DEPARTMENT OF THE INTERIOR, CANADA

Hon. ROBERT ROGERS Minister; W. W. CORY, Deputy Minister.

FORESTRY BRANCH—BULLETIN No. 29

R. H. CAMPBELL, Director of Forestry.

REPORT ON TIMBER CONDITIONS AROUND LESSER SLAVE LAKE

BY

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LETTER OF TRANSMITTAL.

FORESTRY BRANCH,
DEPARTMENT OF THE INTERIOR,
OTTAWA, March 20, 1912.

SIR,—I have the honour to present herewith a report by Mr. D. Roy Cameron, B.A., B.Sc.F., on the 'Timber Conditions Around Lesser Slave Lake,' and to recommend its publication as Bulletin No. 29 of this Branch.

The information contained in this report was obtained by the author as chief of a party which made a reconnaissance survey of the district in the summer of 1911.

The report outlines the work of the party throughout the summer, and proceeds to give a survey of the general conditions of the district under the headings of topography, soil, climate, forest growth, damage to the forest growth by fires, and, finally, the manner and extent to which the forest is being reproduced or renewed.

The country examined is then taken up by districts, ten in number.

The importance of reserving designated portions of the territory, the soils of which cannot profitably be used for agriculture, is urged, not only for the beneficial effect on the navigation of the rivers and for the prevention of erosion of the land, but also in order to render available a timber supply when the country is settled, as it must be in no very long time.

A scheme of fire protection, illustrated by a map, is also submitted.

A number of tables, summarizing important information about the country, are given as appendices.

I have the honour to be, Sir,
Your obedient servant,

R. H. CAMPBELL,
Director of Forestry.

W. W. CORY, ESQ., C.M.G.,
Deputy Minister of the Interior,
Ottawa.

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From Sawridge we worked along the north shore of the lake as far as The Narrows. The season was very rainy and the trails, therefore, in very poor shape. It was found necessary to leave the main camp in charge of the cook at the lake shore, and do the work by sub-camps. Sub-camp parties of two would take two horses and a few days' food, and work their way back into the hills as far as possible.

Continued rains hampered the work very much, and made travelling through the thick brush very disagreeable. It was the middle of August before The Narrows were reached. Inasmuch as the country along the north shore west of The Narrows is largely muskeg, I considered it best to return to Sawridge and start work in the Swan Hills before the season should become too late. Sub-parties ascended all the creeks flowing into the lake from the Swan Hills, one crossing to the head-waters of the Saulteux river. The south shore at The Narrows was reached by September 10. F. McVickar returned from here to college. Several side-trips from the Swan River settlement, and a week's bad weather, prevented our starting for the Swan Hills proper until September 25. These delays rendered it impossible for me to take Lewis into the hills. He therefore returned to college at this time.

Photo D. Roy Cameron, 1911.

PLATE 2.—Packing across Muskeg Brulé.

The supplies and baggage were hauled by wagon up the Swan River to its junction with the overland trail to the Klondyke twenty five miles above the settlement. The main camp was set up there. From this point three long side-trips were made; one east along the 18th base line to the head waters of the Saulteux to connect up with former work; one south along the Klondyke trail to Deep creek, thirty miles from Ft. Assiniboine; and one up towards the head-waters of the Swan river to Freeman lake, across the hills.

The lateness of the season, lack of horse-feed and coming of snow necessitated our return to the lake when these trips were completed. Two short trips to complete timber examinations near the settlement closed the work for the summer. The pack-horses were disposed of at the settlement, and on October 25 the start was made from Wappa on our return trip. We travelled down the Athabaska river by canoe among floating ice cakes. Athabaska Landing was reached just three days before the final freeze-up.

GENERAL CONDITIONS.

TOPOGRAPHY.

The Athabaska river from Athabaska Crossing flows easterly to Ft. Assiniboine. Here it turns and runs north seventy miles to Mirror Landing at the mouth of the Lesser Slave river. Thence it flows easterly again twenty miles before making the big bend down to Athabaska Landing. The country lying to the north and west of this part of the river is that examined last season.

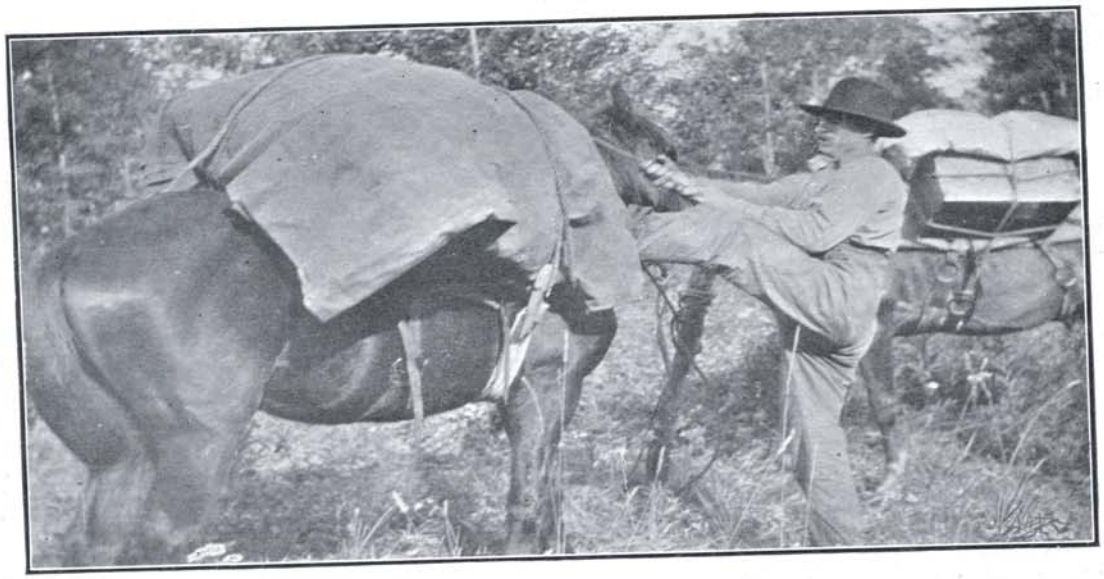

Photo. F. McVickar, 1911.

PLATE 3.—Packing.

The Athabaska river flows between banks 100 to 600 feet high, covered on their slopes with poplar or spruce. Behind, on the general level of the country, are large areas of muskeg stretching to the interior hill country or to the watersheds of other water systems. These muskegs are largely burnt.

The Lesser Slave river lies in a valley eight to ten miles wide consisting of flat burnt muskeg country with interspersed gravel or boulder-clay ridges.

Lesser Slave lake, nothwithstanding its area, is very shallow. The north shore is even, composed of stones. Back from the lake on the northeast corner is Martin mountain, which in reality is a plateau, 1,000 feet above the lake at its highest point. This elevation stretches easterly to Moose lake by lower ridges. This plateau is composed of a very thick blanket of the omnipresent boulder-clay, underlain by shales of Cretaceous origin. The country-rock, however, is never exposed. West of Martin mountain the country is lower, flattening down to muskeg west of the narrows of the lake. Long, low gravel or sand ridges form islands in the general muskeg.

South of Lesser Slave Lake, and ten to twenty miles back from it, is another high plateau country known as the Swan hills. This plateau averages 500 to 1,000 feet higher than Martin mountain. It is a rough country, broken by deep valleys. The northern edge is well defined, and is characterized by the presence of numerous spur-

ridges running north to the shore of the lake. Between these ridges are numerous creeks which have their origin in the plateau.

The Swan River valley is the most conspicuous break in the hills. It penetrates deep into the heart of the plateau. West of The Narrows the high land retreats back from the lake, leaving large areas of agricultural land.

The southern edge of the plateau is not so distinct. The high land descends by large steps or benches. Both the summits proper and these terraces are flat areas, comprising muskeg interspersed with gravel or boulder-clay ridges. This gradually changes to rolling country to the southeast, until agricultural land is found at Deep Creek. More to the west, however, south of the upper waters of the Freeman river is another high plateau reaching to the Athabaska river.

