



PLATE I.—Rocky Mountain Forest Reserve—Lodgepole pine along Oldman river.

[Photo A. Knechtel, 1909.]

# FORESTRY

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No. 1.

## REPORT OF THE SUPERINTENDENT OF FORESTRY.

DEPARTMENT OF THE INTERIOR.

FORESTRY BRANCH,

OTTAWA, MAY 1, 1911.

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

SIR,—I have the honour to submit the report of the work of the Forestry and Irrigation Branch for the year 1910-11, and also the reports of the officials in charge of the different divisions.

### STAFF.

Mr. H. C. Wallin, a graduate of the Swedish School of Forestry at Stockholm; Mr. G. H. Edgecombe, a graduate of the School of Forestry of the University of Toronto; Mr. P. Z. Caverhill, a graduate of the Forest School of the University of New Brunswick; and Mr. G. A. Cromie, a graduate of the Yale Forest School, were appointed on the staff of foresters at the beginning of the year. Unfortunately, owing to private reasons, Mr. Cromie has recently found it necessary to resign.

The administration of Dominion parks has been reorganized and the office of the Commissioner, Mr. Howard Douglas, has been removed to Edmonton. This location will be convenient for reaching all the parks and will be specially so in connection with Jasper park, which is in the initial stages of organization, and Buffalo park, where the large herd of buffalo owned by the Dominion government are kept. Mr. A. B. Macdonald was appointed to the position of superintendent of the Rocky Mountains park vacated by the transfer of Mr. Geo. Hunter to Yoho park.

Mr. John Stewart, commissioner of irrigation, submitted his resignation to take effect at the end of the fiscal year and Mr. F. H. Peters, C.E., has been appointed in his place. Mr. Peters is an honour graduate in engineering of the Royal Military College and has had considerable experience in engineering and water supply investigations. For the last two years he has had charge of water supply investigations on the St. Mary and Milk rivers which are the subject of treaty with the United States. Mr. P. M. Sauder is continued as chief of hydrographic surveys and will act as commissioner when Mr. Peters is absent from Calgary. Mr. R. J. Burley, who has had charge of inspections under the Irrigation Act in the Maple creek district is made divisional engineer for the Cypress Hills district and given charge of the inspections and water supply investigations in that watershed.

### PUBLICATIONS.

During the year the following additional bulletins were issued and have been widely distributed:—

- Bulletin No. 1 (4th edition) Tree planting on the prairies.  
 " " 9 Forest fires in Canada, 1909.  
 " " 10 The farmer's plantation.  
 " " 11 Forest products of Canada, 1909: Lumber, square timber,  
 lath and shingles.  
 " " 12 Forest products of Canada, 1909: Pulpwood.  
 " " 13 Forest products of Canada, 1909: Crossties purchased.  
 " " 14 Forest products of Canada, 1909: Poles  
 " " 15 Forest products of Canada, 1909: general.  
 " " 16 Forest fires and railways.

Successful tree planters. Letters of farmers in the provinces of Manitoba, Saskatchewan and Alberta regarding the planting of shelter belts, &c.  
 Irrigation Bulletin No. 1. Irrigation in Saskatchewan and Alberta.

The demand for literature on forestry and irrigation is rapidly increasing. The publications issued have been designed to meet this demand as indicated by inquiries addressed to the department and have been made popular in style.

Thirty thousand fire notices giving warning of the danger of fire, in English, French, German, Icelandic, Galician, Indian (Cree and Chipewyan), Norwegian, Russian, Hungarian, Hindu, Japanese and Chinese, were distributed and posted throughout the fire rangers' districts.

Two hundred thousand copies of a small pamphlet explaining the danger of fire, the chief provisions of the Fire Acts and the best methods of fighting fire, were distributed in English, French, Ruthenian, German, Norwegian, Hungarian, Swedish and Russian. This pamphlet is now being printed in several other languages.

There were also distributed 15,000 copies of bulletins on the planting and care of trees; 30,000 copies of a general bulletin showing the damage done by fires throughout Canada, and 20,000 copies of miscellaneous bulletins and reports, including the statistical reports of forest products.

#### STATISTICS.

The gathering of statistics of the wood products of Canada, begun in 1909, was continued during last year, and the statistics for the year 1909 have been published. The reports received for 1909 were more numerous than those for 1908 and the figures resulting are therefore a much nearer approximation to the actual product. The collection of statistics covering the year 1910 is at present under way, and as the reports are coming in more readily and quickly it is hoped to be able to publish the compiled statistics early in 1911. A summary of the results of this work is contained in the report of H. R. MacMillan, attached hereto.

#### TREE PLANTING ON FARMS.

The interest in the distribution of trees for planting on farms in the prairie country continues to increase. In 1910, 8,318 applications for trees were received, and 2,533,600 trees were distributed to 3,173 settlers. Owing to the increasing number of applications it has been necessary to cut down the number of trees supplied to each settler, and as the capacity of the present nursery station has almost been reached, it will be necessary to take steps immediately to increase the nursery accommodation.

A stock of coniferous trees having now been grown, it has been arranged that distribution should be made of them. As, however, it is impossible to provide a sufficiently large stock of conifers to supply all possible demands, and as the expense of growing them is considerable, it has been decided to make a charge of \$1 per hundred. Coniferous trees will not grow as easily as the deciduous species, and the

making of a charge for them will probably act as an incentive to greater care. A row of coniferous trees added to a shelter belt of deciduous trees will greatly increase its value as a windbreak, especially in winter.

#### TIMBER SURVEYS.

Owing to the expected early construction of the Hudson Bay railway it was considered necessary that an examination of the timber along the proposed route of the railway should be made. A party under the charge of Mr. J. R. Dickson was sent to make the inspection, starting from The Pas. This party covered the district from The Pas to Split lake, a distance of about 235 miles, and examined the timber for a distance averaging ten miles on either side of the proposed line. The route followed was by way of Metishto and Grass rivers on the northwest side of the proposed line of railway and return was made by Nelson and Pine rivers on the southeast side. The method was to run back lines for four to six miles on either side of the route of travel at intervals of three to six miles. As the stand of timber was generally uniform a large area could be covered in this way and sufficiently accurate information obtained in regard to the quantity available. The whole district is covered with a stand of timber, mainly spruce, but owing to fires and to slow growth in the undrained muskegs the quantity over eight inches in diameter at the stump was found to form but a small proportion of the stand. The approximate quantity available for railway construction purposes in the district examined is 361,300 railway ties and 9,424,000 feet B.M. of timber of sufficient size for lumber purposes.

The great area of timber in the district is a valuable asset and, if preserved from fire, there is no reason why it should not all reach maturity. The great conflagrations are evidently periodic and occur at long intervals, probably when a succession of two or three dry seasons follow one another. With such an extent of country practically uninhabited the only thing that can be done is to have a patrol of fire rangers following the route of travel regularly.

There is but little tamarack and jackpine timber in the district, what mature tamarack there is having been killed, apparently by insects. It will therefore be necessary in the construction of the railway to use spruce to a considerable extent both for timbers and ties. As spruce timber in contact with the earth is short-lived it seems that the necessities of the case would present an opportunity for trying some experiments in the preservative treatment of wood, and it is hoped that an arrangement can be made with the Department of Railways with the object of having such an experiment tried.

Later in the season Mr. Dickson made an inspection of the Bear Hills and Eagle Hills in the province of Saskatchewan south from Battleford. These tracts were found very suitable for the purposes of a timber reservation, but owing to the fact that a large proportion of the lands had already been disposed of it was finally decided that no reservation should be established.

Two survey parties were at work on the eastern slope of the Rocky Mountains with the object of determining the eastern boundary of the Forest Reserve proposed to be established. The parties started with the Elbow river as a base. I accompanied the parties to this point and made an inspection of the valley of the river with the heads of the parties so as to reach a determination on the ground of the general conditions on which the boundary line was to be fixed. The conclusion was reached that the line should be fixed at an elevation of about 4,000 feet above sea level, which would exclude all agricultural and nearly all grazing lands. Except for a few narrow valleys the lands above this point are broken, with steep slopes and frequent rocky outcrops until they finally merge into the grey rock of the mountain peaks above timber line, which reaches to a height of between 6,000 and 7,000 feet above sea level.

One party, under charge of Mr. G. H. Edgcombe, worked south and examined the territory from the Elbow river to the international boundary, a distance of about 130 miles. From the Elbow river for some distance south the foothills slope gradually to the prairie, but approaching the international boundary the mountains break abruptly into the plain. The timber is largely western jackpine, though there are stands of spruce and Douglas fir. The greater part of the district has been fire swept at some period in its history. The stand of mature timber is comparatively small but the reproduction, especially jackpine, is good.

The other party, under charge of Mr. P. Z. Caverhill, worked north and reached the North Saskatchewan river, a distance of about one hundred miles. This district is more difficult of access than the southern one, and owing to the greater extension of the foothills eastward required the examination of a wider territory. The timber is largely of the same type as that farther south, and has suffered from fire in the same way. The mature virgin stand does not exceed twenty-five per cent in the area examined.

It is proposed during the present year to continue the examination of the boundary of this reserve to its northern limit.

An examination of lands in timber berths in British Columbia which were patented or were shown by a survey made by H. G. Wheeler to be lands fitted for agricultural purposes was made in the coast district by Mr. H. C. Wallin and in the mountain district by Mr. G. A. Cromie. The instructions were to report on the timber on such lands and to determine what steps should be taken to make the lands available for the owners or for agricultural settlement. A large number of pieces of land were reported on, but final action on the reports has been suspended for the present.

Mr. J. T. Blackford, an experienced woodsman acquainted with conditions in the north, was appointed to explore, estimate and map the timber, and act as fire ranger in the district surrounding Oxford House.

Accompanying this report is a sketch map made by Mr. Blackford showing the districts which he traversed, and the location of the timbered and burned over areas. Mr. Blackford travelled south from Oxford House to Minnihik, Clearwater and Rat lakes, and north and east from Oxford House to Fox and Deer lakes, covering in all about 5,433 square miles of country.

About 1,612 square miles of this territory still bears merchantable timber; on about 3,821 square miles all the merchantable timber has been destroyed by fire.

There are abundant evidences that this whole country was originally heavily forested with spruce, tamarack, jackpine, balsam, birch and poplar. On the islands, which have been naturally protected from fire, are dense stands of trees two to three feet in diameter, and around some of the lakes are blackened stumps two to three feet in diameter.

A reliable Indian, between sixty-five and seventy years old, said that 'long ago there used to be lots of fine large timber. Every summer there have been fires more or less. Long ago (about 25 years) there was one terrible fire which ran for many days. We could not see the sun and the only way I could get my breath was by putting a piece of flannel over my mouth. This fire started at Robinson Portage and ran from that east to Oxford lake and west as far as Deer lake. Up to this time there were lots of fur and deer by thousands, but since then we have not had much fur, nor have I known one deer to be seen within three or four days journey from here. Before the fire we saw only an occasional moose, but now there are lots. \* \* \* \* Two summers ago we had large fires all around us. The Indians say that many of the fires started inland where there are no people, and that many of them are caused by York boat men. The big fire of twenty-five years ago was started by Indians working on a York boat.'

Hunters on their way to the winter hunting grounds are careless with their camp fires and are responsible for many forest fires. Mr. Blackford found that in this

district freighters and trappers are very careful. The Indians, carelessly leaving camp fires, start forest fires in the Oxford House district every season.

After fire has destroyed the original forest there is nearly always a dense second growth in which jackpine, poplar and birch occur in a greater proportion than in the original forest. This second growth would in fifty or sixty years produce a valuable forest if it were protected from fire. Unfortunately after the first fire there is always a residue of dry resinous wood, which together with the inflammable nature of the young growth itself renders a second fire almost inevitable.

Travelling between Fox lake and Norway House, Mr. Blackford found that day after day he had to cut his way through fire killed timber. Fires are driven with such fury in this country that even the rivers are insufficient to stop them. A fire which occurred three or four years ago burned both sides of the quite wide Fox river. Repeated fires destroy all seed trees, all seed and much or all of the rich upper layers of soil and render it impossible for another valuable forest to start naturally except after a long period of time. Mr. Blackford observed that this had been the case over large areas in the Oxford House district, that the whole country had been fire swept many times, chiefly within recent years, that the soil had been impoverished, that where there had been valuable stands of spruce and tamarack there was now nothing but willow, poplar, birch and scattered small spruce. Where fires had been exceptionally fierce or frequent the country was burned to prairie. Tamarack seems not to be coming in after fires, but where fires have not been frequent there is good natural reproduction of spruce and jackpine, the jackpine usually occurring on the ridges.

On several extensive trips Mr. Blackford never saw the limit of the burned area. Fires have evidently been much more frequent in the country tributary to the routes followed by the York boats than elsewhere.

The muskegs carry fire and have nearly all been burned over.

During the summer Mr. Blackford found no commercial timber of any quantity, but he states that except for fire, the whole country would be covered with timber two or three feet in diameter.

Around Knee lake, along Loaf river, around Nest lake, Mossy lake and God's lake, there is timber five to six inches in diameter, spruce, tamarack, poplar and balsam. On the islands in these lakes timber is two to three feet in diameter.

Around Oxford lake the timber is all of very recent growth.

On the shore of Minnihik lake where it has been naturally protected from fire is about 200 acres of the best timber in the country.

One small grove of timber near Rat lake contained spruce trees thirty-eight inches in diameter and eighty feet high. There were here 320 trees per acre over seven inches in diameter, and 844 trees over four inches in diameter. On a jackpine ridge there were 775 trees per acre over five inches in diameter. These small patches are typical of what the whole country would be if it had not been burned.

On the shore of Minnihik lake there is a strip of timber five miles long and three-quarters of a mile wide, containing trees from eight to twenty inches in diameter, and about seventy-five feet high.

For twenty miles northeast from Oxford House there is a strip of timber, mostly spruce with some jackpine and very little tamarack and balsam, averaging from eight to ten inches in diameter. Along the Deer river there has been good timber but it is all burned. Around Deer lake there is a belt of scrubby spruce twenty-five miles wide.

It has been represented by travellers following Fox river that the river flowed through timber. Mr. Blackford found only a vary narrow fringe of trees along the shores; behind these the country has all been burned. The Indians near Fox river say that as far as they have travelled in any direction the country is all burned. Between Oxford House and Norway House the timber is larger than any near or north of Oxford House. Unfortunately the best of it has been burned. There is much poplar along the waterways.

Mr. Blackford attended the council meetings of the Indians at God's lake and Oxford House. He explained that the government was sending out men to protect the forest from fire, and that it was to the interest of the Indians to prevent and extinguish all fires. The chief and councillors spoke in favour of the work and the Indians seemed during the summer afterward to have been very much impressed and to be acting more carefully than usual. The Hudson's Bay man in charge of the post at God's lake said early in 1911 that he did not know of a single fire started by the God's lake Indians in 1910. This was a most unusual record and he attributed it to the presence and influence of the Dominion fire ranger.

Mr. Blackford gave the boys at the Indian school at Oxford House a talk on fires and how they were to be prevented. He spoke also to headmen of the York boats, and had them promise to be more careful in the future.

The Indians throughout the district deplore the burning of the forest and feel very doubtful about their future should fires continue to destroy the forest and the game.

Mr. Blackford suggests that the Indians may be encouraged to be careful with camp fires if they are given a little badge to wear as Indian volunteer fire rangers. Badges have been supplied to the Indians in the Oxford House district.

Timber and game will, for a long time at least, be the chief products of the Oxford House district. There is but little of the territory fitted for agriculture, as there are so many ridges, muskegs, streams and lakes. It is, therefore, very important that the timber should be protected from fire.

Mr. J. T. G. Whyte, an experienced timber cruiser and fire ranger, was appointed in May, 1910, to make an inspection of the timber along the route of the Hudson Bay railway and to act as forest fire ranger.

Mr. Whyte was stationed near the Hudson's Bay Company post on Split lake, and explored the country south and east of Split lake. He travelled down the Nelson river to Gull lake and Buttneau lake, a distance of seventy miles, up the Nelson river to Manitou rapids, east from Split lake to and beyond the survey of the Hudson Bay railway, and west from Split lake to Assean lake, traversing a district of approximately 2,400 square miles. A sketch map of the country covered by Mr. Whyte accompanies this report.

This whole territory was originally covered with forest. Where the timber has been protected from fire, as on the islands in Split lake, the trees—spruce, tamarack and jackpine—are large enough to make good railway ties, poles and lumber. But except on the islands, the whole country has been overrun by fire, in a few districts once, in the majority of cases many times during the past forty or fifty years, and any timber now standing dates from the last fire and is therefore small.

Along the rivers and lakes fires have been very numerous. Mr. Whyte estimates that the shores of Split lake have been burned over on an average of once every season.

