vol. ii, p. 121 (1840).
28. Gleason, Henry Allan: The Vegetational History of the Middle West; Annals Ass. of Am. Geogs., vol. xii, pp. 39-85 (1923).
29. Graham, Maxwell: Canada's Wild Buffalo; N.W. Terr. and Yukon Branch, Dept. of Int., Canada (1923).
30. Hearne, Samuel: A Journey from Prince of Wales Fort, in Hudson's Bay, to the Northern Ocean, etc., in the Years 1769, 1770, 1771, 1772. Dublin (1796).
31. Hooker, Sir W. J.: Flora Boreali-Americana. London (1840).
32. Hume, G. S.: Mackenzie River Area, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1923, pt. B, p. 12.
33. Kindle, E. M.: Notes on Sedimentation in the Mackenzie Basin; Jour. of Geol., vol. xxvi, pp. 341-360 (1918).
34. ———: The Arrival and Departure of Winter Conditions in the Mackenzie River Basin; Geog. Rev., vol. x, pp. 388-399 (1920).
35. Ibid., pp. 398-399.
36. Lewis, F. J., Dowding, E. S., and Moss, E. H.: The Vegetation of Alberta. II. The Swamp, Moor, and Bog Forest Vegetation of Central Alberta; Jour. of Ecology, vol. xvi (1928).
37. Ibid., p. 39, Figure 3.
38. McConnell, R. G.: Report on an Exploration in the Yukon and Mackenzie Basins, N.W.T.; Geol. Surv., Canada, Ann. Rept., vol. iv, pt. D (1891).

39. Mackenzie, Alexander: *Voyages from Montreal on the River St. Laurence through the Continent of North America to the Frozen and Pacific Oceans in the Years 1789 and 1793, etc.* London (1801).
40. Macoun, John: *Geological and Topographical Notes on the Lower Peace and Athabaska Rivers*; Geol. Surv., Canada, Rept. of Prog. 1875-76, pp. 87-95.
41. — On the Botanical Features of the Country Traversed from Vancouver Island to Carlton, on the Saskatchewan; Geol. Surv., Canada, Rept. of Prog. 1875-76, pp. 110-232.
42. *North Am. Fl.*, vol. xxv, p. 96 (1910).
43. *Ibid.*, p. 94.
44. Northwest Mounted Police, Ann. Repts., 1908-11. Canada, Sessional Papers.
45. *Ottawa Nat.*, vol. xv, pp. 110, 179 (1901).
46. Pammel, L. H.: *A Manual of Poisonous Plants*; The Torch Press, Cedar Rapids, Iowa (1911).
47. Petitot, Emile: *On the Athabaska District of the Canadian Northwest Territory*; Can. Rec. Sci., vol. i, p. 47 (1884).
48. Pike, Warburton: *The Barren Ground of Northern Canada*. London, Macmillan and Co. (1892).
49. Preble, E. A.: *A Biological Investigation of the Athabaska-Mackenzie Region*; N. Am. Fauna, No. 27, U.S. Dept. of Agri. (1908).
50. *Ibid.* The notes here presented are mainly from this volume.
51. Raup, H. M.: *A Survey of the Vegetation of Shelter Point, Athabaska Lake*; Univ. of Pittsburgh, Bull. xxv (Oct. 25, 1928). (This is an abstract of a more detailed paper not yet published.)
52. — *Phytogeographic Studies in the Peace and Upper Liard River Regions, Canada, with a Catalogue of the Vascular Plants*; Cont. Arn. Arboret. vi (1934).
53. — *The Distribution and Affinities of the Vegetation of the Athabaska-Great Slave Lake Region*; Rhodora, vol. xxxii, pp. 187-208 (1930).
54. — *Range Conditions in the Wood Buffalo Park of Western Canada with Notes on the History of the Wood Bison*; Spec. Pub. Am. Comm. for Intern. Wild Life Protect. i, No. 2 (1933).
55. — *Notes on the Distribution of White Spruce and Banksian Pine in Northwestern Canada*; Jour. Arn. Arboret. xiv, 335-44 (1933).
56. — *The Formation of Peat Ridges on the Shores of Muskeg Lakes in Northern Alberta*; Rhodora, vol. xxxiii, p. 18 (1931).
57. Raup, Lucy C.: *A List of the Lichens of the Athabaska Lake Region of Northwestern Canada*; Bryologist, vol. xxxi (July and Sept., 1928).
58. — *The Lichen Flora of the Shelter Point Region, Athabaska Lake*; Bryologist, vol. xxxiii (Sept., 1930).
59. Richardson, Sir John: *Fauna Boreali-Americana*. London (1929).
60. — *Arctic Searching Expedition: A Journal of a Boat-voyage through Rupert's Land and the Arctic Sea, etc.* London (1851).
61. Russell, Frank: *Explorations in the Far North*; Univ. of Iowa (1898).
62. Schneider, C.: *Jour. Arn. Arboret.*, vol. i, pp. 80-81 (1919).
63. Seibert, F. V.: *Map Showing Interior Topography of Wood Buffalo Park*; Natural Resources Intelligence Service, Dept. of Int., Canada.
64. — *A Reconnaissance Survey in the Home of the Wood Buffalo*. Appendix to Canada's Wild Buffalo; N.W. Terr. and Yukon Branch, Dept. of Int., Canada (1923).
65. Seton, E. T.: *The Arctic Prairies*. Charles Scribner's Sons, New York (1911).
66. Simpson, Thomas: *Narrative of the Discoveries on the North Coast of America Effected by the Officers of the Hudson's Bay Company during the Years 1836-39*. London (1843).
67. *Topographical Survey of Canada*, Dept. of Int.: *Map of Alberta, North Sheet* (1923).
68. — *National Topographic Series*, Sheet Nos. 74M, 84P, 74L, and 84I (1929-30).
69. U.S. Dept. of Agri., Bull. 772.
70. Warming, E: *Oecology of Plants*, p. 310 (1909). Oxford Press.
71. Whitney, Caspar: *on Snow-shoes to the Barren Grounds*. Harper Brothers, New York (1896).