SOIL.

Agricultural land occurs in patches increasing in size to the west. North of the Athabaska river, east of Mirror Landing, is an area of poplar country interspersed with muskeg. Of the 100 square miles included here, approximately 75 can be farmed.

A narrow strip along the Lesser Slave river from Muskeg creek to Mirror landing, perhaps fifteen square miles in all, is suitable for agriculture. Back of this on either side of the river is muskeg.

A low spur-ridge, one of the eastern extensions of Martin mountain, contains some twenty five square miles of poplar country which is good land. This is situated in the northwest quarter of township 73, range 2, west of the 5th meridian, and the north half of township 73, range 3, west of the 5th meridian.[1] There are some nine square miles of hay meadows and prairie at the eastern end of Lesser Slave lake adjacent to Sawridge. This is very valuable land.

South of Martin mountain, between Muskeg creek and Martin creek, is a tract of poplar or spruce country about forty five square miles in all, which is capable of being farmed when the prairie land is all taken up. West of this there is little agricultural land on the north side of the lake until the western end is reached.

South of the lake, east of The Narrows, the foot-hills of the Swan Hills plateau extend almost to the water's edge, so that with the exception of some ten square miles in the north half of Township 72, Range 6, west of the 5th Dominion meridian, and a few quarter-sections at the mouths of creeks, there is no agricultural land east of the Swan river valley.

Along the Swan river, for about half a mile to one and a half miles on either side, is prairie or semi-prairie. There are some twenty-five square miles of this. The Swan River settlement is situated here. The land is alluvial soil of the richest kind.

West of the Swan river, north of the Swan hills, is a large area of country covered with a dense growth of poplar, birch, willow and alder, most of which when cleared will be good land. Between Swan river and the west end of the lake there are perhaps 360 square miles of this country. However, there is little likelihood of this land being settled until the prairies further west have been filled.

In general it may be said that the soil of the potentially agricultural regions is a loam, either clay or sandy. This is underlain everywhere by boulder-clay. Sand ridges occur in spots. They are evidenced by the appearance of jack pine.

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[1] The expressions 'west of the 5th meridian' and 'west of the 5th Dominion meridian,' often used in the bulletin, refer to the meridians used as reference lines in the Dominion surveys. The 5th Dominion meridian coincides almost exactly with the 114th meridian of longitude west of Greenwich. This expression is frequently abbreviated: for instance, Section 5, Township 6, Range 10, west of the 5th meridian, becomes Sec. 5,, Tp. 6, Rg. 10, W5M, or even 5-6-10-5.

The country is laid off, in checker-board fashion, in townships, each six miles square. The north and south rows of these are known as ranges, while the east and west row is designated as e.g.: Township 60, (or occasionally as Township 'Tier'). Townships are numbered from the International boundary (Latitude 49 degrees) northward, while the ranges are numbered westward from the meridian next east.

The great areas of non-agricultural land are divisible into two classes, viz., (1) undrained, and (2) broken.

The undrained areas are muskeg underlain by boulder-clay which appears above the general level as ridges.

In the broken hill country we have a different condition, especially along the northern face, or 'shield,' of the Swan hills. Here is a large area much broken by cross-ridges and deep ravines, but covered to a considerable depth with a top layer of fine clay loam mixed with stones. Owing to the latter, and to the rough nature of the country, this region is unsuitable for agriculture, but it is one of the best locations for timber growth that could be found. Indeed, it was once covered with the finest stand of spruce and lodgepole pine in the north country.

The subsoil here is boulder-clay. In less favoured regions in the interior, and on the southern side, the boulder-clay reaches the surface.

CLIMATE.

The climate of this country has been a subject of much controversy. Some claim for it all the possibilities of the wheat belt to the south, others say that it is impossible to grow anything. In the appendix are given results of observations taken from June 3, when the work of the party commenced, until September 24. After the latter date the party moved into the Swan hills. Later than this, variations in elevations, &c., need so many corrections that the data are of little use. Frosts occurred nearly every night in the Swan hills and snow fell frequently. Frosts recorded in July seem to have been of local occurrence. The party was then located in the neighbourhood of Muskeg creek on the north shore of the lake at the east end of Martin mountain. Different inquiries at Swan River settlement seem to confirm the statement that no frost occurred there in July.

As regards crops, I do not think wheat will do well around the lake except, possibly, at the west end. Last summer, even the oats were badly frozen in the Swan river valley, although they are said to do well most years.

There is a great future for the country in hay crops and stock raising.

FOREST GROWTH.

The forest areas of the lands examined may be divided in a general way into eight classes:—

1. Muskeg.
2. Poplar.
3. Cottonwood Flats.
4. Jack Pine.
5. Lodgepole Pine.
6. Summit-Plateau.
7. Height-of-Land.
8. Spruce.

MUSKEG.

This type is omnipresent. It develops in three ways, viz.:

1. Marginal areas to river systems, as in the case of the Lesser Slave and the Saulteux rivers, where the muskeg extends back from the shores for a distance of from three to five miles.

2. Undrained height-of-land areas. Here muskeg occurs surrounding numerous gravel or boulder-clay ridges or islets.

3. On summit of plateau. Here the muskeg is associated with areas of lodgepole pine, black spruce and fir. Muskeg up here is very wet, either it is composed almost entirely of very scattered tamarack, or is bare open tundra of moss or reedy grasses.

In general the muskeg of this country is not so wet as that encountered in the summer of 1910 along the line of the Hudson Bay railway. This is evidenced by the fact that black spruce predominates upon the area instead of tamarack. The spruce is, however, so small in size that the amount of pulpwood which could be cut to four inches diameter is negligible.

There are altogether some 2,000 square miles of muskeg in the 6,700 square miles of country examined, or approximately 30 per cent of the whole. This includes the percentage of muskeg in the height-of-land, summit-plateau and other types.

POPLAR TYPE.

The poplar type covers an area of some 923,000 acres altogether, located as follows:—

Athabaska river valley	60,000 acres.
Martin mountain country	194,000 "
Narrows creeks	102,000 "
North slopes	360,000 "
Otauwau River country	15,000 "
Upper Saulteux	132,000 "
Lower Freeman	60,000 "

This type is generally a mixture of many species, but aspen predominates.

The species on an average will run in mixture as follows:—

Aspen, 80 per cent; balsam poplar, 15 per cent; birch, 4 per cent; spruce, 1 per cent. In some localities jack or lodgepole pine also occurs in the mixture.

The aspen in this country as elsewhere is very susceptible to the attacks of the heart-rot (*Polyporus igniarius*). Studies showed that approximately forty three per cent of the total stand is so defective as to be useless. Of the remainder, only twenty per cent is entirely sound, eighty per cent being more or less discoloured, although the fibre of the wood has not as yet been destroyed.

The average yield in pulpwood to four inches diameter over this area is approximately twenty cords per acre of aspen and balsam poplar. The other species may be neglected. At this estimate we have, of really sound aspen, 3.2 cords per acre; of discoloured wood, 12·8 cords per acre; the total available is thus 16 cords per acre.

The balsam poplar is also subject to grave defects, 50 per cent being useless through frost-crack and other causes. There will remain about four cords of material of pulpwood size per acre. Therefore, there are found of absolutely sound wood per acre:

Aspen	3·2 cords
Balsam poplar	4·0 "
	7·2 "
Of discoloured wood	12·8 "

Figuring at this estimate over the whole area we have, of perfectly sound wood at 7·2 cords, 6,750,000 cords. Adding defective, but not destroyed, wood at 12·8 cords per acre, 11,810,000 cords; total, 18,560,000 cords. Aspen in the poplar type grows at an average rate of one inch in nine years. The average age is 72 years, and the average diameter at breast-height, 8 inches.* Balsam poplar in the poplar-type country has about the same rate of growth.