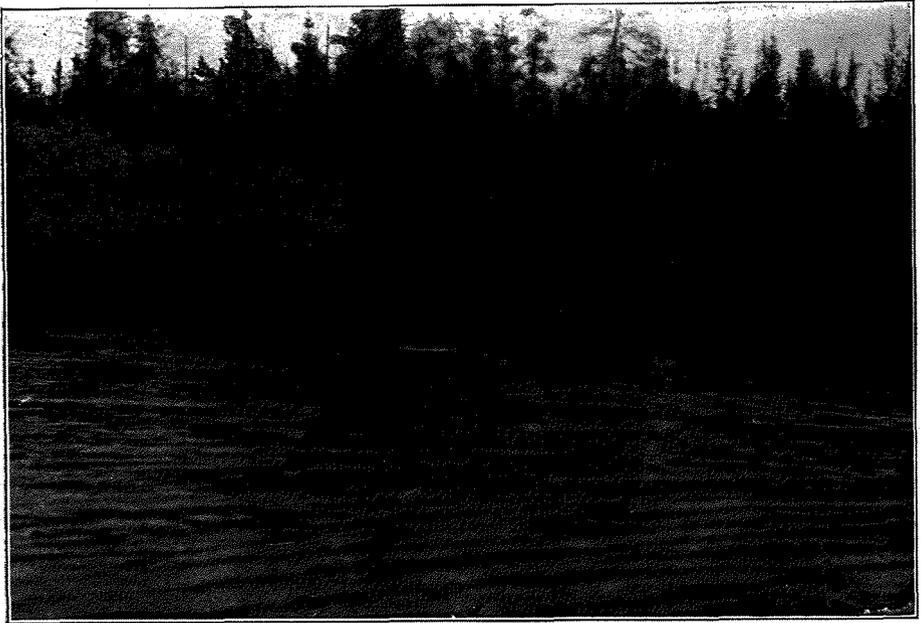
Mr. Whyte observed that the crews of the York boats travelling the waterways of this country do not completely extinguish their camp fires, and that the majority of the forest fires start from these camp fires. He saw one fire which was started by lightning. No fires escaped control in the Split lake district after Mr. Whyte arrived. There were reports of large fires near York factory and west of Nelson House.

Fires in this country are disastrous when they escape control. The timber is all resinous, the living trees are loaded with dry dead branches and moss, the green branches of the young conifers are very inflammable, there are large areas of old burns where the ground is thickly piled with fallen dead trees as dry as tinder, and excepting the streams and lakes, few of which are large enough to stop a raging fire, there are no natural barriers to prevent a widespread conflagration. In the dry seasons the upper layers of moss in the muskegs carry fire rapidly and keep it alive for weeks or months, as long as there is anything to burn.

Mr. Whyte mentions that the fire-killed timber in the Split lake region is not so badly affected by worms as it would be in the Ottawa valley.

Fortunately in this district the soil is deep, only a comparatively small proportion of the country consists of rock outcroppings, and there is always sufficient soil to support another crop of trees. The trees native to Split lake country—the spruce, jackpine, tamarack, balsam, poplar and birch—are very tenacious of their hold on the ground, and the jackpine, poplar and birch are particularly well adapted to reforest burned over land. Practically all the timber in the Split Lake region consists of trees which have come up after fires. Widespread fires have been so recent that but a small proportion of the forest cover reaches a diameter of four inches. The greater part of this territory is covered with young trees, the largest of which reach a diameter of three to four inches. The presence of merchantable forest in situations protected from fire, proves that the young forest now started will become sufficiently valuable to support sawmill and pulp industries and supply a large population if it can be protected from fire.

Mr. Whyte estimates that there is no timber between the Hudson's Bay post on Split lake and Manitou rapids large enough for railroad ties. All the timber around Manitou rapids has been burned. The territory crossed by the Ripple and Landing



[Photo J. R. Dickson, 1910.

PLATE 2.—Mixed Muskeg (Tamarack and Black Spruce), Mitishto river, N.W.T.

rivers has all been cleared by fire. About one-half of it is now covered with trees two and three inches in diameter. The country around Gull lake is mostly green, but the timber is all below three inches in diameter, excepting a narrow fringe of four inch spruce large enough for pulpwood which surrounds a few of the lakes. There is not enough of the pulpwood around the inland lakes between and near Split and Gull lakes to be of merchantable value. Around these lakes is not enough timber to make 500 railway ties. There is said to be on Kettle river enough timber for railway construction purposes.



PLATE 4.—Douglas Fir and Western Cedar in British Columbia.

[Photo A. Knechtel, 1910.]

## SQUARE TIMBER.

In addition to sawn timber which is scaled and reported upon as lumber, about 3,000,000 cubic feet of timber are cut each year for the export square timber trade. Practically all of this timber goes to England; one-half of it is white pine, one-third birch and the remainder chiefly red pine and elm. The export in 1909 was valued at almost \$1,000,000.

The square timber trade reached its height in 1877 and, owing chiefly to the disappearance of the supply of timber fit for squaring, has declined steadily since that date. The average white pine export for the decade 1871-1880 was about 15 times as great as it was in 1909; the export of oak was then 194 times what it was in 1909; the export of birch has kept up better, it was in 1909 nearly one-half as great as it was in the seventies. The export of elm has decreased largely; it is now only one-thirteenth as great as it was thirty years ago. The other timbers, red pine, ash and maple, are only exported to about one-tenth the quantity previously shipped.

## TANNING MATERIALS.

The only native vegetable tanning material in Canada is a forest product, hemlock bark. The value of the hemlock bark and the extract of hemlock bark placed on the market in 1909 was over \$1,000,000. About four-fifths of this was used at home, the remainder exported.

Canadian tanneries used in 1909 about 90,000 cords of hemlock bark, and about 2,250,000 pounds of extract of hemlock bark of a total value of over \$800,000. At one time tanneries in this country depended almost altogether upon hemlock, but owing to a variety of reasons, the decreasing supply of hemlock, the introduction of cheap foreign, chiefly tropical, vegetable tannins, and the multiplication of chemical processes of tanning, hemlock now represents by value only about three-fifths of the vegetable tannins used, and a much smaller proportion of all tannins, vegetable and chemical.

There were exported in 1909 about 20,000 cords of bark, worth \$120,000, and about 3,500,000 pounds of extract of hemlock bark, valued at \$80,000. The bark goes to the United States, the extract to Great Britain. This represents a great decrease from 1880 when the export of bark was 82,000 cords worth \$442,000, and 1883 when there were exported 20,000,000 pounds of extract valued at \$305,000. The exports of tannins from Canada are now less than two-sevenths as great as they were thirty years ago.

All the hemlock bark produced in Canada is not used. Though the bark of the British Columbia hemlock is richer in tannin than that of the eastern hemlock, it is all wasted; and it is estimated that at prevailing prices eastern hemlock bark is wasted to the extent of \$400,000 yearly.

## MISCELLANEOUS PRODUCTS.

In addition to the different classes of products enumerated above, enough material is taken from the forests of Canada each year to make up another \$1,000,000.

Nearly 100,000 cords of wood, worth over \$300,000, are used yearly by the destructive distillation plants manufacturing wood alcohol, acetate of lime and charcoal. Still more valuable is the maple sugar industry of the eastern provinces.

If the forests of Canada are administered for another three or four decades as they are administered at present it will be impossible for them to produce yearly such crops as that described above. No one can doubt this save those who do not know that our seemingly inexhaustible white pine forest has been so reduced that it now contains only thirty years supply at the present rate of cutting, that our valuable hardwoods have been cleared away to such an extent that we now import each year more hardwood lumber than we produce domestically, that our square timber exports are

only one-twelfth what they were thirty years ago, and that two-thirds of the original forests of Canada have already been destroyed by fires. Under the present system of exploitation the forests of Canada are decreasing steadily in area and in available products.

The decrease of the forest area of Canada, and the consequent decrease in available forest products is nothing short of a national calamity. It is not the purpose here to touch upon the favourable influences which the forest exerts upon climate and waterflow, indirect values which are recognized by every one, but to point out how indispensable is the forest as a crop producer.

The forests of Canada stand chiefly upon lands unfit for agriculture even in its most intensive form. They produce a crop valued at \$166,000,000 per year. The harvesting and first manufacture of this crop employs labour to the extent of \$100,000,000 yearly, and probably almost as much more is spent in turning out the more highly manufactured forms of wood products. In addition to supplying a large proportion of the population of Canada with their means of livelihood, the products of the forest are for the whole population the chief source of heat and shelter, are the most important raw materials for the factories, enter largely into the construction of nearly all articles of human use, and furnish one-sixth of the total export of Canada.

Unless the principles of forestry are adopted by those who are responsible for the administration of the forest lands of Canada there is nothing surer than that within a comparatively short period of years the forests of Canada will be so destroyed by fire and exploitation, heedless of the future, that not only will there be no surplus of forest products for export, but there will be an insufficiency of any grade of timber for the building of the homes, the carrying on of the works of the population in this country; and on the mountainous, rocky, sandy and other non-agricultural lands of this country where the forest stood there will be produced nothing. All the symptoms which have ever been met with in history previous to the destruction of the forests of any country now exist and daily increase in Canada.

Forestry seeks not only to prevent the destruction of the forests but to secure their improvement so that they will be in a position to produce each year, without any lowering of their value, even greater crops than they have yet produced under methods of exploitation. To secure this result forestry must achieve fire protection, prevention of waste in the logging, manufacture and use of lumber, and the reforestation of barren and cut-over lands.

#### FIRE PROTECTION.

The measures adopted to protect the forests from fire are now generally understood. They are the removal by education or legislation adequately enforced of the causes of fire, the organization of a patrol to find and extinguish such fires as will inevitably start, and the improvement and organization of the forest areas so as to render most efficient the efforts of fire fighters and to minimize the chances of any fire getting beyond control.

#### PREVENTION OF WASTE AND LOSS OF TIMBER.

One aim of forestry is to further the productivity of the forests by securing the most profitable use of all forest products. There is now a tremendous waste in the use of forest products, a waste which every year leads to the cutting of more than twice as much timber in the forest as ever comes into use. Investigations have not as yet been conducted in Canada to show what percentage of the merchantable timber cut in the forest is wasted, but in the United States, where conditions of logging, manufacture and utilization are similar to those in Canada, it has been found that from 10 per cent to 35 per cent of the merchantable timber is, as a rule, left in the

woods; that of the logs which reach the mill there is lost 49.1 per cent volume, and that after the lumber leaves the mills from 10 to 25 per cent of it is wasted before it is put into use. The waste in logging is due to—

1. Poorly conceived and poorly executed logging plans.
2. Failure to remove from the woods merchantable material which is actually cut.
3. Failure to cut and remove inferior trees, partly defective trees and inferior species which are merchantable.
4. Failure to remove small bodies of timber in comparatively inaccessible places on which the profit is low.
5. The removal of only one class of timber from the forest when others are present and merchantable.
6. Failure to utilize merchantable dead timber.
7. When inferior trees and inferior species are available, the use for construction work of valuable species and valuable trees which cannot be otherwise utilized at a later time.
8. Failure to use materials for the purposes to which they are best suited.
9. The cutting of trees for tan bark only, and waste of logs.
10. The cutting of unnecessarily high stumps.
11. Failure to utilize all of the merchantable material in tops suitable for saw timber or cordwood or other use.
12. Failure in requiring the proper variation in log lengths.
13. The non-use of odd and short log lengths.
14. Unnecessarily long trimming lengths.
15. Unnecessary breakage in felling and transportation.
16. Too great loss in driving.
17. Careless use of logging machinery, such as donkey engines.

All these causes given in the report of the National Conservation Commission as reasons for the great loss of timber in logging in the United States operate in Canada. On one operation on Dominion Lands in the Crownsnest Valley, Alberta, it has been noticed that the waste of timber per square mile was 366,400 lineal feet of mining props, and 480,000 board feet of saw material, or over 10 per cent of the total originally standing. In other districts this loss exceeds 30 per cent and even reaches 50 per cent.

On lands under forest management, it has been found possible to reduce the waste due to the causes enumerated above to less than 2 per cent. There is no loss in preventing this waste, but there is sometimes no profit except the profit which accrues to the country through securing the use of a natural product which would otherwise be lost.

The loss of timber in the manufacture of lumber is partly unavoidable and partly avoidable. The different sources of loss are:—

- (a) Loss due to kerf; 15.5 per cent.
- (b) Loss due to edging and trimming; 10 per cent.
- (c) Loss due to slabs; 10 per cent.
- (d) Loss due to careless manufacture and accident; 4 per cent.
- (e) Loss due to standardizing lengths and widths of boards; 2 per cent.

Much of this waste may be prevented by:—

1. The general adoption of thin saws, band saws and re-saws.
2. By the elimination of gang saws.
3. By manufacturing in round-edged or 'waney' form a large part of the lumber which is to be worked over.
4. By modifying market requirements and usage so as to allow boards of random widths and odd lengths.
5. By admitting short and narrow boards.

6. By modifying standard grading rules to allow defects on ends and edges without seriously reducing the grade of a board.

7. By more careful manufacture and more perfect machinery.

8. By utilizing short boards, slabs, and waste for such articles as matches, tooth-picks, excelsior, novelties, and other purposes for which large boards and planks are now used.

There is great waste of lumber after it is sawn and before it is put into use, due to loss in seasoning, and loss in manufacturing. It is estimated that in the lumber used by the building trades there is a waste of 3 per cent in seasoning, due to checks, stains, &c., and a waste of 12 per cent in cutting for use. There is a seasoning waste of 5 per cent and a manufacturing waste of 20 per cent in the timber used in the furniture industry. There is a waste of 15 per cent in the timber used in the manufacture of boxes, and a waste of 10 per cent in timber used by transportation lines. There is an average waste of 10 per cent in seasoning, and of 15 per cent in manufacturing vehicle parts. Most of the waste of timber in utilization is unavoidable, but with careful management a portion of it may be saved.

A large part of this yearly consumption of timber in Canada is due to the necessity of replacing timber which has decayed in use. The necessity of replacing at frequent intervals all the timber used for trees, poles, posts, mine props, piles and shingles is due chiefly to the destruction of these articles by decay.

It has been proven in Europe and the United States that a cheap process of chemical treatment applicable to almost all timbers doubles the life of the timbers. Doubling the life of poles, posts, mine props, ties and shingles would mean that only half as much timber would need to be cut each year for replacements as is now cut. The general adoption in Canada of a system of giving railroad ties preservative treatment before use would bring about a saving of over 5,000,000 ties yearly. This would, allowing for the cost of treatment, mean an annual saving of from \$6 to \$70.50 on every mile of track in Canada.

The general use of timber preservatives is particularly important in Canada because we have in our forests but limited quantities of naturally durable timber, and very large quantities of timber which decay quickly in contact with the soil. The durable species are being selected, the non-durable species are being left or are being used at a loss. Were the non-durable species given a preservative treatment, for which they are naturally adapted, they would give most efficient and economical service, would add to the revenues and resources of the country, and would lessen the drain on the naturally durable species.

It is a part of forestry to secure the economical use of timber by reducing the waste in logging, reducing the waste of sawing, reducing the waste in manufacture and reducing the loss of timber due to decay. For this purpose it will be necessary to have trained men study all the different sources of loss and prove by experiment that more economical methods may satisfactorily be adopted at every point where there is now an undue loss of timber. This has been done in other countries, must be done in Canada and will be done in Canada.

#### REFORESTATION.

The chief reason for the general admission that there is a need for scientific forest management in this country is that cut-over lands are not restocking with valuable species of trees. Under the exploitation system of handling our forests, land which is capable of producing a continuous crop of timber usually produces but one good crop. After the virgin crop is removed it is just an accident if there is another, and if there is another there is either required an unnecessarily long period for its production, or it is composed largely of trees of poor quality.

One great aim of forestry is to secure the reforestation with valuable species of cut-over timber lands. There are many who believe that this reforestation consists of the planting of a small tree where a large one has been cut. There are instances where it is advisable to plant cut-over areas to secure another crop of timber, but planting, though it produces the best crop, is an expensive operation, and for that reason is not at present practicable, except on a limited scale, in so extensive a country as Canada. Foresters rely rather upon natural reproduction than planting to secure the restocking of cut-over lands necessary for the permanence of the productivity of the forest.

The securing of natural reproduction is dependent upon the method of removal of the original forest. It is the intention of the forestry branch to so regulate the cutting of timber on forest reserves that there will be produced conditions conducive to the plentiful reproduction of the most valuable species of trees. In order that this may be done, it is necessary that the tract to be logged be studied by trained men. These men, familiar with the markets of the region, and with the qualities and habits of the trees, will first decide what trees occurring in the present forest it is most profitable to encourage in the next; will then study the conditions under which the seedlings of these trees are most readily produced, and will draw up a plan of managing the logging operation so that there will be assured an abundance of seed of the valuable species of trees, that the seed will find the condition of the seed bed most conducive to its germination, that the seedlings will receive the right amount of light and shade, and that they will be protected from fire.

To secure these desiderata without imposing regulations which increase logging costs or interfere with logging operations, requires common sense, experience and a high degree of technical knowledge.

There is no rule of thumb for the securing of natural reproduction on cut-over areas. The different trees have each different habits of growth which necessitate different methods of treatment, and in every locality there are varying market requirements and logging methods which require special consideration.