*Breast-height, a term frequently used in this bulletin and in forestry literature generally, is understood to be four and a half (4½) feet above the ground. For the sake of uniformity and to afford a basis for accurate comparison, measurements of the diameter of trees are invariably taken at this height for forestry purposes. 'This point is above the root-swelling and is the natural place to caliper a standing tree.' (*H. S. Graves, Forest Mensuration.*) The expression 'diameter at breast-height' is frequently abbreviated, especially in tables, to D.B.H.

Considering the poplar type as a whole, one may state that it is in general a temporary type, the result of fires. At one time or another, most of this area was covered with spruce, and is capable of being reforested with that species under proper management. This is evidenced by the fact that, wherever conditions are at all suitable, spruce reproduction appears, even though the spruce seed-trees in mixture compose only one per cent or less of the stand. Many localities where the humus cover is too deep to allow spruce seeds to germinate show reproduction of balsam fir. This would undoubtedly, in the climax type, be largely replaced by spruce.

Along the alluvial benches of the streams flowing into Lesser Slave lake from the south, the conditions of growth of balsam poplar (or balm) are altogether different.

COTTONWOOD FLATS.

Along the Swan river, for instance, so-called 'cottonwood' flats are found where this species grows intermixed with some spruce. Here we find trees growing 100 feet high with 65 feet clear and a diameter at breast-height of from 15 to 60 inches. The average will be about 24 inches. The older and larger trees are mostly defective from heart-rot, but the younger up to 2 inches in diameter are sound and beautiful timber.

Photo D. Roy Cameron, 1911.
PLATE 4.—Cottonwoods along Ninemile Creek.

These patches are, however, very limited in area, and are generally confined to a strip one to three chains wide along the river or in narrow flats of one to five acres, formed by the sinuosities of the rivers. This tree in such locations has the fastest growth of any in the north country. Rings are often seen over half an inch wide.

On the average it will grow, for the first fifty years at least, at the rate of an inch every four years. Height-growth will average ninety feet for the stand.

BIRCH TYPE.

The birch type is very localized, being confined to small areas around the mouth of Nine-mile creek and in the Assineau River valley. The area is really negligible, but is interesting as showing development in pure stands of the northern canoe-birch (*Betula resinifera.*) This tree is small and spindly, and, except in exceptional cases, does not attain a diameter of more than six inches. It is susceptible to attacks of Polyporus fungi, and, when dead, disintegrates very rapidly.

JACK PINE TYPE.

The jack pine shows development in pure stands wherever sand is found. Along the Athabaska and Lesser Slave rivers it grows freely; generally, however, the stands are as yet young, the average age being fifty to fifty five years, and the average diameter eight inches. A remnant of an older stand is to be found around Mirror landing. Here are trees up to 24 inches in diameter at breast-height. They are, however, short and very limby. Growth around Mirror landing is rapid, probably averaging an inch in diameter every four or five years. This is, however, exceptional, and the average growth will not be greater than an inch in six years.

LODGEPOLE PINE TYPE.

This type covers the largest area of any in the country examined. It is the characteristic type of the valley slopes of the Swan hills, to which it is practically confined. There are, roughly, some 1,900 square miles of this type.

In the timber, lodgepole pine predominates, with a large admixture of black spruce wherever a flat bench occurs. Such benches—really small muskegs—cover twenty per cent of the area. It seems that the lower the elevation the pine can obtain, the better it will grow. In creek gulches and on the outer edges of the benches, it attains tie size, and has a rate of growth of approximately one inch every seven years. Such locations are, however, scattered, and on over 95 per cent of the area the pine will never make tie size. The growth on this latter area is the typical Rocky Mountain timber-line development—dense, spindly growth one to six inches in diameter at breast-height (4½ feet from the ground), and twenty to forty feet high. On such locations this type is useful principally as a protective covering and as a possible pulpwood supply for the future.

On the better locations stands occur which will cut, on an average, twenty-five ties to the acre. No definite areas for this can be given, but, figuring on a basis of five per cent of the total area we have 95 square miles, or 60,000 acres, which gives roughly some 1,500,000 ties. There will be, easily, this amount on the area, but the patches are so scattered as to make it doubtful if it can be used for some time yet, at any rate. On the remaining 95 per cent of the area, comprising some 1,196,000 acres, there can be found at present five cords of pulp per acre of pine and spruce—5,980,000 cords in all. Inasmuch as a great deal of this timber is a young growing stand it may be considered certain that in twenty years time the yield will increase 100 per cent. Thus, by the time this timber is needed for pulp there should be a supply of at least 11,000,000 cords, if fire is kept out.

Trees examined on an optimum site showed an average height of 75 feet and a diameter of from 4 to 13 inches.

SUMMIT-PLATEAU TYPE.

This type is confined to the flat tops of the Martin mountain and Swan Hills plateaux. Altogether, it covers an area of some 1,300 square miles, of which almost four per cent or fifty square miles, is on Martin mountain.

This type is an admixture of lodgepole pine, balsam fir and black spruce in varying proportions according to drainage and exposure.

The composition is different on Martin mountain to that seen on the Swan hills. On the former plateau, the average stand is approximately:

Balsam Fir	50 per cent.
Lodgepole Pine	25 "
Black Spruce	25 "

Growth is very slow, the trees are stunted (pole size only) four to eight inches in diameter, with occasional pines in better sites up to fourteen inches.

On Martin mountain this type will run ten cords of pulpwood per acre, or some 32,000 cords in all.

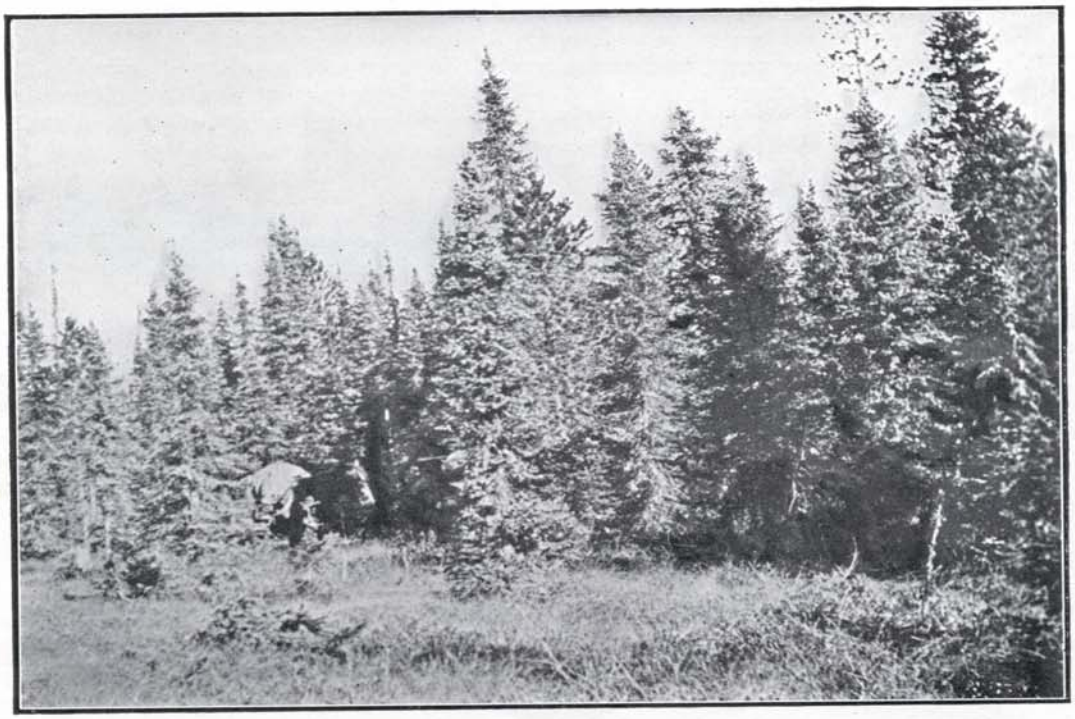

Photo D. Roy Cameron, 1911.

PLATE 5.—Summit-Plateau Type: Summit of Swan Hills. (Tp. 66, Rg. 11, w5M.)

On the Swan Hills summits, which are 500 to 1,000 feet higher than Martin mountain, the species are generally more clearly separated, the pine preferring boulder-clay ridges and the black spruce the muskegs. The percentage of balsam fir is also different, being only 10 per cent. as compared with 50 per cent for Martin mountain. A tendency is seen also to open tundra areas between the ridges in the Swan Hills summits. Fifty per cent of the area on these hills is muskeg. Nowhere on the Swan Hills will the timber of this species be of use for anything more than a protective covering. But it has an important function in this regard.

HEIGHT-OF-LAND TYPE.

This type is divisible into two parts according to which species of pine grows upon it.

The first type occurs north of Lesser Slave river and lake. This is really the head-waters country, forming the divide between the Lesser Slave and Wabiskaw water systems. It appears on the lake shore west of Martin creek. Elsewhere it is far in the interior. In all, there are about 675 square miles of the country within the tract examined last season. The timber of this type is mostly pole size or under. The country consists of an alternation of muskegs and ridges of boulder-clay, or, rather, islands in a sea of muskeg. The ridges contain open stands of limby pole jack pine and the muskegs bear stunted tamarack and black spruce. About sixty per cent of the area is muskeg. Forty per cent of the country has been burnt within the last thirty years.

South of the Swan hills, in the region lying between the head-waters of the Saulteux river and Deep creek is another tract of height-of-land country. Here are found the same characteristic topographic features, of ridges surrounded by muskeg. The only thing to differentiate the country from that lying north of the lake is the fact that the lodgepole pine replaces the jack pine on the ridges.

The lodgepole pine grows in dense stands, the trees are small and spindly, rarely over four inches in diameter at breast-height and forty feet high. Towards the southern boundary of this type, occasional large ridges occur, showing a mixture of aspen and spruce on their northern slopes.

SPRUCE TYPE.

This type is taken to comprise those areas where commercial spruce is found as the predominant tree. It is at present confined to small scattered patches, remnants of stands which formerly covered much larger areas.

Two main variations of this type occur, namely, spruce-poplar, and spruce-cottonwood.

The spruce-poplar type consists of white spruce with an admixture of aspen and balsam poplar. It occurs mainly on well-drained uplands or slopes. The run of the timber varies as to proportion of spruce to poplar. The spruce is generally limby, not averaging one log clear. The average height varies from 85 to 105 feet, according to the site. The diameters run up to forty eight inches, but the average will be about fourteen inches. In this type is found the best development of aspen poplar. Specimens were found in this type two feet in diameter and 100 feet high, with 75 feet clear. Trees of this size, however, are always very defective from heart-rot (*Polyporus igniarius*).

The spruce-cottonwood type occurs principally on lower levels, on overflow lands, in creek valleys, or occasionally on the lower slopes of hills. In these last localities there is generally a transition to the spruce-poplar type. The timber is generally large in the spruce-cottonwood type, but the stand is more open and the trees more limby. Sample areas taken showed timber running over 30,000 feet per acre. The height-growth of spruce will average higher than in the spruce-poplar type as will also the diameters.

In this type we have cottonwood occurring in transition to pure cottonwood stands as dealt with above. Trees of this species occur frequently overtopping the spruce, with a height-growth of 110 feet. In general, however, the percentage of defect is great.

These spruce types are remnants of a former forest. Both show a majority of the trees mature or over-mature. Depreciation in value is occurring every year, so that a thinning out is urgently needed. If this were done younger suppressed growth would be given a chance.

FIRES.

Of the total area of land examined last season, 14 per cent, or 900 square miles, has been fire-swept within the last twenty-five years. Of this area 85 per cent is either muskeg country or a type containing a large percentage of muskeg. The

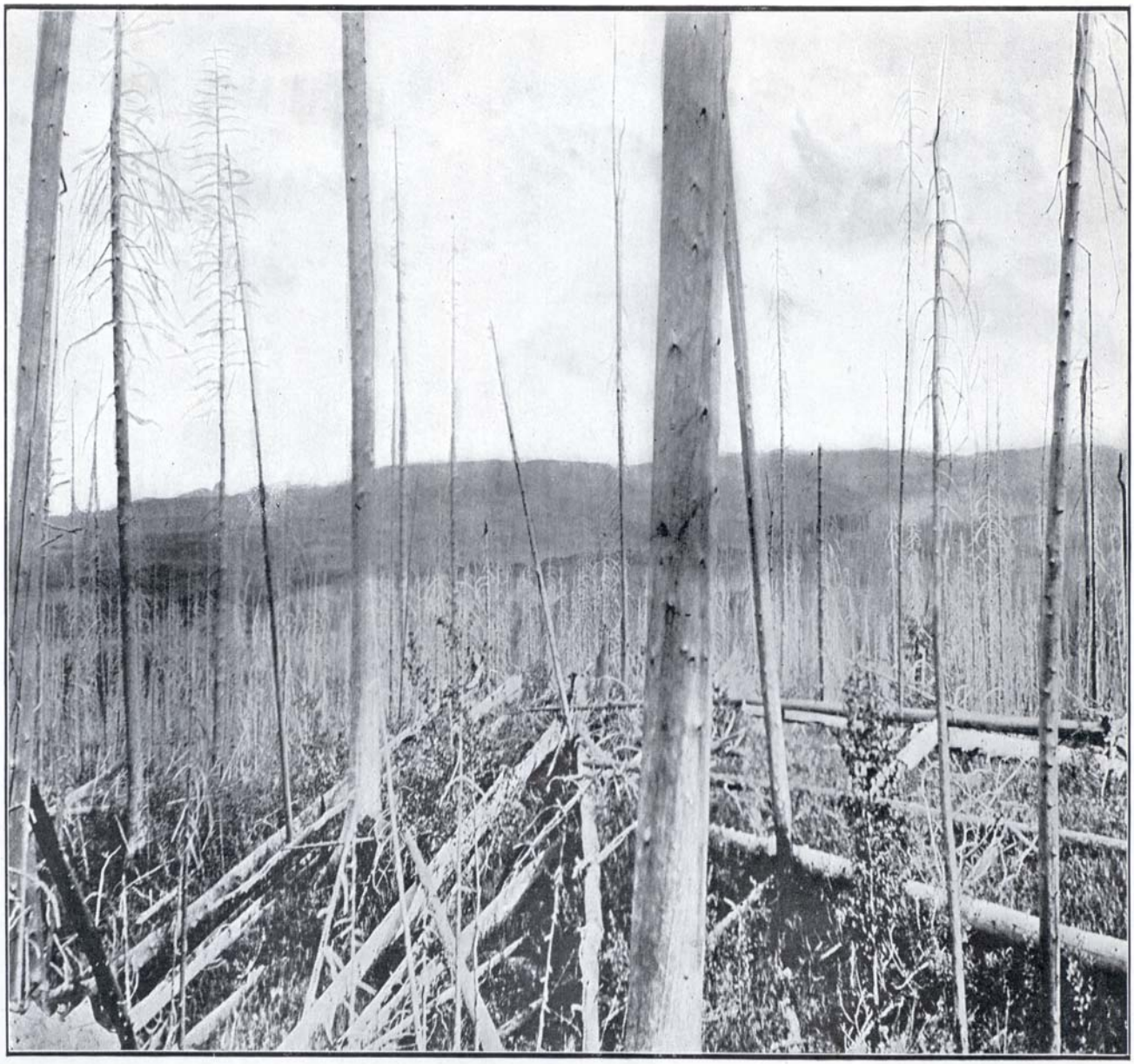

PLATE 6.—Big Brulé at Head-waters of Assineau River.