A brief outline of the method of treatment of one important species, the lodgepole pine of the Rocky Mountains forest reserve, will serve to show how the above mentioned principles may be applied.

Lodgepole pine grows in an even-aged forest in which but few other trees occur. As all the trees in a lodgepole pine forest are about the same age, they usually vary but little in size. They are all ready to cut at the same time. When a large number of trees are cut from a lodgepole pine forest and only a few left, these few usually break off or blow over. They have not been accustomed to the full force of the wind.

There is always abundant seed in a lodgepole pine forest; the seed is well protected by heavy cones and is uninjured by a light fire. The seed of lodgepole pine germinates best on a mineral soil such as is exposed by a fire, and the seedlings require full light for their development.

Knowing these habits of the tree, the forester plans to have all the trees cut on the tract to be logged except a few small clumps or strips so located as to throw seed on the cleared area. On the logged area everything that can possibly be used is taken, the remainder is scattered and burned. The clumps and strips of trees left are protected from the fire.

The cutting of all the trees exposes the cleared area to the full strength of the sun, the burning of the brush exposes the mineral soil, and opens the cones which have been on the ground, releasing the seed. This seed, together with that which blows from the clumps and strips of trees standing, readily germinates in the full light on the mineral soil, and there is produced a thicket of young seedlings, all of lodgepole pine, which, in the absence of any shade, grow very rapidly. The burning of the brush is also a safeguard against further fires.

An instance of the mode of management adopted for another important tree in the Rocky Mountains forest reserve, the Englemann spruce, will serve to illustrate how important it is that a different method of management be adopted to suit the different habits of trees.

Englemann spruce grows in uneven-aged forests, in which there are all sizes of trees from the youngest seedlings to the oldest trees. There are frequently mixed with Englemann spruce other trees. In a natural spruce forest there are always a large number of trees below commercial size. Spruce produces seed every three or four years, the seed germinates best in the shade on moist soil, and the seedlings require to be shaded from the direct sunlight.

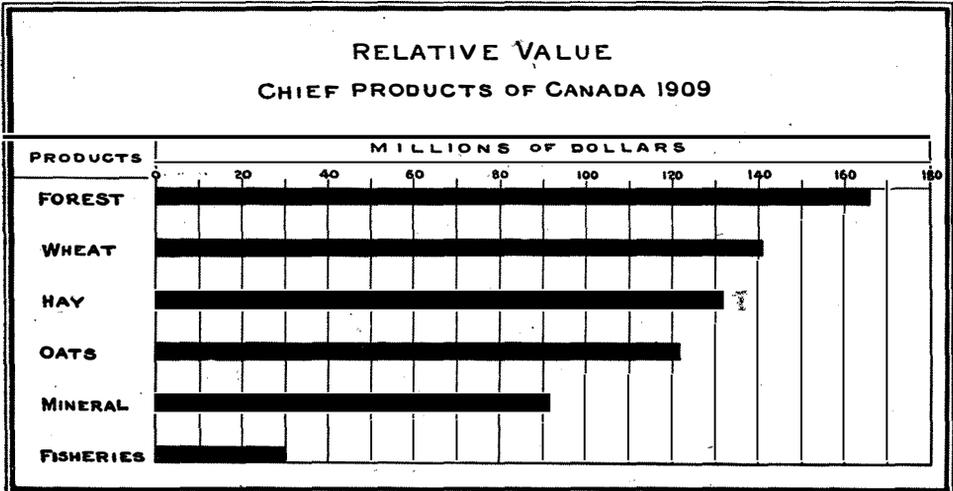
Spruce reproduction is best secured when the logging is confined to a selection of the larger trees. The removal of the large trees gives the medium and the small trees a chance to grow more rapidly. When the trees left next bear seed, it is distributed by the wind and other agencies through the small openings left by the removal of the large trees where it finds a moist soil protected from the direct sun. Under such conditions it germinates well and the young trees find the best conditions for their growth.

When a forest is logged under this system, care is taken to protect the young trees, and the brush is usually lopped so as to lie flat on the ground and decay readily. The medium sized trees left at the first logging operation form the basis of the next cut in a few years.

It may readily be understood from a comparison of the habits of the two trees here discussed that a plan of management that would favour one tree would be fatal to another.

The protection of the forest from fire, the improvement of Canadian methods of utilizing wood, the regeneration of the forest by planting and by encouraging valuable natural reproduction is a task which will require for its accomplishment many years, much money and a large body of trained men. That it is a very important task is proven by the position which the forest holds as a producer of natural wealth.

DIAGRAM No. 4



The forest products of Canada are more valuable each year than any of the field crops, are nearly twice as valuable as the total mineral products, and are over five times as valuable as the total of inland and ocean fisheries. Over 90 per cent of this great crop is produced on public lands. Under wise scientific management the public forests of Canada will perpetually maintain their productivity; under unwise manage-

ment or lack of management they will be destroyed by fire, or when once harvested will produce no more crops. The great annual value of the forest products of Canada is the best argument that can be put forth to prove that money should be provided to secure for the public timber lands the highest grade of technical officers.

Respectfully submitted,

H. R. MACMILLAN.

No. 3.

REPORT OF A. KNECHTEL, INSPECTOR OF FOREST RESERVES.

DEPARTMENT OF THE INTERIOR,

OTTAWA, March 31, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry and Irrigation,  
Ottawa.

SIR,—I have the honour to submit hereby my third annual report, which describes the work done on the Dominion forest reserves during the year ending March 31, 1911.

There were nineteen permanent rangers employed on the forest reserves who are charged with carrying out the administration of the reserves under the instructions of the department. On the large reserves the chief rangers have charge of the work of several permanent rangers. The success which has attended their efforts will appear in this report. Additional men were employed during the summer to help the rangers with the work of cutting fire guards. The rangers had authority to call out additional men in case of fire.

FOREST FIRES.

During the spring of 1910 it was exceedingly difficult for the forest rangers to guard the reserves against fire. The snow left the ground very early; in Manitoba and Saskatchewan before April 1, and in Alberta there was scarcely any snow on the ground later than March 15.

Not only did the snow leave the ground early, but the season was exceptionally dry. The following quotation is from the meteorological report of the province of Saskatchewan for the year 1910:—

'The year 1910 was noted for its early spring and sultry midsummer weather. The spring was most favourable for seeding, which was fully three weeks earlier than usual. March was exceptionally mild. The weather continued dry and warm throughout April. During the first two weeks of May, cool weather, frosts and high winds were experienced, but more favourable conditions prevailed during the remainder of the month, when frequent showers proved very beneficial to the farming interests. Precipitation was heaviest in the southern portion of the province. June was very much warmer and drier and had less of a rainfall than usual during this month. A narrow area in the southeast had a little more rain than the rest of the province. July weather conditions may be said to have been a replica of those of June. The effect on the crops, however, was more severely evident by reason of the longer spell

of dry, hot weather. During this month the drought was most pronounced in the south-east, where the total rainfall of the month was less than one inch. The average precipitation for the month was only 1.44 inches, as compared with 5.36 inches in July, 1909, and 2.28 inches, the average of ten years. The temperature exceeded the average of the preceding twenty years by about three degrees.

Such were the weather conditions in Saskatchewan for the spring of 1910, and these may be considered the average for the three prairie provinces. In Manitoba the drought was rather less pronounced, but in Alberta it was much intensified, especially in the southern half.

#### DESTRUCTION OF MERCHANTABLE TIMBER.

Notwithstanding these adverse conditions the fires did but little damage to merchantable timber on the forest reserves. In British Columbia, 6,500 feet of saw timber was destroyed on the Monte Hills reserve, and 13,400 feet on the Tranquille reserve. On the Manitoba and Saskatchewan reserves there was none killed. On the territory which is now the Rocky Mountain forest reserve, large quantities of saw timber were destroyed, but this reserve was not established until some time after the fires started, and was at no time during the fires under forest reserve management. I am adding to this report, however, a statement of these fires, as the territory was set aside as a reserve later.

A large total loss of saw timber, estimated at two hundred million feet board measure, occurred along the eastern slope of the Rocky Mountains. Fires began about the middle of April and were not all extinguished before August 5. They covered the following territories, the total area being approximately 494 square miles:—

In the Porcupine Hills a fire occurred in townships 12 and 13, range 1, west of the 5th meridian, which covered an area of fifty square miles, destroying about 50 per cent of the timber. This was the beginning of the fires on the eastern slope of the Rockies. It occurred in April and was fought under the direction of Fire Ranger Wm. Flack. A ploughed guard of two furrows was made across the hills between townships 11 and 12 for a distance of six miles.

From Coleman in township 8, range 4, on the Crowsnest railroad to Sheppard creek in township 15, range 3, west of the 5th meridian, a burned strip extends in a northeasterly direction 42 miles long, having an average width of six miles. This strip was mostly covered with young timber from 30 or 40 years of age with small areas of mature timber. About 80 per cent of the trees were killed. A ploughed guard of four furrows was made along the eastern side of the fire in townships 13, 14 and 15 for a distance of 75 miles.

In townships 17, 18 and 19 a fire followed the Highwood river for a distance of forty miles, with an average width of about three miles. About 50,000,000 feet of saw timber was destroyed in this fire and a large area of young spruce, pine and poplar from thirty to forty years old.

Fire occurred in township 2, range 4, west of the 5th meridian, destroying about a quarter township of large spruce, and in township 21, range 6, west of the 5th meridian, killing young pine which covered about half the township.

In townships 28 and 29, ranges 6, 7 and 8, west of the 5th meridian, a large fire occurred which burned during the months of July and August and covered an approximate area of 110 square miles. About 14 square miles of this area was covered with good merchantable spruce and pine which would yield probably 25 million feet of lumber. At least 10 million feet of this was killed. The remaining area bore a good growth of young pine and spruce, most of which was killed, though a sufficient quantity was left green and may re-seed the ground.

Along Fallen Timber creek in township 30, ranges 6 and 7, a fire destroyed about a quarter township of young pine about four or five feet high.

## FOREST CONDITIONS ON ROCKY MOUNTAIN FOREST RESERVE.

There is no doubt that Mr. W. I. Margach, the chief forest ranger, and his assistant rangers, did everything in their power to stop the spread of fire. When fire once gets started on the eastern slope of the Rockies, it is a very difficult matter to get it under control. In eastern Canada and on the eastern slope of the Rockies when a fire breaks out, rain usually comes in two or three days and puts it out, but the moist winds which climb the western slope are robbed of their moisture by the mountain tops and come down the eastern slope dry and hot, and fire fighters are likely to look in vain for many days for a providential rain.

On the eastern slope the abundance of dead wood lying on the ground facilitates the destruction of the woods by fire. It remains many years without rotting. In moist climates the frequent rains through the summer cause dead wood to decay quickly. In the eastern provinces and on the western slopes of the Rockies rotten wood is everywhere in evidence. On the ranches at the foot hills of the eastern slope, the weather is so dry that hay cures standing in the fields, and carcasses of dead animals mummify. In the summer of 1909 I made a trip with the Chief Forest Ranger through the hills from the Highwood river southward to Frank on the Crow-nesset railroad. For many miles we followed an old horse trail that had formerly been much used by the Stony Indians as a hunting trail, but had for a long time been abandoned. There were so many dead, dry trees lying across the trail that we thought it cruelty to the horses for us to stay upon their backs. We went ahead, climbing over the logs, and the horses scrambled after. These logs had been there for many years and were by no means rotten. Such windfall areas through old burns are frequent throughout the mountains.

There is considerable snow in the hills through the winter, but moisture in that form does not rot timber as quickly as summer rains. Rot is caused by fungi whose growth is favoured by moisture in warm weather. In winter the weather is cold and when spring comes the snow quickly disappears.

## ORGANIZATION OF PROTECTIVE FORCE FOR ROCKY MOUNTAINS.

Since the territory has been placed under forest reserve management the protective work has been reorganized. Heretofore the rangers were employed only temporarily during danger periods. When the danger seemed to be over they were discharged and when danger reappeared they were re-engaged. Now the reserve is blocked off into large blocks having each a frontage towards the settlements of about thirty miles. A ranger is employed by the month upon each block and he is held responsible for its protection. During the danger periods he keeps constantly on patrol. When there is little danger he employs his time in clearing existing trails, making new trails, ploughing fire guards, marking and cutting out the boundary line of the reserve, and guarding the reserve against trespass.

The rangers selected for the Rocky Mountain forest reserve were selected on the qualification of being strong, sober, industrious men, used to logging operations. They can locate and estimate timber, scale timber, do a logging job, run a sawmill, build log houses, organize and manage a crew of fire fighters, and have education enough to report intelligently to the department.

At convenient points on the reserve, close to main trails, the rangers are instructed to build caches for fire fighting tools. These will be built of logs. The inside measurements will be 14 feet by 16 feet by 8 feet. The roof will be made of boards covered with sheeting and earth. The cache will have a good floor and door, and a small window with heavy board shutter. The cache equipment will be a cook stove with necessary utensils, a bed for the ranger, and the following tools for fighting fire:—

3 long handled square point shovels.

- 12 long handled round point shovels.
- 9 axes.
- 12 grubhoes.
- 6 galvanized pails.
- 6 brooms.

Where ploughed fire guards are to be made a heavy brush-breaking plough will be added to the above equipment.

Telephone connection is to be established between the caches and the settlements, so that when fire occurs assistance can be promptly obtained to put it under control.

#### DESTRUCTION OF YOUNG GROWTH ON FOREST RESERVES.

If a fire runs over a territory but does not destroy saw timber, the general public, and in some cases forest rangers, consider that no damage has been done, though large areas of young reproduction growth may have been destroyed. When one considers that it costs \$12 an acre to plant a forest with young pine or spruce trees, and that the trees will at the time of planting be only a foot high, it becomes evident that fire, running over large areas well stocked with young trees of these species, causes great loss. To ascertain the loss per acre, one should figure the amount of \$12 with compound interest at three per cent for the number of years that it has taken the trees to grow from a foot in height to their height at time of destruction. I state three per cent, as that is about the annual rate of interest yielded by the planted forests of Saxony, Germany.

There is a general impression that such a forest when destroyed will restore itself. It may, if there are a sufficient number of trees left to throw a plentiful supply of seed. Otherwise it will not be restored by natural seeding, and at best in pine and spruce forests, it is a very slow process. On the Monte Hills reserve in the railway belt of British Columbia, young pine and spruce were destroyed on 853 acres, and on the Tranquille reserve in the same region 1,707 acres. On the Rocky Mountain forest reserve, as has been already stated, there were large areas of such young growth destroyed.

On the other reserves it was nearly all young poplar that was killed. In such case the loss is not so great. To have young poplar growth restored, the ground does not need to be planted, nor is it necessary to have seed scattered. Poplar restores itself by shoots from the root. It is seldom that a fire kills the roots of a poplar forest. In one year after a fire, young shoots as high as a man's head may cover the ground. Even if fire runs over the ground several years in succession the growth still continues to come.

Of young poplar not large enough for firewood there was destroyed in Manitoba reserves as follows: 6,560 acres on the Riding Mountains, 9,600 acres in the Porcupine Mountains, and 2,500 acres in the Turtle Mountains.

#### NUMBER OF FIRES AND THEIR CAUSE.

There are not complete data as to the number of fires that occurred on the eastern slope of the Rocky Mountains. On the other forest reserves the rangers extinguished in all 73:—On the Riding Mountain, 27; Duck Mountain, 12; Porcupine Mountain, 7; Turtle Mountain, 8; Spruce Woods, 10; Beaver Hills, 2; Cypress Hills, 2; Cooking Lake, 2; Monte Hills, 3.

The forest rangers report the following as the causes of forest fires: locomotives, 21; campers, 17; settlers, 11; travellers, 8; threshing engines, 3; unknown, 13.

Men received \$2 a day for fighting fires. On the Riding Mountain reserve 65 men did in all 269 days work at \$538.15; on the Duck Mountain 18 men did 100 days work at \$200.95 and 4 teams, 5 days work at \$20. (Note—\$4 a day was paid for teams.) On the Turtle Mountain, 21 men did 34 days work at \$68; on the Spruce Woods, 4 men

did 4 days work without pay; and on the Monte Hills reserve, 1 man did 10 days work for \$20. Where necessary, board was furnished to the fire-fighters by the department.

#### PROSECUTIONS.

Some settlers in the vicinity of the Moose Mountain reserve in Saskatchewan were in the spring of the year very careless of their fires in clearing land, and let them spread from their own land, endangering the forest reserve. For this carelessness the forest ranger prosecuted five men and obtained a conviction in each case. The total fines amounted to \$60 and costs. Chief Forest Ranger W. A. Davis prosecuted 7 men for letting fires run in the neighbourhood of the Riding Mountain reserve and secured 5 convictions; each fine was \$50 and costs.

#### BURNED GUARDS.

Along the boundaries of the reserves there are many sloughs covered with reeds, bushes and long grass. There are also higher grounds covered with a rank growth of hay and peavine. The forest rangers find that it is not a difficult matter to burn a guard through such a growth if it is done at the right time, that is, just as soon as the snow is off the fields, but before it is out of the woods. During the year just closed, 65 miles of such guards were made, 12 miles along the Riding Mountain, 40 miles along the Duck Mountain, 3 miles along the Beaver Hills and 10 miles along the Cooking Lake reserve. Such a guard has been found very beneficial in preventing fires from coming into the reserves from the prairie.

#### PLOUGHED GUARDS.

Ploughed guards to protect the reserves are being made wherever such measure is practicable. These are the best kind of guards when properly made. From experience the rangers have learned that they are best made a rod wide with two furrows two rods distant, running parallel with the guard and located on the side from which the fires usually come. To be effective the guard should be continuous. Spots too hard to plough on account of ground juniper, roots of trees or for any other reason should be spaded. Nineteen miles of ploughed guards were made on the Cypress Hills reserve, 8 miles on the Beaver Hills, 3 miles on the Riding Mountain and 6 miles of new guard on the Spruce Woods reserve. Besides this, a guard which had formerly been made 8 feet wide on the Spruce Woods reserve was ploughed 16 feet wide, and 25 miles, 8 feet wide. The cost was \$379, which gives \$7.82 as the cost per mile of guards, 16 feet wide.

#### FIRE ROADS.

During the year the rangers did excellent work in making roads along the boundaries of the reserves. The following table indicates the extent of this work:—

BOUNDARY ROADS MADE DURING THE YEAR ENDING MARCH 31, 1911.

Name of Reserve.	Miles in Length.	Width in Feet.	Cost.
			\$ cts.
Riding Mountain.....	22	8	752 00
" ".....	15	10	642 75
" ".....	32	16	1,603.75
Duck Mountain.....	36	8	925.00
" ".....	12	16	737.50
Porcupine.....	24	6	200.00
Turtle Mountain.....	3	9	103.42
Total.....	144	Aver. 10'34	4,964.42

This gives an average cost of \$34.47 per mile of road 10-34 feet wide. On the Riding Mountain and the Duck Mountain reserves the roads were cut through heavy timber. The trees were cut close to the ground and the logs, which were laid at the road side, were taken away on settlers' permits. The brush was gathered up and piled, and in the winter it was burned.

These roads are very serviceable to the rangers in moving about the reserves, in guarding them against fire, and in preventing trespass. They also allow the settlers easy means of getting out their timber.

Besides these boundary roads there were roads made in the interior of the reserves as follows:

In the Moose Mountain reserve the ranger made 6 miles of good road 20 feet wide on which there was 100 yards of grading done at a cost of \$24, and 7 culverts built for \$31.90. This will be a well travelled road and was made accordingly. The total cost was \$248.25.

In the Turtle Mountains a similar road 6 miles long on which 5 culverts were built and 7 repaired cost \$291.75.

On the Beaver Hills reserve a road 15 miles long and 12 feet wide was brushed out at a cost of \$37.50; on the Porcupine, 26 miles 10 feet wide at \$196.86. A pack trail was also made in the Porcupine reserve, 28 miles long and 4 feet wide, at a cost of \$72.

THE SAWMILLS.

In my report of 1910 I recommended that small portable sawmills should be permitted to operate upon the forest reserves; and last fall the department made an attempt to carry this recommendation into effect. Certain tracts on the Riding Mountain reserve, where it was thought desirable to have mills operate, were examined, mapped, and described, by J. R. Dickson. The following form of contract was approved and tenders were called for:—

APPLICATION FOR CONTRACT FOR CUTTING TIMBER IN FOREST RESERVE ON SETTLERS' PERMITS.

To the Minister of the Interior,  
Ottawa.

SIR,—I hereby tender for the contract to lumber upon settlers' permits only, on the tract of forest reserve known and described as:

1. I agree to cut lumber to satisfy settlers' permits at the following cash prices:—

(a) If the logs are delivered by the settler at the sawmill, hereinafter referred to as the mill, to be located or placed by me as specified in the paragraph numbered '8' of this tender:—

Spruce, pine, tamarack and balsam.. . . .	\$	per thousand feet.
Poplar.. . . .	\$	"
Other species.. . . .	\$	"

(b) If the settler requires me to get the logs from the woods:—

Spruce, pine, tamarack and balsam.. . . .	\$	per thousand feet.
Poplar.. . . .	\$	"
Other species.. . . .	\$	"
Slabs.. . . .	\$	"

2. In case I am required by any settler or settlers to get the logs from the woods to satisfy their respective permits, I agree to take only such trees as are designated by the forest officer in charge of the reserve wherein such trees are.

3. I agree to cut such trees, logs or timber into boards, scantling, plank. or square timber, as the settlers respectively require.

4. I agree to dress such quantity of the lumber so cut by me, as the settlers respectively require, at the following cash prices:—

Surfacing . . . . .	\$	per thousand feet.
Matching . . . . .		“
Siding and shiplap . . . . .		“

5. I agree to take out of the woods, and pile in a convenient place near the mill, all tops of trees taken to satisfy settlers' permits which are not suitable for lumber but are suitable for fence posts, and to furnish them to the settlers upon their respective permits, at the rate of \$ each.

6. I agree to cut no timber upon the said tract except to satisfy settlers' permits; that before I do his cutting I shall have received, in every case, from the settler his permit; that the permit shall be kept on file at my place of business for delivery to the forest officer in charge of the reserve in which such tract is situated upon that officer's request, and that immediately after his request for such permit has been made to me I shall deliver it to such officer.

7. I agree to cut the brush left in the woods so that it will lie flat on the ground, or to pile it in the woods, as the said forest officer directs.

8. I agree to locate the mill upon the site selected by the said forest officer, and to locate and construct the roads for logging and other purposes in connection with the milling operations, to the satisfaction of the said forest officer.

9. I agree to furnish the mill with boiler and engine of not less than twenty-five horse-power, and with proper equipment, including saw, gang-edger, trimmer, planer and matcher, and also that the carriage shall be well set, and all the machinery shall be kept in good repair.

10. I agree to avoid all unnecessary waste and destruction of timber, and to take and cut into lumber, from every tree, all portions suitable for such purpose, to the satisfaction of the forest officer.

11. I agree to cut the trees down with a saw and to leave no stumps more than eighteen inches high; and I also agree not to use any pine, spruce, tamarack or balsam for skids or head-blocks.

12. I agree to avoid all unnecessary damage to young growing trees or to trees to be left standing.

13. I agree, if called upon to do so, to make and plough, at my own expense, a fireguard fifteen feet wide completely around the mill, at a distance of not less than 1,000 feet; and not more than 1,500 feet from the smoke stack, the fireguard to be made under the direction of the said forest officer; no fires to be kindled for this purpose except under his immediate supervision.

14. I agree that before I commence operations in the woods I shall obtain from the land agent nearest to the tract in which such woods are situated, a permit for the timber which I shall require for the construction of the mill, stables and boarding camps, and I agree to pay for the same the regular settler's fees. I also agree that any timber, log size, used in the construction of the buildings shall be poplar only.

15. I agree to remove from the reserve, immediately after the completion of the contract based on this tender, all buildings which I shall have erected therein.

16. I agree that the forest officer may cause the work to be suspended, or that the Minister of the Interior may cause the said contract to be revoked, for violation of any of the foregoing conditions by me or my employees, and that I shall not have any claim for damages on account of such suspension or revocation.

17. I agree to make no assignment of this contract without permission in writing from the Minister of the Interior, or from one duly authorized in writing by him.

18. As a guarantee of the faithful performance of the conditions of this agreement I agree, upon being notified of the acceptance of this tender, to furnish forthwith a bond in the sum of one hundred dollars, which bond, in case of failure on my

part to fulfil each and every of the foregoing conditions and requirements, shall become the property of the Department of the Interior as liquidated damages, and not as penalty.

I understand, and it is the true intent and meaning of this tender that the words 'I agree,' wherever they appear therein, mean that I.....agree with the Minister of the Interior, and his successors, for myself, my executors, administrators and assigns.

20. Unless an extension of time is allowed by the Minister of the Interior, I agree that the contract based on the terms and conditions of this tender shall expire on the first day of April, nineteen hundred and..... and I further agree to cease all milling operations on or before that date.

It is further understood and agreed between me, the said ..... and the said Minister of the Interior, that upon the endorsement by him or by his deputy or some other person thereunto duly authorized by him in writing, upon this tender, of its acceptance, such tender and every condition therein contained shall be and become forthwith, without the execution of any further contract, the contract to be observed and fulfilled by me in the matter to which this tender relates.

Dated at ..... this ..... day of ..... 191 .  
 .....,  
 Signature.

Under the foregoing form of contract no mill was located on the reserve. The millmen refused to tender upon it for the following reason:—By the terms of the contract a millman placing his mill in the forest reserve is forbidden to cut any timber until he has received permits from the settlers. The settlers do not, as a rule, apply for permits before February. Consequently if a mill is placed in the reserve it must stand there idle till February. Even the logging cannot be done in advance of settlers' permits. Hence, there is no chance at all to do business at a profit.

A form of contract should be provided which will allow the millmen to know in advance how much timber they will be allowed to cut during the season. They would then be able to plan upon an economical basis. They could get the logs cut and placed on the skidways before the deep snow comes. With snow, they could get them promptly to the mill, and then the mill could run steadily till the lumber is cut out.

The department put into operation last year in Alberta a form of contract which, modified somewhat to suit local conditions would, I am convinced, be accepted by the millmen in the neighbourhood of any reserve. It reads as follows:—

APPLICATION FOR A PERMIT BERTH.

I, ..... of ..... desire to obtain a permit to cut timber on ..... section ....., township ....., range ....., west of the .... meridian, under the provisions of the order in council of the 19th February, 1907, which timber will be manufactured at my sawmill now situated on section ....., township ....., range ....., west of the .... meridian.

Dated ..... 19 .  
 .....,  
 Signature.

.....  
 Post Office address.

AFFIDAVIT.

I, ....., the person named in the above application for a timber permit berth, make oath and say:

1. That I am not the holder of any permit berth or licensed timber berth.
2. I agree to have my sawmill in actual operation satisfactory to the Department of the Interior within three months of date of the permit herein applied for.

3. I agree that the timber that may be cut under the authority of the permit herein applied for shall all be manufactured into lumber and other sawn products.

4. I agree that all such lumber and sawn products shall be disposed of for use in mines, and to settlers residing in the vicinity of the berth for use on their farms and that no portion thereof shall be disposed of to lumber merchants or dealers.

5. I agree to pay in advance of receiving the permit a rental at the rate of \$100 per square mile, and 20 per cent of the royalty dues on the timber covered by the permit.

6. I agree to render to the Crown Timber Agent, having jurisdiction in the matter, sworn returns monthly or at such periods as the Minister of the Interior may direct, accounting for the number of pieces of round timber cut upon the berth and manufactured into lumber and other sawn products and the quantity sold and on hand, and to pay dues thereon at the rate of 50 cents per thousand feet, board measure on the quantity sold.

7. I agree to take from the said tract all dead merchantable timber suitable for sawing into lumber or other products; or for cordwood, mine timber, or mine props, to the satisfaction of the forest officer.

8. I agree to take from the said tract only such green trees as are designated by the forest officer in charge of that portion of the reserve in which the said tract is situated.

9. I agree to cut the brush left in the woods so that it will lie flat on the ground, or to pile it in the woods, as the said forest officer directs.

10. I agree to furnish the mill with boiler and engine of not less than twenty-five horse power, and with proper equipment, including saw, edger, trimmer, planer and matcher, and also to have and keep the carriage well set, and all the machinery in good repair.

11. I agree to avoid all unnecessary waste and destruction of timber, and to take and cut into lumber, from every tree, all portions suitable for such purposes, to the satisfaction of the forest officer.

12. I agree to cut the trees down with a saw and to leave no stumps more than eighteen inches high; and that any merchantable timber used for skids or head-blocks will be manufactured into marketable products before the conclusion of operations.

13. I agree to avoid all unnecessary damage to young growing trees or to trees to be left standing.

14. Unless released from such obligation by written approval of the forest officer, I agree to make and plough at my own expense, a fireguard fifteen feet wide completely around the mill, at a distance of not less than 1,000 feet and not more than 1,500 feet from the smokestack, and to clear the space within such fireguard of inflammable material, subject to the approval of the forest officer.

15. I agree to remove from the reserve, immediately upon the expiration of the permit, all buildings which I shall have erected therein.

16. I agree to make no assignment of this contract without permission in writing from the Minister of the Interior.

17. I agree that the forest officer may cause the work to be suspended, or that the Minister of the Interior may cause the said permit to be revoked, for violation of any of the foregoing conditions by me, or my employees, and that I shall not have any claim for damages on account of such suspension or revocation.

18. I understand, and it is the true intent and meaning of this application that the words 'I agree' wherever they may appear therein, mean that I agree with the Minister of the Interior and his successors, for myself, my executors, administrators and assigns.

19. Unless an extension of time is allowed by the Minister of the Interior, I agree that the permit based on the terms and conditions of the application shall expire on the first day of.....nineteen hundred and..... I further agree to cease all milling operations on or before that date.

20. It is further understood and agreed between me, the said..... and the said Minister of the Interior, that upon the endorsement by him, or by his deputy or some other person thereunto duly authorized by him in writing, upon this application of its acceptance, such application and every condition therein contained shall be and become forthwith, without the execution of any further contract to be observed and fulfilled by me in the matter to which this application relates. Dated at.....this.....day of.....19 .....

Signature.

Two mills, one in the Cypress Hills, and one in the Rocky Mountain forest reserve, are already operating under this form of contract.

#### LICENSE BERTHS.

In my report last year there was included a list of all timber removed from license berths on forest reserves. I am again adding the list this year, so that by comparison, it will appear what berths are not being operated. While operating a berth the licensee pays an annual ground rent of five dollars per square mile, except for lands situated to the west of Yale, in the province of British Columbia, in which case the yearly ground rent is five cents per acre. When license berths are not operated the department increases the ground rent, hence the necessity for such comparison.

#### LICENSE BERTHS IN MANITOBA.

Reserve.	No. of Berths.	Area Sq. M.	Quantity Cut.	Royalty.
			Feet B.M.	\$ cts.
Duck Mountain.....	14	122.79	6,607,099	3,157.20
Riding Mountain.....	5	65.00	2,198,733	718.32
Lake Manitoba West.....	1	8.00	.....	.....
Total.....	20	195.79	8,805,832	3,875.52

#### LICENSE BERTHS IN ALBERTA.

Reserve.	No. of Berths.	Area Sq. M.	Quantity Cut.	Royalty.
			Feet B.M.	\$ cts.
Jasper Park.....	6	56.89	90,390	122.35
Rocky Mountain Park.....	8	334.08	7,522,602	2,784.46
Total.....	14	390.97	7,612,992	2,906.81

## LICENSE BERTHS IN BRITISH COLUMBIA.

	No. of Berths.	Area Sq. M.	Quantity Cut.	Royalty.
			Ft. B.M.	\$ cts.
Yoho Park.....	9	26.44	929,486	462 75
Glacier Park.....	8	35.13	2,985,257	1,507 51
Long Lake.....	1	25.00	.....	.....
Donald.....	3	16.68	.....	.....
Total.....	21	105.25	3,914,743	1,970 26

## SUMMARY OF LICENSE BERTHS.

Province.	No. of Berths.	Area Sq. M.	Quantity Cut.	Royalty.
			Ft. B.M.	\$ cts.
Manitoba.....	20	195.79	8,805,832	3,275 52
Alberta.....	14	390.97	7,612,992	2,906 81
British Columbia.....	21	105.25	3,914,743	1,970 26
Total.....	55	692.01	20,333,567	8,752 59

## SAWMILL PERMITS.

Permits to owners of mills to cut timber over a definitely described tract of land not exceeding one square mile in extent are granted on the reserves of Alberta on payment of a fee at the rate of \$100 per square mile for each permit, a permit being good for only one year from date of issue and renewable only once. The royalty dues are 50 cents per thousand feet on the timber cut, one-twentieth of which is payable when the permit is issued, and there is no ground rent. The permit gives exclusive right to the timber on the tract. The following is a list of sawmill permit berths:—

## SAWMILL PERMITS.

Reserve.	No. of Permits.	Area Sq. M.	Logz.	Mine Props.	Lumber.	Royalty paid.
			Lin. ft.	Lin. ft.	Ft. B.M.	\$ cts.
Rocky Mountain.....	505	$\frac{7}{8}$	8,706	.....	241,865	8 75
".....	529	1	16,060	1,902	289,025	172 84
Cypress Hills.....	531	$\frac{1}{4}$	985	.....	45,000	47 50
Total.....	1,565	2 $\frac{1}{8}$	25,751	1,902	551,332	229 09

## SETTLERS' PERMITS.

When a settler wishes to get timber from a forest reserve, he obtains a requisition from a forest ranger. To convenience the settlers, notices are posted in post offices and other public places stating that the ranger is to be at a given place at a given time. This arrangement is quite convenient for settlers. It has its defects,

however. During the spring months, especially in January, February and March, the rangers find themselves so much occupied in taking requisitions that they have no time for work in the woods, and so after the permits are issued the cutting in the woods goes on without supervision. Moreover, trespassers learning from the posted notices the movements of the rangers, are able to trespass without detection. If it could be arranged that postmasters could take requisitions under advice from the rangers, the latter would be left free to see that the cutting proceeds according to the regulations. The following table shows the amount of requisition business the rangers have had during the year just closed:—

SETTLERS' PERMITS ISSUED BY MANITOBA AGENCIES.