Photo D. Roy Cameron, 1911.

exception is the burned-over area south of Lesser Slave lake in the northern foothills of the Swan hills. This fire burnt mostly spruce and poplar.

As a general rule it may be stated that the poplar country has either escaped or resisted fire almost entirely. This is no doubt due to the fact that the debris and humus accumulations are less inflammable than those forming the litter of a coniferous forest.

The prevalence of fire in the muskeg is probably an exception to the general rule. This is due to two main factors. In the case of pure muskeg such as occurs in the Lesser Slave River valley it is the result of successive fires occurring with such frequency that finally all has been burned. In the case of country which is only partly muskeg, the susceptibility to fire may be accounted for by the presence of numerous small ridges of jack pine and lodgepole pine, which serve as points for the concentration and subsequent diffusion of the flames.

The areas burnt are divisible into five parts:—

1. Lesser Slave River valley.
2. East of Martin mountain.
3. Narrows creek.
4. Northern shield of Swan hills.
5. Miscellaneous small fires.

THE LESSER SLAVE RIVER VALLEY.

The Lesser Slave River valley is the long established route to the Peace river country. Hence it has suffered, naturally, from successive fires for a great many years. At the present time it is practically destitute of green timber of any kind. Fortunately for the surrounding hill country, the Lesser Slave river flows through the centre of a vast muskeg, which stretches on either side three to five miles, so that fires have not been able to penetrate far into the hills.

Within the last twenty-five years fires have burnt an area of over 300 square miles in this district, but not much merchantable timber has been destroyed.

COUNTRY EAST OF MARTIN MOUNTAIN.

This region includes the district forming the head-waters of the Driftpile river, and the country lying north of Moose lake towards the foothills of Pelican mountain. These areas are similar in character, and have been burnt at approximately the same time.

They are, however, separated by a green tract five to ten miles wide. Both belong to the height-of-land type explained above; therefore, no very valuable timber has been destroyed. The principal effect of fire here is its detrimental effect on water-flow. The head-waters country of the Driftpile river has an area of approximately 110 square miles burnt. The burn lying north of Moose lake covers some 120 square miles.

NARROWS CREEK.

The country lying north of The Narrows comprises, first, a low range of poplar hills, and then a large area of flat muskeg country. The latter is practically all burnt, the only exception being places where the ground was too wet for fire to run. Some ninety square miles were mapped in as being burnt here, and undoubtedly a much larger area to the north, which is of the same type, has also been fire-swept. No valuable timber was destroyed here.

NORTHERN SHIELD OF SWAN HILLS.

Fifteen years ago settlers clearing land in the Swan River valley started a fire which swept eastward over fifty miles, with varying widths of from two to six miles. Again two years ago a fire starting at practically the same spot swept the same area, destroying the remnants left of the former stand, and the reproduction which had just gained a foothold. The country thus ravaged comprises that region spoken of before as the northern face, or 'shield,' of the Swan Hills. It was covered formerly with a magnificent stand of spruce and lodgepole pine. Now it is a blackened ruin, treeless and in many cases soilless, a monument of man's recklessness.

Photo D. Roy Cameron, 1911.

PLATE 7.—Big Brulé, Swan Creek Valley.

In this region I have estimated that some 140 square miles of country have been fire-swept. Of this, an area of some 110 square miles, or 70,000 acres approximately, were spruce. Remnants left average from ten to twenty-five thousand feet, board measure, per acre. Putting the average run over this area as five thousand feet, board measure, per acre, 350,000,000 feet of merchantable timber must have been destroyed. These two fires have destroyed enough timber to supply the needs of a large community for a great many years.

The head-waters of the Otauwau show another fire slightly older. This occurred some twenty-five years ago. It burnt about forty-five square miles of lodgepole pine, jack pine, black spruce and poplar.

Several areas have been burnt along the Klondyke trail. The largest is along Deep creek where ten square miles along the creek were burned over about fifteen years ago. A burn of about the same size was noted near the head-waters of the Swan river. This is conspicuous because it is the only burn in a very large area of country.

In the Martin mountain district there is a new burn in the summit-plateau type, covering some seven square miles, and another east of Divide lake around the head-waters of the east branch of Martin creek, which has burnt over about six square miles.

REPRODUCTION.

The burned areas in general show little sign of good reproduction. This is due to the fact that most of the fires have occurred within the last few years. It is a well-known fact that muskeg areas are a long time in restocking. As most of the country burnt is of this type it may be expected that the new growth will be slow in coming. At present these areas are for the most part destitute of reproduction of any kind.

The spruce tract south of the lake which was burnt fifteen years ago had restocked well, but the second fire has exterminated the second growth and totally destroyed the

soil, so that it is doubtful if another growth can secure a footing for many years. The outlook for another spruce crop at any rate is very poor.

The burn in the Otauwau head-waters country is practically the only one where the forest cover is complete and a new crop well started. In that district there is a thrifty young growth of lodgepole pine, jack pine and poplar.

Along the Klondyke trail near Deep creek good reproduction of lodgepole pine is seen, and in the burn in township 65, ranges 6 and 7, west of the 5th Dominion meridian.

The spruce remnants are interesting as showing the natural course of reproduction of the climax types where fire has not disturbed the rotation. In such localities we find that the reproduction under the spruce itself is 90 per cent balsam fir. This is due to two factors; first, to the fact that the fir seeds will germinate and obtain nourishment on ground so covered with litter that the mineral soil is nowhere exposed, whereas the spruce will not, and, second, to the greater tolerancy of the fir. The relation of these factors to the conditions found is evidenced by the fact that where localities are encountered where wind-throw has occurred, in the resulting second growth spruce predominates. Here the sun has had a chance to effect the decomposition of most of the litter and to provide light—conditions suitable for the growth of spruce.

REPORT ON COUNTRY EXAMINED BY DISTRICTS.

MOOSE LAKE.

This district is taken as being bounded on the north and east by the limit of survey, on the south by the Athabaska river, and on the west by a line drawn from the west end of Moose lake to Mirror landing. Moose lake divides this district into two parts, northern and southern.

SOUTHERN.

The southern section is generally gently rolling agricultural land interspersed with scattered sloughs and small muskeg; 50 per cent of this country has been burnt within the last ten years. Timber where left intact is generally poplar, both aspen and balsam poplar, in the proportion of 60 to 40 per cent, with a few scattered large but very limby spruce. Occasional gravelly ridges carry jack pine of pole size. With the exception of a few scattered remnants along the south shore of the lake there is no timber of any consequence between Moose lake and the Athabaska river.

Areas along the lake will total 2·1 million feet. They are situated about one mile back from the lake. They can be taken out via Moose lake and Moose river in high water to Lesser Slave river.

An area of spruce of pole size or better is seen in section 5, township 72, range 26, west of the fourth Dominion meridian. This area is about half a mile square. It contains 16,000 ties and 320,000 feet, board measure, of saw timber. This is a promising young stand, and valuable from its proximity to the Athabaska river, which is only three miles south. In Section 23, Township 73, Range 1, west of the fifth Dominion meridian, is a small patch of spruce about forty acres in area, which will run ten thousand feet, board measure, per acre or 400,000 feet, board measure, in all.

NORTHERN.

There is no agricultural land of any consequence north of Moose lake for many miles. The country consists of numerous ridges of boulder-clay and gravel, with muskegs between. Most of these hummocky ridges are bare from numerous fires. Altogether this land is in very bad condition. If not soon taken care of, reforestation, for a hundred years at least, will be impossible.

This region is composed entirely of the height-of-land type, excepting for a narrow strip of poplar along the north shore of Moose lake. Farther west toward the Driftwood River divide, and extending many miles north, is an unburned area of the same height-of-land type. The Driftwood River watershed is over 50 per cent burnt. The transition from the valley proper to the surrounding general level is very gradual. The valley is wide and very shallow and floored with muskeg and scattered pine ridges.