Reserve.	No. of permits.	Lumber.	Logs.	Cord-wood.	Fence posts.	Fence rails.	Roof poles.	Receipts.
<i>Dauphin Agency.</i>		Ft. B.M.	Lineal ft.	Cords.	No.	No.	No.	\$ cts.
Riding Mountain .....	281	2,213,665	10,466	3,594	25,030	9,600	4,700	3,774 36
Duck Mountain.....	80	781,716	18,080	389	7,720	4,000	2,700	850 39
Lake Manitoba West..	4	.....	10,260	145	2,900	2,000	400	17 75
Porcupine.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	365	3,200,912	38,806	4,128	35,650	15,600	7,800	4,642 50
<i>Brandon Agency.</i>								
Riding Mountain. ....	11	55,000	.....	110	.....	.....	.....	162 75
Turtle Mountain.....	42	.....	.....	488	.....	.....	200	21 50
Spruce Woods.....	6	.....	1,000	55	.....	.....	.....	1 50
Moose Mountain.....	2	.....	.....	30	.....	.....	.....	50
Total.....	61	55,000	1,000	683	.....	.....	.....	186 25
Summary for Manitoba	426	3,255,912	39,806	4,811	35,650	15,600	8,000	4,642 50

SETTLERS' PERMITS ISSUED BY SASKATCHEWAN AGENCIES.

Reserve.	No. of permits.	Lumber.	Logs.	Cord-wood.	Fence posts.	Fence rails.	Roof poles.	Receipts.
<i>Regina Agency.</i>		Ft. B.M.	Lineal ft.	Cords.	No.	No.	No.	\$ cts.
Moose Mountain.....	32	.....	3,000	364	1,200	.....	.....	27 00
<i>Estevan Agency.</i>								
Moose Mountain.....	.....	.....	.....	.....	.....	.....	.....	.....
<i>Prince Albert Agency.</i>								
Porcupine No. 2.....	.....	.....	.....	.....	.....	.....	.....	.....
The Pines.....	101	43,991	34,916	2,653	5,595	20,025	4,300	566 00
* <i>Yorkton Agency.</i>								
Beaver Hills.....	.....	.....	.....	.....	.....	.....	.....	.....
Summary for Saskatchewan.....	133	43,991	37,916	3,017	6,795	20,025	4,300	593 00

\* No data furnished.

## SETTLERS' PERMITS ISSUED BY ALBERTA AGENCIES.

Reserve.	No. of permits.	Lumber.	Logs.	Cord-wood.	Fence posts.	Fence rails.	Roof poles.	Receipts.
		Bd. ft.	Lineal ft.	Cords.	No.	No.	No.	\$ cts.
Rocky Mountain.....	144	6,000	39,000	9,357	.....	.....	7,000	1,475 75
Cypress Hills.....	11	16,528	7,520	40	2,680	4,000	1,200	12 75
Cooking Lake.....								
Summary for Alberta	155	22,528	46,520	9,397	2,680	4,000	8,200	1,488 50

## GENERAL SUMMARY OF TIMBER CUT ON SETTLERS' PERMITS.

Reserves.	No. of permits.	Lumber.	Logs.	Cordwood	Fence Posts.	Fence Rails.	Roof Poles.	Receipts.
		Bd.Ft.	Lineal Ft.	Cds.	No.	No.	No.	\$ cts.
Manitoba.....	426	3,255,912	39,806	4,811	35,650	15,600	7,800	4,642 50
Saskatchewan.....	133	43,991	37,916	3,017	6,795	20,025	4,300	593 00
Alberta.....	155	22,528	45,520	9,397	2,680	4,000	8,200	1,488 00
* British Columbia.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	714	3,322,431	124,242	17,225	45,125	39,625	20,300	6,723 50

\* No Data from Agencies.

## TOTAL OUTPUT OF TIMBER FROM DOMINION FOREST RESERVES.

—	Number	Lumber.	Logs.	Cordwood	Fence Posts.	Fence Rails.	Roof Poles.	Receipts.
		Ft. B.M.	Lineal Ft.	Cds.	No.	No.	No.	\$ cts.
License berths.....	55	20,333,567	.....	.....	.....	.....	.....	.....
Permit berths.....	14	.....	.....	1,991	.....	.....	.....	.....
Sawmill permits.....	.....	553,234	27,653	.....	.....	.....	.....	.....
Settlers' permits...	714	3,322,431	124,242	17,225	45,125	39,625	20,300	6,723 50
Total.....	783	24,209,232	151,896	19,216	45,125	39,625	20,300	6,723 50

During the year the rangers were vigorous in guarding the reserves against trespass. The chief trespassers are settlers and owners of small mills who try to get timber without permit and escape the dues, which are \$1.50 for poplar and \$3 for other species per thousand feet board measure. When timber is taken without permit, double dues are charged. This deters the average settler who wishes to use the timber on his own place, but does not deter settlers or millmen who take timber in trespass for commercial purposes. For instance, in some localities spruce logs sell from private lands at \$10 per thousand feet while timber taken in trespass from the reserves in the same localities bears only \$6. In such cases a fine of \$6 a thousand feet should be imposed and the timber should be confiscated. The following table indicates the number of seizures made during the year, and states the quantities and kinds of timber seized, with receipts therefrom:—



PLATE 4.—Lundbeck Falls, on Crow'snest river, Southern Alberta,

(Photo H. C. Ritchie, 1910.)

is a source of water supply for the city of Moosejaw, and for a number of other smaller places along the Soo line of the Canadian Pacific railway, and, although a small stream, it is therefore of considerable value. The measurements of flow on this stream are being continued.

The observations on the St. Mary and Milk rivers are specially important, as the waters of these rivers are a subject of treaty with the United States, and are to be divided with that country. I particularly call attention to the observation of the officer in charge of this work in his report attached, in which he points out the expensive nature of inspections on Milk river and the difficulty of getting reliable results owing to the shifting nature of the channel, and suggests the construction of concrete weirs at the points where the river crosses the international boundary. The cost of such weirs is estimated at \$5,600, but they would save in the second year almost the total cost of inspection which, with two parties, costs \$5,200 per annum.

The hydrographic survey will be extended immediately to the Red Deer river and its tributaries, and to the Wood mountain district, as applications for water in the districts in question are now being received and information in regard to the water supply is required. The survey should be extended to all important streams in the west without delay.

The proper means for carrying on river profile and reservoir site examinations, outside of the work done on Moosejaw creek, were not available during last season, but as a small appropriation to cover such work has been provided this year, it is hoped to overtake such work of this kind as is of a more pressing nature.

Respectfully submitted,

R. H. CAMPBELL.

IRRIGATION SCHEMES, 1910-11.

	Number of Schemes.	Acres Irrigated.
Licensed. . . . .	29	6,516.75
Authorized. . . . .	41	16,754.7
Applications. . . . .	16	5,860.8
	<hr/>	<hr/>
Total . . . . .	86	29,132.25

	Railway.	Municipal.	Domestic.	Miscellaneous.	Total.
Licensed. . . . .	12	3	..	..	15
Authorized. . . . .	29	1	..	3	33
Applications. . . . .	12	7	2	..	21
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total. . . . .	53	11	2	3	69

DRAINAGE.

Approved. . . . .	10
Applications. . . . .	1
	<hr/>
Total. . . . .	11

## No. 2.

## REPORT OF H. R. MacMILLAN.

DEPARTMENT OF THE INTERIOR, FORESTRY BRANCH,

OTTAWA, April 4, 1911.

R. H. CAMPBELL, Esq.,  
 Superintendent of Forestry,  
 Ottawa.

SIR,—The statistical work conducted by the Forestry Branch during the past year has enabled us, for the first time, to form an authoritative estimate of the quantity and value of the annual forest products of Canada.

The quantity of timber cut and its value at the point of production for each of the classes of forest produce for 1909 is given in Table I herewith. The figures for quantity and value have been rounded off to millions.

TABLE I.

THE Cubic Feet of Forest Material required for, and the Total Value of, the Forest Products of Canada, 1909.

Product.	Cubic feet of Material cut in the forest.	Value.
		\$
Lumber, lath and shingles.....	840,000,000	87,500,000
Firewood.....	1,430,000,000	45,000,000
Poles, posts, rails.....	280,000,000	11,000,000
Pulpwood.....	150,000,000	10,000,000
Hewed ties.....	125,000,000	5,000,000
Cooperage.....	28,000,000	2,500,000
Round logs exported.....	20,000,000	1,000,000
Round mining timber.....	20,000,000	1,000,000
Square timber.....	3,000,000	1,000,000
Tanning materials.....		1,000,000
Miscellaneous products*.....	10,000,000	1,000,000
Totals.....	2,896,000,000	166,000,000

\* Distillation wood, maple sugar and syrup.

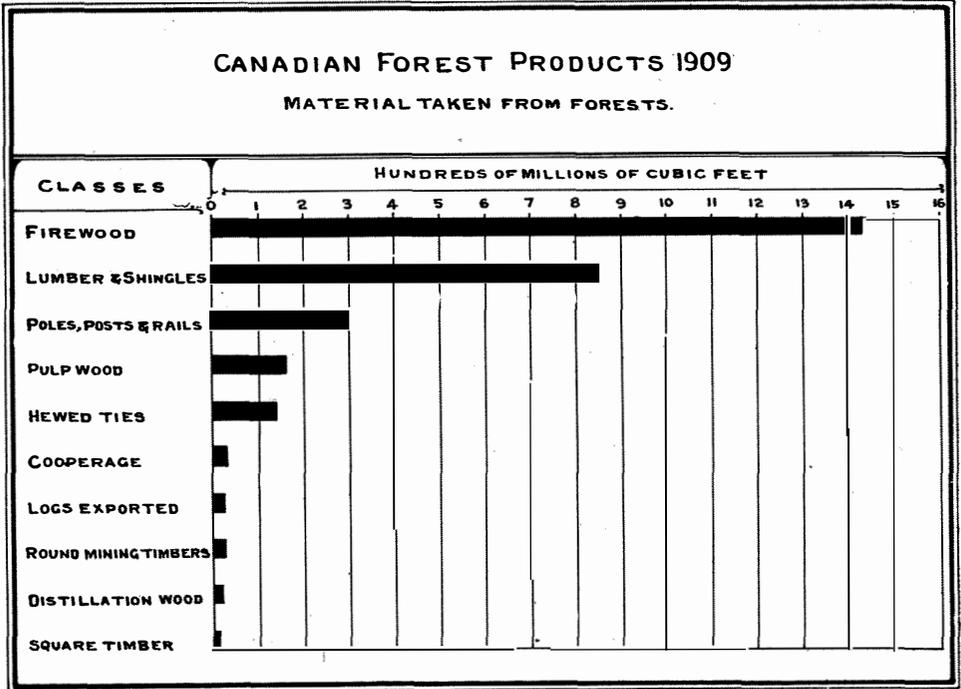
The quantities given in Table I represent the amounts of timber cut in the woods to furnish the material necessary for each class of products. Owing to the very great waste in the utilization of wood in Canada only about one-half of this wood was ever actually put into use.

The values given in Table I are the actual values of each class of products at the point of manufacture. Were the timber products of Canada to be traced to their highest manufactured form their total value would greatly exceed the \$166,000,000 given here.

Lumber, lath and shingles represent a little over one-half of the total value of the forest products of Canada; firewood constitutes over one-quarter of the total and the remaining one-quarter is made up of nine different classes of products, of which posts, poles and rails, and pulpwood are the most important.

Diagram I illustrates the relative importance of the different classes of forest products in point of wood used.

DIAGRAM No 1



About 2,896,000,000 cubic feet of wood are cut annually in the forests of Canada. One-half of this is used for firewood, three-tenths for lumber and shingles, one-tenth for poles, posts and rails. These three classes of products together require nine-tenths of the wood cut in this country.

The total value, at the point of production, of the annual forest products of Canada is at least \$166,000,000. This is \$22.44 for every person in Canada, March 31, 1909. In 1909, there were cut from Canadian forests about 400 cubic feet of timber for every inhabitant of the country. This is a per capita timber usage unequalled by that of any of the other important countries in the world.

The different classes of forest products will be discussed here in the order of their importance.

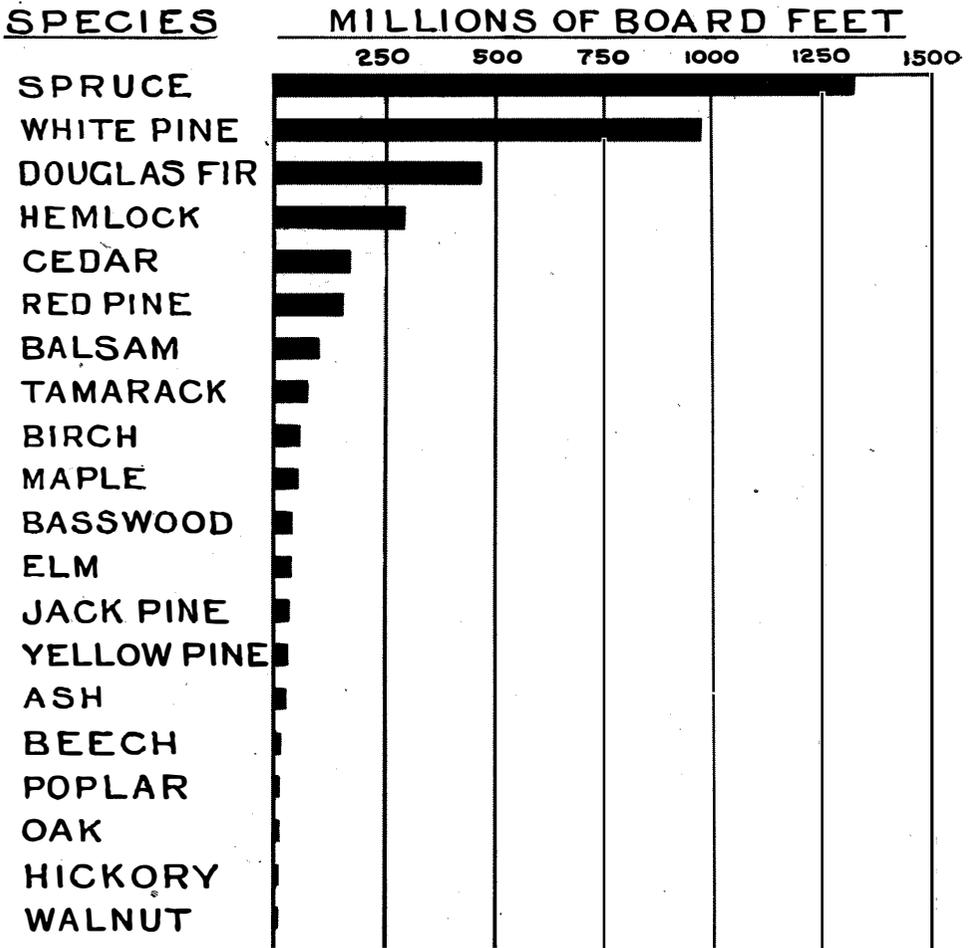
#### LUMBER, LATH AND SHINGLES.

Lumber is Canada's most valuable forest product. There were cut in 1909 about 4,900,000,000 board feet of lumber worth at the mill \$80,700,000. Twenty different species make up this total, only six of which, spruce, white pine, Douglas fir, hemlock, cedar and red pine, reach a cut of over one hundred million per year. These six species constitute 86.5 per cent of the total lumber production of Canada. The relative standing of the different timbers contributing to the lumber supply of this country is shown

in Diagram II. Spruce, which has been the leader this last two or three years, in 1909 formed 29.5 per cent of the total, white pine 27.4 per cent, Douglas fir 12.3 per cent, hemlock 7.9 per cent, cedar 5 per cent and red pine 4.4 per cent.

DIAGRAM No. 2

## LUMBER PRODUCTION BY SPECIES. 1909



Soft woods constituted about 94 per cent of the lumber cut in 1907, compared with 6 per cent supplied by hard woods. The only Canadian hardwoods, of which over 20,000,000 feet are cut per year, are birch, maple, basswood and elm.