The height-of-land type surrounds this watershed on three sides, extending to the west to the rougher Martin Mountain country which rises from the general level by low ridges. Only two patches of timber occur in this region, one at the extreme east end of Moose lake and one about two miles northwest from the west end of the lake.

The former area is some two miles long by one quarter of a mile wide. There are, therefore, some 320 acres, which will run five thousand feet, board measure, per acre of small spruce, or 1,600,000 feet board measure, in all. The second area is small, some forty acres only. This runs 10,000 feet, board measure, per acre, or 400,000 feet, board measure, in all. This timber can be easily hauled to Moose lake and driven down Moose river to the Lesser Slave river.

TABULAR STATEMENT OF TIMBER.

Type	Area.	Average per Acre.			Totals for District.		
		Ties.	Cord-wood.	Timber.	Ties.	Pulp-wood.	Timber.
	Acres.	Pieces.	Cords.	Ft. B.M.	Pieces.	Cords.	Ft. B.M.
Poplar	60,000		7·2			432,000	
Jack Pine	105			20,000			2,100,000
Spruce	320	50		1,000	16,000		320,000
	320			5,000			1,600,000
	40			10,000			400,000
	40			10,000			400,000
					16,000	432,000	4,820,000

LESSER SLAVE RIVER VALLEY DISTRICT.

This district is taken to comprise those lands which are bounded on the west by Lesser Slave lake, on the north by the foot-hills of Martin mountain and on the east by a line drawn from the west end of Moose lake to Mirror landing, and on the south by the southern limit of the great valley muskeg, that is to say, the beginnings of the foot-hills of the Swan Hills country.

This whole district is flat, and consists entirely of muskeg except for a narrow strip along the lower Lesser Slave river. In the muskeg are included small ridges of jack pine or poplar, mostly, however, burnt.

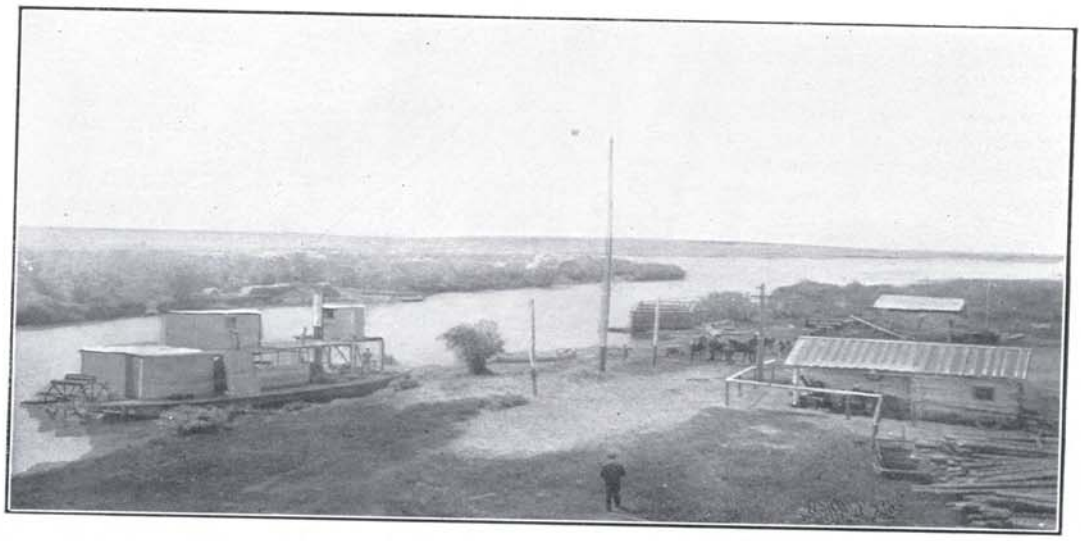

Photo F. McVickar, 1911.

PLATE 8.—Sawridge, Alta. (East End of Lesser Slave Lake).

At the east end of Lesser Slave lake there are some nine square miles of valuable meadow or prairie land. This area was once muskeg or willow swales, which repeated fires have transformed into prairie. A couple of scattered patches of merchantable timber occur in this district. There is a ridge about two miles long by half a mile wide, some three miles southwest from Mirror landing, which contains scattered spruce and poplar. There will be altogether about fifteen million feet, board measure, here. This timber can be hauled in winter over the muskeg either to Mirror landing or to the Athabaska river two miles east.

There is also a small patch of tie timber about one mile southwest from Mirror landing. This has only 5,000 ties, but it is so convenient that it is valuable.

Small scattered areas of spruce occur in flats formed by bends of Lesser Slave river along the lower fifteen miles of its course. These will total 100 acres, averaging 10,000 feet, board measure, per acre, or 1,000,000 feet, board measure, in all.

TABULAR STATEMENT OF TIMBER.

Type.	Area.	Average per Acre.			Totals for District.		
		Ties.	Cord-wood.	Timber.	Ties.	Pulp-wood.	Timber.
	Acres.	Pieces.	Cords.	Ft. B.M.	Pieces.	Cords.	Ft. B.M.
Jack Pine	100	50	.....	.....	5,000	.....	.....
Spruce	100	.....	.....	10,000	.....	.....	1,000,000
	750	.....	.....	2,000	.....	.....	1,500,000
					5,000	.....	2,500,000

MARTIN MOUNTAIN.

This natural district is bounded on the north by the northern edge of the high land forming the Martin Mountain elevation, approximately half-way up township tier 77. It is bounded on the east by the Driftwood river valley, on the south by the Lesser Slave River valley, and on the west by a line drawn north from the mouth of Martin creek.

The district includes the Martin Mountain plateau proper and the lower spur-ridges surrounding it. The plateau proper is in the shape of a triangle whose base extends from Martin creek on the west to the west branch of Muskeg creek on the east. The Martin Creek valley forms the west side, and a line northerly from the west branch of Muskeg creek to Divide lake in township 76, range 4, west of the fifth Dominion meridian forms the east side. This country has an average elevation of about 800 to 1,000 feet above Lesser Slave lake. It is broken by steep, deep, creek-valleys, running mostly into Martin creek.

The edge of this plateau country is distinct on three sides, on the north, south and west. On the east it descends more gradually into the height-of-land type of country forming the head-waters of Driftwood river.

Martin creek divides into two branches about fifteen miles from its mouth. Of these, the north branch has its origin in Divide lake, in the northwest corner of township 76, range 4, west of the fifth Dominion meridian. This lake also drains north into the Wabiskaw waters. The south branch drains the northern end of the plateau. Fringing this main elevation are subsidiary ridges, especially on the north and southeast. Those to the north form the north side of the valley of Martin creek, and those to the southeast form the north side of the Lesser Slave river valley. The latter extend from the west branch of Muskeg creek eastward to the Driftwood river.

The agricultural land north of Saulteux landing mentioned before is included in this district. This patch of good land is about eight miles long by three wide. It consists of gently rolling country, covered with poplar from four to fourteen inches in diameter at breast-height, with scattered older spruce. A low ridge near the northern end bears thicker patches of scattered spruce, about one million feet in all. The soil is a rich clay loam, with a few gravelly ridges and scattered sloughs, the latter well adapted for hay meadows, if drained.

This country is much better farm land than that surveyed along the Lesser Slave river, but is, unfortunately, cut off from all access to the government roads and river transportation by five miles of very bad muskeg. To the north of this region of agricultural land is a tract of non-agricultural poplar country stretching from three to five miles farther north. It extends from the west branch of Muskeg creek to the Driftwood river valley. The soil is stony boulder-clay. The poplar is small and badly defective; scattered spruce occurs along creek gulches, &c. No spruce reproduction occurs under the poplar here, largely owing to the depth of humus, which here averages six inches.

Towards the east end of this region, areas of jack and lodgepole pine, mixed with black spruce, occur. There is a transition to the height-of-land type which floors the Driftwood river valley.