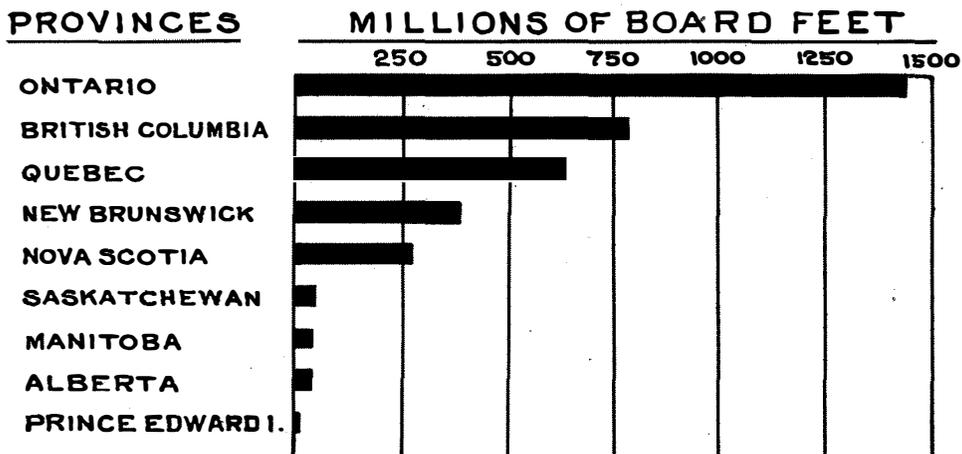
The valuable hardwoods, oak, hickory and walnut, are almost extinct in Canada. The total cut of these three species in 1909 was less than 10,000,000 feet, and was less than one-fifth as great as the quantities of these necessary woods imported in that year from the United States.

The relative lumber production of the different provinces is graphically represented in Diagram III.

DIAGRAM No. 3

## LUMBER PRODUCTION

### BY PROVINCES . 1909



Two-fifths of the lumber of Canada is produced in Ontario, one-fifth in British Columbia and one-fifth in Quebec; New Brunswick and Nova Scotia together make up the greater part of the remaining fifth, and but proportionately small quantities are manufactured in Saskatchewan, Manitoba, Alberta and Prince Edward Island.

The per capita lumber production in Canada in 1909 was about 684 board feet, probably the greatest in the world. The per capita production in the United States in 1909 was 470 board feet. It is probable that with an increased demand due to forest depletion in other countries, with the development of transportation system to northern forest regions, now inaccessible, the forest production of Canada will still further increase even though it has already reached proportions which under present systems of administration the forest of this country cannot permanently support.

There were manufactured in 1909 about 965,000,000 lath, worth about \$2,400,000. About one-half the lath manufactured were spruce and one-third were white pine; cedar, Douglas fir and hemlock made up the remainder. For every 3,000 or 4,000 feet of lumber milled there are produced enough slabs and edgings to make 1,000 lath. It is from this material, at present considered valueless for any other purposes, that practically all the lath produced in Canada is manufactured.

About 2,330,000 shingles, worth \$4,400,000, were manufactured in 1909. Cedar is the favourite shingle wood; three-quarters of the shingles manufactured in Canada

are of cedar, the production being about equally divided between the red cedar of British Columbia and the white cedar of Ontario, Quebec and New Brunswick. Spruce and white pine are the only other species used to any extent for shingles; together with cedar they make up 98 per cent of the total output. The western white pine (*Pinus monticola*), of British Columbia, supplies three-quarters of the white pine shingles of Canada.

As nearly as can be judged almost as much cedar is used for shingles in this country as is sawn for other products.

Two-fifths of the shingles manufactured are produced in British Columbia, almost one-fifth in Quebec; the remaining two-fifths are supplied chiefly by New Brunswick and Ontario.

#### FIREWOOD.

It is estimated that in addition to the sawmill waste used for fuel, about 15,000,000 cords of firewood, valued at \$45,000,000, are consumed yearly in Canada. The use of wood for domestic fuel is general in the country excepting in the areas tributary to the eastern and western coal fields, the comparatively small prairie district where there is no timber, the denuded area of southwestern Ontario, and a few of the larger cities. Much, if not most, of the firewood used comes from the uncleared portions of farms in eastern Canada, and a fairly large proportion of it consists of hardwood timber which would be worth more if manufactured into lumber or other products.

All the common woods are used for fuel, but the species used to the greatest extent are maple, birch, beech and spruce in eastern Canada, tamarack, jackpine, spruce and poplar in central Canada, and Douglas fir on the Pacific coast.

#### POLES, POSTS AND RAILS.

There are used each year about 400,000 poles over twenty feet in length, and about 110,000,000 posts and rails, of a total value of \$11,000,000.

For the poles, which constitute the chief means of support for the transmission lines maintained by the telephone, telegraph, railroad and electric companies, cedar is practically the only native timber suitable. Nearly 95 per cent of the poles used in Canada in 1909 were cedar, mostly eastern white cedar. The remainder were tamarack, spruce and Douglas fir.

Wherever cedar is available it is also the favourite timber for posts and rails, as it is the only common Canadian wood durable in contact with the soil. Chestnut and oak are valuable for post timbers, but are native to only a small area in Canada, and are almost extinct. Posts and rails are usually secured as near as possible to the locality where they are to be used, and where cedar is not available the woods most commonly used are tamarack, spruce, jackpine, lodgepole, pine, poplar and Douglas fir.

#### PULPWOOD.

The cut of pulpwood for 1909 was nearly 1,700,000 cords, valued at \$10,000,000.

Over four-fifths of the pulpwood cut in this country is spruce; spruce and balsam together supply 99 per cent of the pulpwood. Other species included in the remaining one per cent are poplar, hemlock and jackpine. Three-fifths as much spruce is cut yearly for pulpwood as is cut for lumber. About 46 per cent of the pulpwood cut in Canada is domestically manufactured, and about 54 per cent is exported in the raw form to the pulp mills of the United States. Over one-half of the pulpwood domestically manufactured is manufactured in Quebec, about 30 per cent in Ontario, 14 per cent in New Brunswick and 4 per cent in Nova Scotia. Nearly all the pulpwood exported is cut in Quebec. About 70 per cent of all the pulpwood produced in Canada is cut in Quebec.

The pulpwood which is yearly exported from Canada to the United States, keeps running 69 of the 251 pulp mills in the United States. If this pulpwood were manufactured in Canada, it would supply each year about 73 mills of the average size of those already existing. We have now 60 pulp mills in Canada. If we manufactured at home all the pulpwood which we cut, we would have about 133 pulp mills.

#### HEWED RAILROAD TIES.

In addition to the sawed ties, reported and classified as lumber, which Canadian roads, steam and electric, purchased in 1909, there were purchased 9,500,000 hewed ties, valued at \$5,000,000. The species used chiefly for hewn ties are cedar, jackpine, tamarack, hemlock and spruce. The making of hewn ties involves a tremendous waste of timber and leaves a great accumulation of slash in the woods, which as a rule results in the destruction of the entire forest by fire.

#### COOPERAGE.

Two classes of cooperage are manufactured, tight for liquids, and slack for materials other than liquids. Tight cooperage requires a very high quality of wood; white oak is preferred and is used almost exclusively. There is no supply of wood suitable for high grade tight cooperage in Canada, consequently there is practically no tight cooperage industry excepting that which depends upon logs or staves imported from the United States, or excepting a low grade of tight cooperage for less penetrating liquids for which some Canadian woods are suitable. There were manufactured in Canada in 1909, 567,000 sets of tight heading and 12,000,000 tight staves. The greater part of the tight cooperage used in Canada is manufactured in the United States, and of the remainder a good proportion is manufactured in Canada of logs imported from the United States.

Most of the woods common to Canada are suitable for the manufacture of different grades of slack cooperage. There were manufactured in Canada in 1909, 139,000,000 slack staves, 11,000,000 sets of slack heading and 47,700,000 hoops. Four-sixths of the staves were elm, one-sixth were spruce, and the remainder chiefly poplar, maple, birch, beech, basswood and ash. About one-quarter of the heading was poplar, one-quarter elm, and the remainder basswood and spruce. Nearly 90 per cent of the hoops are elm. Over three times as much elm is used for cooperage in this country as is cut for lumber. The total value of the cooperage output for 1909 was \$2,500,000.

#### LOGS EXPORTED.

Public lands regulations prohibit the export of unmanufactured logs from the greater part of Canada. The logs exported are chiefly cut on private lands in Ontario, Quebec and New Brunswick. At times cedar logs are exported from British Columbia. There were exported in 1909, 20,000,000 cubic feet of logs, valued at \$1,000,000. Practically all logs exported go to the United States.

#### ROUND MINING TIMBERS.

The operation of the mines of Canada requires the cutting each year of about 20,000,000 cubic feet of round timbers worth about \$1,090,000. About eight-ninths of this is used for the coal mines and one-ninth for the metal and other mines.

Softwoods form the chief source of supply, and as a rule thrifty young trees are used.

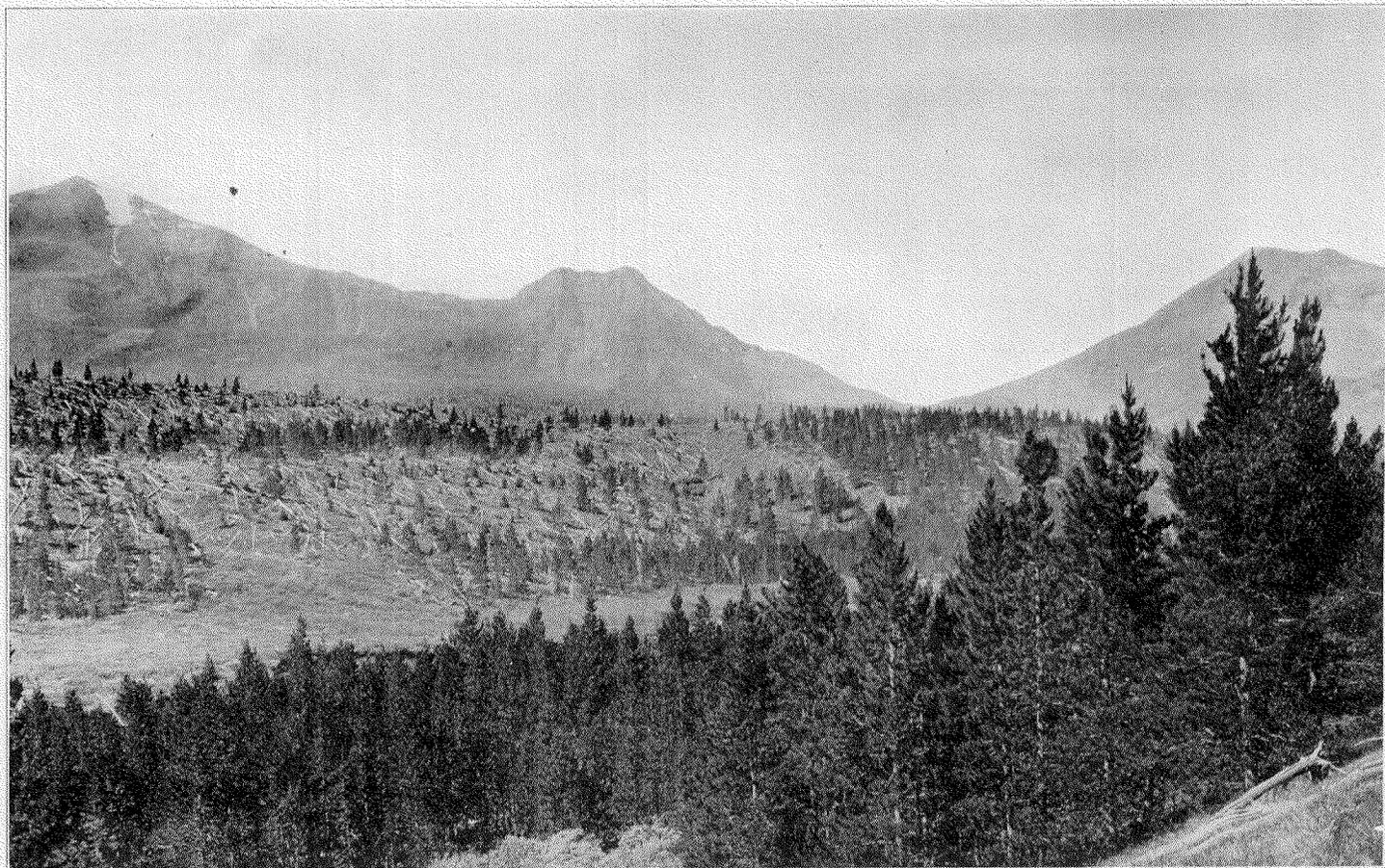


PLATE 3.—Rocky Mountain Forest Reserve—Burned-over mountain-side along Northwest Branch of Oldman river. [Photo A. Knechtel, 1909.]

at divisional points on the railway. These officers have since been regularly inspecting locomotives and have helped towards making the situation along the railways safer.

Another source of danger arises from the right-of-way being frequently covered with combustible material contrary to the provisions of the Railway Act. Representations on this subject were made to the Board of Railway Commissioners and an order was issued by the Board to the railway companies calling their attention to the provisions of the Act in this respect and the necessity for the companies complying with it. The officers of the department acting as agents of the board were also instructed to report as to the carrying out of this requirement.

Patrols of fire rangers have been maintained along lines of railway under construction through forested districts, namely, the Grand Trunk Pacific railway, west from Edmonton, the Canadian Northern railway, north from Prince Albert, and in the railway belt in British Columbia, and the Great Northern Railway also in British Columbia, and the Alberta Central railway in Alberta. On all these lines the right-of-way has been thoroughly cleared of debris and the debris burned on the right-of-way in accordance with instructions. The patrol on such construction work has been thoroughly satisfactory.

#### IRRIGATION.

The specially dry season of 1910 in southern Alberta and Saskatchewan, forced on public attention the water supply problems as one of first importance. The fall of 1909 was unusually dry, little snow fell during the winter, and there was little or no rain during the spring, or until the late summer or fall. Many small streams dried up entirely, so that in such places even a supply of water for domestic purposes was difficult to obtain. The drying up of such small streams also prevented their use for irrigation purposes, and those who waited to irrigate from them during the summer, found that the supply had failed. Where a water supply was available and was used for irrigation purposes, the results showed the benefit of having such a resource to depend upon.

When attending the irrigation convention at Pueblo, Colorado, last September, I had the opportunity of seeing a number of the irrigation districts of the western states, and the development which has been taking place there in recent years, as a result of the irrigation works established is striking. The attitude there towards irrigation is that it is an unmixed blessing, and faith in it is justified by the increased prices of lands in irrigated districts, and the substantial growth and development seen throughout such districts. If irrigation were taken up as seriously in Canada, the development possible would be incalculable.

#### HYDROGRAPHIC SURVEYS.

During the year the first report of the hydrographic surveys in the irrigation district was issued. It brought together the results of the measurement of streams so far as determined up to the time of publication, and will form a most useful reference work for engineers and others having to deal with the water supply in the irrigation district. The work will, however, have to be continued for some years before general averages of sufficient reliability can be obtained.

The divisions of the district covered by the hydrographic survey are Calgary, Macleod, Milk river and Maple creek. This covered the principal streams of the irrigation district, such as the Bow, Elbow, Oldman, Waterton, St. Mary, Milk, Belly and south Saskatchewan rivers, and the streams flowing from the Cypress hills.

A special examination was made of the valley of Moosejaw creek in order to determine the water supply and the storage possibilities on this creek. This creek

Between Split and Assean lakes the country is green. The timber here is between four and eight inches in diameter, and is large enough for pulpwood, but there are only scattered spruce and tamarack trees large enough for ties and piles.

Along the valley of the Hudson Bay railway survey between Manitou rapids and Buttneau lake, a distance of seventy miles, is a level muskeg covered with small trees. The largest trees will make a Number 1 tie, but they are scarce.

There is a belt of green timber about fifteen miles wide west of the Nelson river between Manitou rapids and Split lake. The trees are spruce, jackpine and tamarack; about four per cent of the spruce, and one per cent of the tamarack and jackpine are large enough for railway ties. There are here about four cords of pulpwood per acre, and on the whole tract there are over two million cords of pulpwood. About five per cent of the timber is large enough to make poles sixteen to twenty feet long, twelve inches in diameter at the butt, six to eight inches in diameter at the top, and about fifteen per cent is large enough to make poles ten inches in diameter at the butt.

Mr. Whyte reports that very little of the land he traversed was suitable for agriculture. The soil is a heavy clay, much of it covered with muskeg. The region is comparatively level.

There are fish in all the inland lakes. Fur-bearing animals and game, moose, deer, bear, beaver and otter are fairly plentiful.

Mr. Whyte recommends that an arrangement be made with the Hudson's Bay Company to have a man accompany all York boats travelling through the territory, equipped with fire-fighting tools, and authorized to see that York boat crews extinguish all the fires which they start. He also recommends that two Indians be employed during the dangerous months of June, July and August, one to patrol the country between Manitou rapids and the centre of Split lake, the other to patrol from the centre of Split lake to Gull lake, together with Assean lake.

#### FOREST RESERVES.

A new Bill relating to Forest Reserves has been prepared and presented to parliament. It provides for the withdrawal of the Lake Manitoba West forest reserve in the province of Manitoba, and the Donald forest reserve in the province of British Columbia. The additions proposed by the Bill are as follows:—

#### PROVINCE OF MANITOBA.

	Acres.
Duck Mountain forest reserve. . . . .	97,920
Spruce Woods forest reserve. . . . .	73,280
Total. . . . .	171,200

#### SASKATCHEWAN.

Duck Mountain forest reserve. . . . .	51,840
Beaver Hills forest reserve. . . . .	17,280
Nisbet forest reserve. . . . .	5,760
Cypress Hills forest reserve. . . . .	47,360
Total. . . . .	122,240

#### ALBERTA.

Cypress Hills forest reserve. . . . .	40,320
Rocky Mountain forest reserve. . . . .	11,656,320
Buffalo forest reserve. . . . .	101,760
Total. . . . .	11,798,400

## BRITISH COLUMBIA.

Yoho forest reserve. . . . .	1,103,040
Glacier forest reserve. . . . .	367,360
Total. . . . .	<u>1,470,400</u>

The total area added to the reserves is 13,562,640 acres and the withdrawals are 159,040 acres, leaving a net addition of 13,403,600 acres, and making a total area reserved of 16,128,960 acres.

The Forest Reserves Bill was so framed as to include all lands reserved for parks as well as for forest reserves proper, and authority is given to the Governor in Council to set apart as parks such lands within reserves as are suitable for that purpose. Consequently the parks previously set apart have been included in the Bill. These are Yoho and Glacier parks in British Columbia; Rocky Mountains park and Jasper park in Alberta, which are now included in the Rocky Mountain forest reserve, and Buffalo park, also in the province of Alberta.

The increase in the number and area of the forest reserves and other developments referred to hereafter make it necessary to consider the organization and administration of the forestry work of the Dominion government. The question is not so much at the present time one of legislation or of theoretical speculation or general inquiry but of providing an adequate and efficient organization established on right lines so as to properly study the conditions of each locality and apply the principles of management suited to those conditions.

Protection from fire and enforcement of laws and regulations are the first things to be provided for, and this means a sufficient and efficient staff of forest rangers. The experiences with forest fires last year, both in the United States and in Canada, emphasize strongly the necessity for such a staff and there is no question whatever that the success of a forest administration rests to a very large degree on the intelligence, the faithfulness and the practicability of the forest ranging staff. The work of a forest ranger is arduous and requires a man of energy and strong physique. The qualifications for appointment as a forest ranger should be as follows:—

1. He should be between the ages of twenty-five and forty.
2. He should be sober, industrious and physically fit.
3. He should be able to read and write and have sufficient knowledge of arithmetic to transact the ordinary business of the reserve, such as calculating the dues on permits.
4. He should be able to handle horses and to ride.
5. He should be experienced in work in the woods, should be accustomed to handling an axe and should be able to estimate and scale timber.
6. He should be able to handle a gang of fire fighters or men working on roads or trails.

To ensure these qualifications some test or standard of examination will be necessary, and in the forest service of the United States it was not until a regular plan of examination, in which, however, large credit is given to previous experience, was adopted for the appointment of rangers that that service was placed on an efficient basis.

The district which one ranger can protect will depend on conditions on the ground. The United States forest service consider that there should be an average of one ranger for each one hundred square miles. To equip the Dominion forest reserves with rangers as fully as this standard would demand would mean a staff of 250 rangers. Of permanent rangers now on the Dominion reserves, there are 19, and though this number was increased by temporary appointments during seasons of danger or necessity it still is only a fraction of the force required.

Mechanical means of assistance will be required to make the rangers' work effective, such as lookout stations to give views over large extents of forest, roads

and trails to give quick and easy access in case of fire, means of communication such as telephone lines, and in some cases the clearing of special fire guards.

The experience both in Canada and the United States during the dry season of 1910 demonstrated the absolute necessity both of a sufficient number of rangers and of all the mechanical aids that can be provided.

During the past year one or two small areas of timber were granted to owners of small mills and, before cutting, the timber to be cut was marked by a forester and an agreement was signed by the owner of the mills to carry out the operations in accordance with the orders of the forester and to clean up the debris after operations. The clearing after such operations has a decidedly beneficial effect in case of fire, but the effect of such clearing needs further careful study. Natural reproduction will be the chief means followed to provide for the renewal of the forest, and it must be definitely determined what the effect of various methods of lumbering on natural reproduction is if this purpose is not to be defeated.

At this point the scientific forester is needed and the forester must not only be provided but he must have time to study conditions. It is not to be inferred that a forester is turned out with any rule of thumb knowledge by which he can solve every question that arises. When such products of the schools are found they are usually found to be useless. The pressure of purely administrative work and the necessity for widely extended timber surveys have not given the opportunity for such investigation as is necessary for intelligent work, but with the additions being made to the technical staff it is hoped to overcome this difficulty within a short time.

#### DOMINION PARKS.

The various park offices were inspected last autumn and an accounting and correspondence system established which would meet the requirements of the department.

As the portion of the Calgary-Banff coach road which lies within the Rocky Mountains park was fairly well completed last fall, it was considered advisable to yield to the many requests received from those interested in automobiles for permission to enter the park as far as Banff with their motors. The necessary authority was therefore obtained and regulations established which provide for:

1. The usual precautions for public safety.
2. The use of one direct route to the various hotels in Banff.
3. Running in daylight only.
4. Registration at Banff on arrival, and the issue of a certificate of registration upon payment of a fee of 25 cents.

The protection of game and the prevention of fire have received a good deal of attention and the results have been satisfactory. Game has become more plentiful, and, particularly at Banff, is frequently seen in the neighbourhood, and sometimes even in the streets of the village. A photograph has been secured of a couple of wild mule deer on the lawn of the superintendent's cottage and the superintendent reports that some of the deer have become veritable pets.

The mountain sheep in captivity and the increasing numbers in the vicinity of Banff have already begun to attract artists and other students of natural history, who can now with very little effort study many species at comparatively close range. But while, under the protective system now in force, game has increased, noxious animals have also thrived; and it has been found necessary to take active measures to reduce their numbers. These measures are meeting with good success.

The park game guardians act also as fire wardens and their efforts are reinforced by special help during the dry season. Particular care was exercised last year along the line of railway construction in Jasper park, and a special velocipede patrol was placed on the railway between Canmore, Banff and Laggan. A strict watch was also maintained upon campers to see that no fires were left burning. By these various

means quite a number of fires were extinguished which would otherwise have been disastrous in their results.

About 170 miles of fire guard, 20 feet wide, have been broken in Buffalo park, which, though necessitating a good deal of labour each year to keep in effective condition, is worth the labour and expense for the security it affords to Canada's large buffalo herd.

A number of moose, elk, antelope and other animals have been placed in the various parks in a state of partial captivity with a view to developing a reasonable-sized herd of each species. During the year, 112 buffalo were received from Montana, 30 being purchased from the herd of Mrs. Conrad, of Kalispell, and 82 from Mr. Michel Pablo, of Ronan, who has supplied up to date 710 head. This will probably complete, or nearly so, the shipment of buffalo from Montana. Reports show that all the buffalo have wintered well and that a substantial increase may be expected this year. Outside of this spring's natural increase there are now in the several parks 904 head of buffalo, 832 of which are in Buffalo park, 48 in Elk park and 24 at Banff.

Until within the past year little or no revenue was being derived from the townsites of Canmore in the Rocky Mountains park, and Field in the Yoho park; but some months ago these townsites were thoroughly canvassed and many of the inhabitants were required to apply for leases of their dwelling lots. As a result 51 persons in Canmore and 41 in Field have already applied for leases and are contributing revenue to the department in the form of rental.

Considerable work has been done in the way of repairing the various roads and trails of the park and in opening up new ones. This feature of the work is regarded as highly important, since the tourist is largely dependent upon the roads and trails for his enjoyment of otherwise inaccessible mountain scenery. Further, the more pleasure the park visitor derives in this way the more extended is his stay and the more money does he spend in the park; also the more the marvellous beauties of the parks are made available to the tourist the more widely and enthusiastically are they advertised. One of the principal features of the work planned for the ensuing year is the construction of new roads and trails which will add materially to the number of points of interests.

#### ST. LAWRENCE ISLAND PARKS.

These islands, twelve in number, in the St. Lawrence river, between Brockville and Gananoque, are growing in popularity. Every day during the summer season and particularly on holidays, they are occupied by large numbers of people who take advantage of the pavilions, tables, stoves and other conveniences provided by the government and spend some time in rest, and in quiet enjoyment of the pleasant surroundings. To the cities of Brockville and Gananoque these islands constitute breathing places and objective points for short water trips, the value of which can hardly be overestimated. As nearly all of the most desirable of the Thousand Islands are now in the hands of private individuals, and the public are in consequence debarred therefrom, the wisdom of reserving a number for public recreative purposes has already been demonstrated. Realizing their importance, special attention has been given these island parks by the Forestry Branch. They have been visited each year and their requirements closely noted. As a result two new pavilions have been erected during the year, one on Stovin island near Brockville, which now possesses two pavilions, and one on Aubrey or Burnt island near Gananoque. Several open-air stoves have also been built; and a number of additional tables, benches and garbage cans placed on each island.

The parks on Stovin, Mallorytown and Grenadier islands are looked after by local guardians, while the islands lying west of Grenadier are cared for by Mr. J. B. MacKenzie, of Gananoque, who was recently appointed to succeed the late Mr. O. V. Goulette.

## FIRE RANGING.

The number of temporary fire rangers employed during last year was 107, distributed as follows:—

Railway Belt, British Columbia.. . . . .	37
Calgary District.. . . . .	8
Edmonton District.. . . . .	12
Athabaska District.. . . . .	12
Along Grand Trunk Pacific railway in Alberta.. . . . .	6
Prince Albert District, including Canadian Northern railway..	18
Battleford District.. . . . .	2
Moose Lake District.. . . . .	1
Hudson Bay District.. . . . .	8
Eastern Manitoba.. . . . .	3

The year 1910 was specially dry. Warm weather came in March and melted the snow and afterwards the weather became cold and dry and remained so all spring, thus preventing the growth of new herbage and leaving the dead grass, leaves and other debris of the previous year in the best possible condition for causing fire.

## FOREST FIRES ON DOMINION LANDS, 1910.

The number and causes of fires were as follows:—

Causes.	Number caused by each.
Unknown.. . . . .	343
Not reported.. . . . .	188
Locomotives.. . . . .	184
Settlers.. . . . .	158
Campers.. . . . .	113
Hunters.. . . . .	89
Lightning.. . . . .	55
Incendiary.. . . . .	33
Travellers.. . . . .	18
Indians.. . . . .	12
Land seekers.. . . . .	5
Logging engines.. . . . .	4
Children.. . . . .	3
Surveyors.. . . . .	2
Other causes.. . . . .	20
Total number.. . . . .	1,227

Serious fires occurred in May along the Prince Albert line of the Canadian Northern railway and, fanned by high winds, got entirely beyond control. A careful inspection of the burned district was made and the number of distinct fires reported was 25, only three of which were attributable to any other source than the railway, and even one of these three might have been due to sparks falling on the right of way. The total area burned over was 137 square miles and about 10,600,000 feet board measure of merchantable timber was damaged and destroyed, besides a large area of young growth which becomes a total loss.

In addition to the standing timber destroyed, about 75,000 logs belonging to the Great West Lumber Company were burned on Timber Berth No. 974. At Mistatim a sawmill of the Cowan Construction Company was burned, together with a quantity

of ties and logs, and nineteen freight cars belonging to the Canadian Northern Railway Company were burned. The probable total loss as a result of these fires was half a million dollars.

Of the merchantable timber damaged about seventy-five per cent was suitable for manufacturing into lumber and was accordingly put up for sale on the condition that it should be cut within one year.

Several requests had been made to the railway company to have its right-of-way cleared of inflammable material in accordance with the requirements of the Railway Act, and the failure of the company to do so, was a largely contributing cause to the damage which occurred along this line.

Alberta suffered the most severely of the western provinces. In the northern district, particularly along the Athabaska river, there was heavy loss by fire in the spring, and although no close estimate was made, the damage done affected many millions of feet of timber. In the southern part of Alberta the dry conditions continued well on through the summer, and as a result fires started in every direction, and at one time there was a line of fire more or less continuous of over seventy-five miles. The total area burned over was approximately 494 square miles, and, although this included a considerable area of prairie and scrub land, still the damage to the forest was serious.

The largest area of fire was in the district north from the Crowsnest pass between the Livingstone range and the Rocky mountains. One of the fires which burned over this tract started near a mill just east of the Crowsnest mountain. Several others were started in the vicinity of a ranch known as Boulton's ranch in the valley of the Livingstone river. As there were some seventeen fires started in the vicinity of this ranch, it is quite clear that they were of incendiary origin, but it was impossible to obtain sufficient evidence to get a conviction, and although a case was entered the charge failed. In this tract the quantity of merchantable timber burned was probably about one hundred million feet board measure, and about sixty per cent of the area was covered by young growth from thirty to forty years old.

One of the most disastrous fires was one that swept the valley of the High river for a distance of thirty miles, with a width of five or six miles. This tract was held under license by Mr. N. D. Beck, of Penetanguishene, Ont., and by Mr. John Lineham, of Calgary. It comprised one of the finest areas of mature spruce on the eastern slope of the Rocky mountains, running from 12 to 24 inches in diameter. The mature timber destroyed was forty-five to fifty million feet board measure. Of this a portion can be saved by immediate removal, but it means a disorganization of the business of the licensee and a hasty and wasteful cutting of a tract that could have furnished a regular and steady supply of timber for years to come. The quantity of immature growth destroyed was very large, and this is a total loss.

This fire was caused by a fire lighted as a smudge for horses by a survey party sent in by Mr. A. P. Patrick, D.L.S., to survey a timber berth for Mr. N. D. Beck. Although everything in the valley was dry as tinder at the time, this fire was set out where there was sufficient grass to carry a fire, and where the view from the camp was so obscured by a slight ridge that the fire could not be seen, and could easily get away without observation till it was too late to control it; and that was what actually happened. There was a bare gravel bar in the middle of the river at the camp, and in full view from it. A smudge could have been made there without the slightest danger, and the condition then prevailing demanded every precaution. The fire got away, and with a gale behind it, swept the valley. No fire ranger or staff of fire rangers could stop its progress.

A case was entered against Mr. Patrick, and the local magistrate fined him \$25 without costs. An appeal was made, and the appeal judge quashed the conviction, giving judgment that the fire was caused by an act of Providence. In regard to this judgment, I may say that I went over the evidence carefully myself, and also visited the ground to examine the conditions, and I am perfectly satisfied that the case was one of pure carelessness.

People sometimes talk as if the lumbermen had too great privileges, but here is a case where a timber holding was practically wiped out in two or three days, where he was forced to spend immediately a large sum of money in order to save anything from the wreck, and where his business for future years was completely disorganized. Unless otherwise financially able, it simply meant ruin to him, and all the result of carelessness, of one man not troubling himself to take ordinary precautions which meant almost no additional labour.

Fire occurred also in the vicinity of Elbow and Ghost rivers, causing the destruction of ten to twenty million feet board measure of merchantable timber.

None of the fires in southern Alberta are traceable to the railways, but were caused by the carelessness of individuals. A more thorough organization of this district is being made since it is being included in a forest reserve, but it is quite clear that a considerable campaign of education is yet required before the people and the courts realize that carelessness with fire is criminal in the highest degree.

As the work of the fire ranger is arduous and trying, and frequently one of extreme danger, it is gratifying to know that the work is appreciated, and I quote with pleasure the following extract in regard to one of the Dominion fire rangers which appeared recently in an article in the *Saturday Evening Post*:—

‘It has always been difficult to understand the difference in mental attitude toward the restraints of the law that exists between the American and the man who lives just north of him, across the Canadian line. In that country it is not considered a hardship to pay either reverence to nature or a tribute to those in whose charge lies the protection of nature and natural resources. A thousand miles north of the British line one has seen a fire guardian, the only officer of his kind in a section of country hundreds of miles in extent. A splendid, quiet, self-respecting chap this man was too; one whose word was law and accepted as such unhesitatingly by red and white. Part of this man’s duty was the posting of fire notices, each of which had a good, stiff penalty attached, in all the places where human beings, red or white, were apt to see them—steamer landings, fur posts, traders’ stores. Nor did this man dread the red men so much as he did the newcomers of the white race, always more careless about fires than were the aborigines.

‘One day during a steamer voyage this fire guardian saw smoke on the horizon far inland from the river on which we were travelling. He stopped the boat at once, got his pack together and went ashore. As he figured it out, this fire was forty miles away, probably at the edge of a certain large prairie surrounded by heavy woods. He would reach it in the afternoon of the second day on foot. He would carry most of his camp kit on his back until that night; then would cache some of it, and would leave yet more of it midday of the next day, cached against his return to the river, where he could get supplies or find the trail in and out of the country. He did not know who had started the fire or what shape the fire itself would have by the time he got to it. All alone, a sturdy and self-reliant figure—representing the law, representing civilization even in the wilderness, representing a decent regard of organized society for the organized society that is to follow us—he set out on foot for his wilderness journey across an untracked country. In all of one’s experience with outdoor men, rarely has one met a better, simpler and nobler figure than this one.’

#### FIRES AND RAILWAYS.

Fires along the railways are frequent, and although all of them cannot be charged directly against the railways still they are responsible for the large proportion of them.