The first rise from the lake towards Martin mountain occurs at a distance of about two miles back from the lake. This increases towards the east. There are two to three miles of side-hill, gentle at first and steepening towards the top. This land is non-agricultural, covered with a dense stand of poplar in which are interspersed scattered spruce.

The poplar is in most places a temporary type, but on some of the more gravelly ridges has evidently been established through several rotations. In general, however, with proper treatment, the whole south slope of Martin mountain could be reforested with spruce.

The bench-lands lying between the lake and the mountain slopes from Martin creek to the west branch of Muskeg creek are in general suitable for agriculture. This tract is about fifteen miles long by three miles wide. It is covered with a heavy stand of poplar and scattered spruce. The former are badly diseased from *Polyporus igniarius*, over seventy per cent of the stand being affected. The soil is a clay loam with scattered small muskegs and willow sloughs.

This land will undoubtedly be farmed some day, but it is improbable that it will be settled for many years to come, on account of the heavy clearing necessary.

The northern slopes of the plateau proper which form the south side of Martin creek valley, and all the subsidiary ridges north of Martin creek, are clothed with poplar from four to ten inches in diameter at breast-height, badly diseased. The latter ridges slope on the north gradually down to the height-of-land country forming the head-waters of the Wabiskaw watershed.

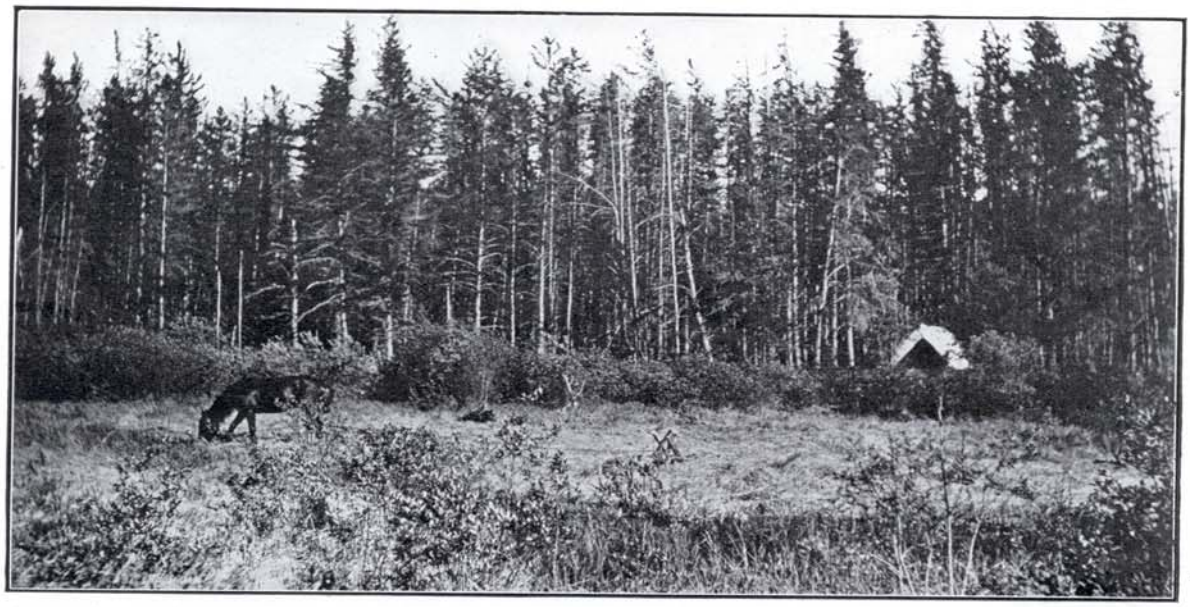

Photo D. Roy Cameron, 1911.

PLATE 9.—Jack Pine Ridge. (Tp. 73, Rg. 2, W5M.)

The west branch of Muskeg creek, just above where it enters the muskeg, has about two square miles of prairie. This is so isolated, however, as to be of little value at present. Another patch of semi-prairie is found at the mouth of Martin creek, about one square mile in all. This is a fine situation for a ranger's headquarters.

The summit type of the Martin Mountain country is the summit-plateau type described before. A fire at the head of a small creek flowing into Martin creek has swept over about seven square miles of this type.

The hills between the south fork of Martin creek and Divide lake have been burnt over, an area of about six square miles.

Several areas of good spruce occur in this district. There are two along the lake shore. The first is in or near sections 6 and 7, township 74, range 5, west of the fifth meridian. Here there are about 500 acres which will average twelve thousand feet, board measure, per acre, or 6,000,000 feet, board measure. The timber is generally of small diameter, ten to fifteen inches, but the stand is very thick and the trees tall and clear. This area is only about three quarters of a mile from the lake.

The timber can therefore be easily hauled to the shore and rafted from there to any desired point. This timber is mostly growing well yet, and will not deteriorate if allowed to remain untouched.

About twenty acres of poorer pole stuff fronting on the lake have been cut during the past few years to meet local requirements.

Another area is to be found about two and a half miles farther up the lake, on or near sections 23 and 24 of township 74, range 6, west of the fifth Dominion meridian. There are about 800 acres of small timber-size spruce which will cut about eight thousand feet, board measure, per acre; so that there will be approximately 6,400,000 feet, board measure, of spruce in this area.

This timber lies within half a mile of the lake shore and is therefore easily accessible. These two areas should be sufficient to supply the wants of the settlers around Sawridge for a few years. It is important, therefore, that they be conserved from trespass or fire.

In or near section 34, township 73, range 5, west of the fifth Dominion meridian, on the river muskeg is an alder swamp with scattered black spruce, ten to thirteen inches in diameter at breast-height, which will run about one thousand feet, board measure, per acre. There are about 300 acres, or 300,000 feet, board measure, of small timber here. At the border of the muskeg just east of the east branch of Muskeg creek is another area of about two square miles of tamarack and black spruce, which will run to twenty five ties per acre, or about 30,000 in all.

North of Saulteux landing, in or about section 21, township 73, range 2, west of the fifth Dominion meridian, is another tamarack area about a mile long by half a mile wide, which will run 100 ties to the acre, or 32,000 in all.

Three miles north of this area in or near section 33, township 73, range 2, west of the fifth Dominion meridian, is another small area of 100 acres of tamarack and spruce, containing some 5,000 ties or fifty to the acre.

About five miles up Martin creek is a tract of jack pine country covering about ten square miles. This will average twenty five ties to the acre. There will be, therefore, some 160,000 ties here. These can be driven down Martin creek in high water, if the few log-jams in the creek are cleared out.

Bordering this jack pine country on the southwest is a brulé about ten years old. This covers an area of four square miles. The area burnt was formerly jack pine, with some poplar on the southern side. Reproduction of poplar about ten years and jack pine about four years of age is coming up thickly throughout the burn.

TABULAR STATEMENT OF TIMBER.

Type.	Area.	Average per acre.			Totals for District.		
		Ties.	Cordwood	Timber.	Ties.	Pulpwood	Timber.
	Acres.	Pieces.	Cords.	Ft. B. M.	Pieces.	Cords	Ft. B. M.
Poplar	194,000		7·2			13,968,000	
Jack Pine	6,400	25			160,000		
Tamarack and Black Spruce	300			1,000			300,000
	1,280	25			30,000		
	320	100			32,000		
	100	50			5,000		
White Spruce	500			12,000			6,000,000
	800			8,000			6,400,000
Lodgepole Pine, Black Spruce, Balsam Fir	32,000		10			320,000	
					227,000	14,288,000	12,700,000

THE NARROWS.

This district is bounded on the north and west by the limit of survey, on the east by Martin mountain district, and on the south by Lesser Slave lake. Low ridges of boulder-clay lie immediately behind the lake and extend back from five to fifteen miles. These ridges run from northeast to southwest. Between them are the branches of two creeks, the East and West Narrows creeks. These drain a large area of height-of-land and muskeg country lying behind the shore ridges.

There is no agricultural land in this district, except for a narrow strip of willow lands one half mile to one mile, and hay meadows along the shore, and about a square mile of hay meadow at the forks of West Narrows creek about five miles from its mouth. The soil of the ridges is gravel or sand. Muskegs, as usual, are underlain by boulder-clay, which also appears as ridges in the height-of-land country.

Three main types occur in this district:—

1. Poplar.
2. Height-of-land type.
3. Muskeg.

The poplar is confined to the low sandy ridges between the creeks. It is interspersed with numerous willow bottoms or small muskegs.

The poplar here has in mixture lodgepole pine and spruce up to eight per cent. The latter species fringe the sloughs and muskegs, but nowhere occur in any quantity. There are about 160 square miles of this country in all.

The height-of-land country is an extension of the Wabiskaw country which, sweeping around the west end of Martin mountain in a belt about four miles wide, reaches the lake shore just west of Martin creek.

The muskeg country lies behind the ridges mentioned before. A narrow burnt strip some three miles wide extends southwest twelve miles down the east branch of West Narrows creek from the main muskeg. Of the main tract, some 100 square miles of the eastern half is burnt. This burn extends far into the north beyond the patch examined.

The western side of this district is bounded by unburnt muskeg, which probably reaches the lake shore about fifteen miles west of the Narrows.

Merchantable timber is very scarce, three small areas comprising the whole in this district. Of these, two are along the lake shore, and the third one, on the ridge between East and West Narrows creek, about five miles back from the lake, is situated near section 20, township 26, range 8, west of the 5th meridian.

The shore areas are to be found about six miles east of The Narrows. They occur as narrow strips along the lake shore, forming a fringe to semi-muskeg behind. There are two small tracts, some 55 acres in all, containing 220,000 feet, board measure, or 4,000 feet, board measure, per acre. This timber is small spruce mixed with tamarack just above tie size. The inland tract in section 20, township 26, range 8, west of the 5th meridian, is also small stuff, but heavier than that along the lake shore. It will run 6,000 feet, board measure, per acre. There are about 250 acres in all, or 1,500,000 feet, board measure.

TABULAR STATEMENT OF TIMBER.

Type.	Area.	Average per Acre.			Totals for District.		
		Ties.	Cordwood	Timber.	Ties.	Pulpwood	Timber.
	Acres.	Pieces.	Cords.	Ft. B. M.	Pieces.	Cords.	Ft. B. M.
Poplar	102,000	.....	7·2	.....	.....	734,400	.....
Spruce	250	.....	.....	6,000	.....	.....	1,500,000
Spruce and Tamarack	55	.....	.....	4,000	.....	.....	220,000
					.....	734,400	1,720,000

OTAUWAU RIVER DISTRICT.

This district is bounded on the north and east by the south and west limits of the great Lesser Slave River muskegs, on the south approximately by township tier 69, on the west by the eastern limit of the Swan Hills plateau proper and the Prairie Creek divide.

This district comprises the northeastern foot-hills of the Swan Hills. The elevation, therefore, increases towards the southwest. The Otauwau river drains almost the entire district. An unimportant branch of the Saulteux drains a small poplar area to the southeast, and Jackpine and Meetsu creeks on the north.

Photo F. McVickar, 1911.

PLATE 10.— Boulder-clay Ridge, Otauwau Trail.

The Otauwau River valley is steep and broken, being only four miles wide and from 500 to 1,000 feet deep. Between its branches are high ridges of boulder-clay, gravel or sand. No agricultural land occurs within the boundaries of this district.

Jack pine creek has its origin in a large basin surrounded by high hills. The basin is floored with hummocks of boulder-clay separated by muskegs.

Three main types of timber are to be found in this district:—

1. Poplar.
2. Spruce.
3. Pine.

Poplar country bounds this district to the north and east. The hummocks in the head-waters country of Jack Pine creek (Brown Valley), are clothed with reproduction to pole stuff of poplar, birch and jack pine. Underneath this is good reproduction of white spruce. There are some twenty three square miles of this type. North of the big brulé of 1910 from Meetsu creek to the Otauwau river is an area of some twenty four square miles of mature poplar country composed of trees eight to fourteen inches in diameter with good spruce reproduction underneath. East of the Otauwau river surrounding the timber ridge is another area of forty five square miles of poplar reproduction ten to fifteen years of age, with scattered pole stuff throughout, remnants of a former fire.

The inside boundary of these poplar areas is formed by the great brulé caused by the fire of 1910, which came from the Swan River valley. This fire entered the district at Florida lake near the centre of the west side of township 71, range 5, west

of the 5th meridian. The brulé crosses this township with a width of one to two miles. Then it turns south and crosses the west half of township 71, range 4, west of the 5th meridian. A narrow strip along the Otauwau river extends to the great muskeg. Southward from township 71, range 4, west of the 5th meridian, it extends in a branch about three miles wide diagonally across the township named and ends in the northwest corner of township 69, range 3, west of the 5th meridian.

The timber burnt by this fire was, on the south and west, mostly pine, and, on the north and east poplar and spruce tracts which had survived former fires. The area burnt in this district is approximately fifty square miles, of which 25 per cent was good timber.

South and west of the big brulé the timber is mostly pine, both lodgepole and jack pine, the former predominating. In this region two types may be distinguished. The northern part is a high plateau country broken by steep narrow ravines and containing numerous muskegs. The soil is stony, gravelly, or sandy. The timber is mostly reproduction of lodgepole pine, jack pine, poplar and spruce, twenty years old. This type covers some forty five square miles.

South of this is an area of some thirty square miles of the same nature, but covered with pole stuff instead of reproduction. Under this pole stand is good young reproduction.

Several patches of good spruce occur in this district. The most important is situated mostly in the southwest part of township 71, range 3, west of the 5th meridian. This timber is on a wide ridge, forming the divide between the Otauwau and Saulteux rivers. This ridge slopes from the Saulteux muskeg up about 300 feet in one to one and a half miles. On the top is a plateau one to two miles wide, followed by a gradual descent to the Otauwau. The timber is in the shape of a triangle with a base of four miles and sides of three and a half to four miles, the longest side extending east and west on the south side. Within the limits of the timber patch two creeks descend from the plateau to the muskeg on the east side. The gorges of these creeks cut into the plateau half a mile beyond the general edge. The southern we called Notch creek, and the northern, Spruce creek. One creek flows westerly to the Otauwau. This we called Lodgepole creek because a few scattered lodgepole pine were found near its source. Spruce creek and Lodgepole creek have their common origin in a small muskeg on the plateau.

Three main types of timber are found in this tract, viz., heavy, medium and light. The heavy timber runs fifteen thousand feet, board measure, per acre. It is confined to a patch of 1·85 square miles, lying in the east slope and between the valleys of Notch and Spruce creeks.

This timber is generally of large size, in fairly open stand of white spruce and cottonwood. The trees are limby. They will not average one log clear, but have great height and cylindrical shape. There is approximately 17,700,000 feet there.

West of this on the plateau is lighter forest growth, comprising white and black spruce, poplar and tamarack with small muskeg patches. This timber will average five thousand feet, board measure, per acre. It covers practically the whole of the plateau and descends to the muskeg down the east slope north of Spruce creek. It also comes down the hill south of Notch creek in a narrow band at the southern extremity of the tract.

In the southwest corner a long, narrow spur follows the crest of the ridge one and a half miles beyond the main tract. There are, roughly, 4·66 square miles of this type, or 14,900,000 feet in all.

North of Lodgepole creek is an area along the upper western slopes of the ridge which consists of better timber than the plateau type. This runs ten thousand feet, board measure, over one square mile, or about 6,400,000 feet in all. This timber is white and black spruce and poplar.

Just at the edge of the great muskeg between Notch and Spruce creeks below the timber ridge is a narrow belt of tamarack, about twenty-five acres in all. This will run forty ties per acre, or 1,000 ties in all.