Fires from the railways may be caused by sparks from the locomotive escaping either from the smokestack or ashpan. The regulations of the Board of Railway Commissioners require the thorough covering of both with netting of a specially designated character. In order to assist in seeing that these regulations were being effectively carried out officers of the department were appointed agents of the Board

## TIMBER SEIZED.

Reserve.	Number of Seizures.	Lumber.	Logs.	Cordwood	Fence Poles.	Fence Rails.	Roof Poles.	Dues.
		Ft. B.M.	Lineal Ft.	Cds.	No.	No.	No.	\$ cts.
Riding Mountain..	17	60,934	1,702	114	900	.....	36	739.60
Duck Mountain....	1	402,000	.....	.....	.....	.....	.....	2,442.00
L. Manitoba West.	1	1,075	.....	.....	.....	.....	.....	6.45
The Pines.....	2	.....	.....	70	.....	.....	.....	72.50
Cooking Lake.....	1	.....	560	.....	.....	.....	.....	11.20
Total.....	21	464,009	2,262	184	900	.....	36	3,271.75

The work begun in 1908 and carried on in 1909, of marking the reserve boundaries with triangular iron stakes painted red, was continued in 1910. These are placed one mile apart. During the year, 166 stakes were set. These are very serviceable in reducing trespass.

## HAY PERMITS.

Applications for permits for hay are received at any time after the first day of January and permits are granted at any time after the first day of April. It would seem as if applications should not be received until there is indication as to how much hay any area applied for is likely to produce. The first of May is early enough for all practical purposes to receive applications, and the first of June for the issue of permits.

Any actual settler residing in the vicinity of a forest reserve is granted hay for his own use up to forty tons on paying therefor at the rate of 10 cents a ton. Permits are granted to cut hay for barter or sale, or for any quantity over forty tons at the rate of 50 cents a ton.

In case two or more applications are received on or before the first day of April to cut hay on one parcel of land the officer in charge of the forest reserve has authority to arrange a division among the applicants. In case he cannot arrange a division of land to suit the several applicants he calls for tenders for the whole tract, and a permit is issued to the person offering the highest cash bonus over the regular rates. It would seem to be more practical to require an applicant to tender for only the quantity of hay he needs, the highest bidder having first allotment according to the estimated quantity of hay on the whole tract. With present procedure the highest bidder has opportunity to withhold hay that he does not need from other applicants.

The following table shows the number of permits issued for hay, the number of tons cut, and the revenue derived:—

## HAY PERMITS ISSUED.

Reserve.	No. of Permits.	Tons Cut.	Revenue Derived.	
			\$	cts.
<i>Dauphin Agency.</i>				
Riding Mountain.....	64	1,194	145	10
Duck Mountain.....	2	14	2	40
Manitoba West.....	2	22	3	20
<i>Brandon Agency.</i>				
Turtle Mountain.....	33	565	73	00
Spruce Woods.....	16	357	54	50
<i>Regina Agency.</i>				
Moose Mountain.....	20	527	62	70
<i>Prince Albert Agency.</i>				
The Pines.....	12	117	16	90
Prince Albert.....	2	7	1	70
<i>Edmonton Agency.</i>				
Cooking Lake.....	17	7,015	270	00
<i>Medicine Hat Agency.</i>				
Cypress Hills.....	188	7,400	888	00
<i>Calgary Agency.</i>				
Rocky Mountain.....	22	1,680	201	60
Total.....	378	18,898	1,719	10

## GRAZING.

During the year the department has begun the matter of regulating grazing on the forest reserves. On Turtle Mountain reserve a large tract, consisting of ten sections of township 1, range 22, and all of township 1, range 21, west of the principal meridian, is being fenced, the posts being already on the ground. The fence will have a length of 5,361 rods. Settlers will be allowed to graze cattle and horses within the enclosure at a charge of 25 cents a month.

Large grazing problems present themselves on the Rocky Mountain forest reserve. Here fencing would probably be impracticable; but it seems to me that a small fee should be charged for stock permitted to graze on the reserve. Probably the following charges would be fair:—25 cents per head for cattle and horses for the summer grazing season, and 50 cents per head for the entire year; 6 cents per head for sheep for the summer grazing season, and 12 cents for the entire year. Only stock over 6 months old should be counted. Grazing areas should be set aside for sheep, and these should be located on the higher altitudes which are not much frequented by cattle and horses. Persons who allow stock to drift and graze upon the forest reserves should be considered as trespassers.

The number of head to be admitted to any area and the length of grazing period should be fixed by the forest officers.

Applicants for grazing permits should have preference as follows:—

1. Small nearby owners whose stock regularly graze upon the forest reserve and who are dependent upon its use.

2. Larger nearby owners. These should be limited to a number which will not exclude more distant owners whose stock regularly graze, or are wintered on the reserve.

3. Owners of transient stock, that is, stock that has not been regularly grazed upon the reserve.

Milch or work animals owned by bona fide settlers to the number of 10 head should be allowed to graze without permit, and free of charge, as should also the few animals used by prospectors, campers and travellers.

#### REFORESTING.

During the summer of 1910, the forest rangers collected 42 bushels of spruce cones, 44 bushels of jackpine, 100 bushels of bullpine, 100 bushels of lodgepole pine, and 4 bushels of Douglas fir. These were sent to Indian Head, where during the

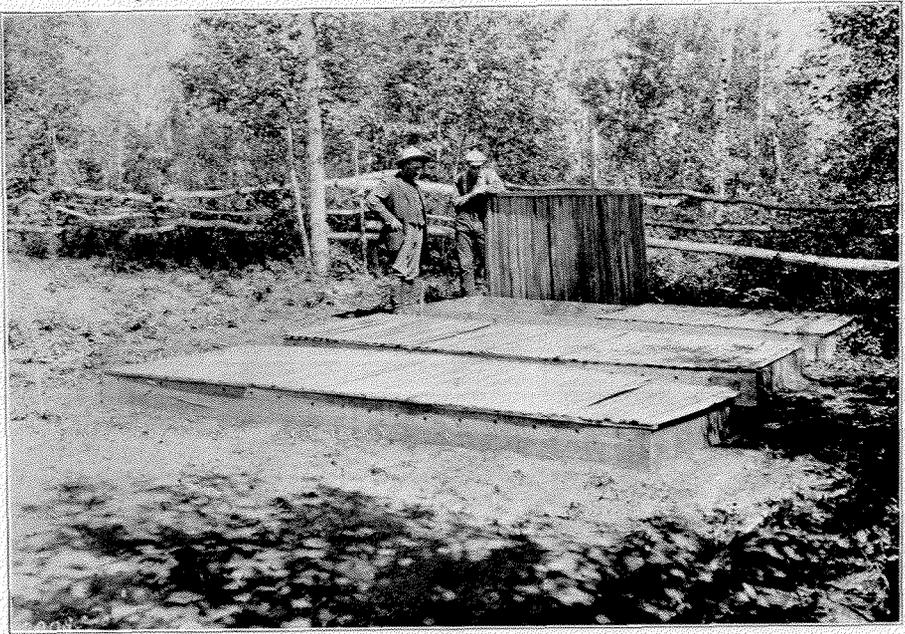


PLATE 6.—Moose Mountain Forest Reserve. Seed Beds in Nursery, July, 1910. [Photo A. Knechte

winter the seed was extracted, some to be used in the nursery at that place, the rest to be used on the forest reserves. The year was not a seed year for spruce, the crop being almost a total failure. Out of the total number of cones of this species collected, only two pounds of seed were obtained.

Four seed beds were made on the Spruce Woods reserve and sown with conifer seeds, and one with the seed of the green ash. The ash did well but owing to the seed having been taken by chipmunks the beds sown with seed of evergreens were a total failure. Two beds made on the Moose Mountain reserve, one of spruce and one of pine are this spring looking fine. Mrs. W. D. Reesor, of Graburn, Alberta, whose husband runs a large ranch on the Cypress Hills, made last summer two beds of jackpine, spruce and lodgepole pine. I examined those beds last fall. One was a decided success, the other had rather a scattered growth. The forest ranger, Mr. W. X. Wright, informs me that the seedlings are all alive this spring.

The forest rangers have made a praiseworthy attempt to do nursery work but they are too busily engaged otherwise to make a success of it. Besides, it requires technical knowledge and is therefore work for a forester.

The department has started a tree nursery on the Cooking Lake reserve in Alberta on a scale sufficiently large to employ the entire time of the forester who has been placed in charge, Mr. C. F. Brandt, who has had training and experience in such work in Thuringia, Germany.

This reserve lies 25 miles due east of Edmonton. It has large areas which are entirely denuded. The soil is a good sandy loam for evergreens. The district has an annual precipitation of 17.48 inches. As this region is covered with poplar bluffs the wind is much broken. The conditions are, therefore, considered favourable for reforestation. Frost is the chief thing to be feared.

The nursery site is on the shore of a beautiful lake and is well sheltered by a wood of tall poplar timber. During the coming summer twenty seed beds will be made and planted with white spruce, Norway spruce, jackpine, lodgepole pine, bullpine, tamarack and green ash.

#### FOREST SURVEYS.

During the summer of 1910 two forest survey parties operated on the eastern slope of the Rocky Mountains, running a line of survey intended to separate the farm land and ranch land on the east from the forest land on the west. This line has been submitted to the Minister of the Interior as a suitable eastern boundary for the Rocky Mountain forest reserve and with some slight alterations has his approval.

The leaders, G. H. Edgecombe and P. Z. Caverhill were assisted by seven students from the forestry schools of Toronto and Fredericton and two from Western Canada College at Calgary. These students all did excellent work.

J. R. Dickson examined a large tract known as the Eagle Hills district in Saskatchewan with a view to having it set aside as a forest reserve. As the forest on the tract, if it can be called a forest, being rather a poor growth of poplar, is largely held by private parties, it was concluded that the tract was not suitable for such purpose.

#### GAME ON FOREST RESERVES.

The forest rangers are required by the department to report the number of game animals observed by them on the forest reserves. The following table is a summary of their reports:—

TABLE OF LARGE GAME.

Reserve	Moose.	Elk.	Deer.	Bear.	Timber Wolves.
Riding Mountain.....	265	203	51	1	0
Duck Mountain.....	50	60	8	1	1
Porcupine.....	10	10	2	5	6
Spruce Woods.....	1	0	0	1	0
Turtle Mountain.....	0	0	1	0	0
Beaver Hills.....	0	1	1	0	0
Cypress Hills.....	0	0	20	0	0
Moose Mountain.....	0	1	1	0	0
Cooking Lake.....	0	30	50	0	9
Monte Hills.....	0	0	2	0	0
Total reported.....	325	305	136	8	7

Besides the large game mentioned in the table the rangers observed numerous small game. Beaver are not numerous but are observed in the Riding Mountain, Duck Mountain and Porcupine reserves.

Prairie chicken are very numerous on all the reserves. Partridge are also in evidence but cannot be said to be numerous. Duck fly up from the lakes like swarms of bees from their hives. Geese are reported as being very plentiful on the Riding Mountain and Beaver Hills reserves.

It will be observed that the game reported from the Saskatchewan reserves are few. The reserves there are not large and they are only four in number. Game animals were formerly abundant upon them but they were hunted so hard that they were very likely to become extinct. The department set aside the Moose Mountain as a game reserve and the Saskatchewan government in 1910 prohibited the taking of game on any of the forest reserves. It is therefore hoped that the reports of the rangers as the years go by will show a gradual increase in the number of game.



PLATE 7.—Moose Mountain Forest Reserve, Sask. Shore of Fish Lake. [Photo A. Knechtel.

#### SUMMER RESORTS.

During the year a summer resort of 115 lots was laid off on the shore of Fish lake in the Moose Mountain reserve, and one of 43 lots on Arbor island in Lake Max in the Turtle Mountains.

#### FORESTRY LECTURES.

For three years the inspector of forest reserves has devoted some time each year to lecturing upon forestry subjects in the towns and cities of Canada. During the year just closed two lectures were presented, one entitled 'The Forests of Canada' and the other 'The Forests of Europe.' Each lecture was illustrated with one hundred lantern slides, coloured as nearly true to life as it was possible to have them made.

The following places were visited:—

Lachute, 1 lecture; Ottawa, 2; Brockville, 1; Toronto, 2; Stratford, 1; London, 1; Strathroy, 1; Norwich, 1; Lindsay, 1; Barrie, 1; Collingwood, 1; Huntsville, 1;

North Bay, 1; Fort William, 1; Winnipeg, 2; Brandon, 2; Souris, 1; Carlyle, 1; Arcola, 1; Melville, 1; Saskatoon, 2; Battleford, 1; Calgary, 3; High River, 1; Macleod, 1; Taber, 1; Vancouver, 3.

The lectures were presented before boards of trade, Canadian clubs, horticultural societies, agricultural associations, colleges and churches. In the prairie provinces about fifteen minutes time was given at each meeting to a discussion of tree planting on city streets. At nearly every place visited the audience room was crowded with people interested to learn about the forestry work being done by the forestry branch.

#### RANGERS' MEETINGS.

At the close of each fiscal year for three years a convention of forest rangers has been held to discuss the work of the past year and to plan for the ensuing year. This spring, the meeting was held at Saskatoon, and the work of the convention occupied two days. All the rangers of Manitoba and Saskatchewan were present. On each evening, the inspector of forest reserves lectured, on the first evening in the Opera House and on the second in St. John's Hall, where the convention was held. These audience rooms were placed at the disposal of the rangers free of charge by the Board of Trade.

The following resolutions passed at the meeting to be submitted to the superintendent of forestry, will give an idea of the nature of the discussions:—

#### *Resolutions.*

1. Certain postmasters designated by the forest rangers should be given authority to take requisitions for timber permits.
2. No lumber permit should issue between March 15 and May 15.
3. Timber taken from the reserve in trespass should bear double dues. If taken for commercial purposes the timber should also be confiscated.
4. Hay permits should issue upon the reserves upon application made through forest rangers only or upon their approval.
5. Applications for hay permits should be received by the land agent on or after the first day of May in each year, and permits should be issued on or after the first day of June in each year.
6. In cases requiring that tenders should be received for hay, the tenders should be made for not more than the quantity of hay stated in the application.
7. Certain settlers living near the reserve should be appointed as fire wardens, whose duty it should be when fire occurs to notify the forest ranger and get out men enough to put the fire under control. For this service, the warden should receive \$2.50 per day only for the time during which he is employed in extinguishing the fire, ordinary men to receive \$2 a day.

Respectfully submitted,

A. KNECHTEL,

*Inspector of Forest Reserves.*

## No. 4.

## REPORT OF J. R. DICKSON.

DEPARTMENT OF THE INTERIOR, FORESTRY BRANCH,  
DAUPHIN, MANITOBA, April 1, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry,  
Ottawa.

SIR,—I beg to submit the following report of my work during the departmental year beginning April 1, 1910:—

Acting under the inspector's instructions I was engaged during April in locating and examining several tracts in the Riding Mountain reserve, suitable for small saw-mill sites. Separate reports on these, with maps and recommendations, were duly rendered. Ranger A. McLeod assisted me with the first four areas, situated on the eastern slope of the mountain, and Ranger W. Middleton with the last one, just north of Lake Audy, township 20, range 20.

The local situation is this: the supply of desirable spruce timber in this reserve within easy reach of the surrounding settlers having now been largely exhausted, the necessity arises of utilizing the more interior stands. The green logs cannot be teamed with economy more than six miles, so that it would seem advisable, under careful logging rules and such other regulations as are found necessary to guard the forest, to admit a number of small mills. In my opinion the present fixed area method of controlling the work of these mills might advantageously be changed. The timber is not in large quantities but in small scattered bluffs, and the present hard and fast square mile rule is not elastic enough to be practicable. Dependence should be placed rather upon volume control than upon area. All interests concerned have nothing to lose and much to gain by this simple change.

Given proper supervision, I see no reason why the entry of small mills should not benefit both the settler and the forest. To the settler it opens up a further supply of cheap lumber by making it possible to draw upon the now inaccessible material the removal of which is highly desirable. Constant and effective supervision of all the logging operations will also be possible, which is the first important step in forest management and improvement.

In April, also, I attended the annual ranger convention at Brandon, where a number of the more pressing local problems were considered and discussed. Such meetings are most helpful and valuable to all concerned.

## HUDSON BAY RAILWAY SURVEY.

On May 1, you instructed me to meet the inspector at Winnipeg and complete arrangements for taking charge of an exploration party along the proposed Hudson bay route, north of The Pas in Keewatin.

On May 15, I left for The Pas with Messrs. D. R. Cameron, J. A. Doucet and J. L. Bremner as assistants. There I secured four Indian canoe-men and a cook, and upon the arrival of our supplies left on May 26 for Moose lake and the north. On Metishto portage two of my men fell sick and were forced to return. This shortage of men, together with delays caused by storms on Moose lake, and by the Nine-mile portage, lost us considerable time.

For the first month, that is, until Setting lake was reached we passed through a muskeg country. Except for a varying percentage of rock outcrop, usually in the form of low ridges covered by stunted jackpine, this great muskeg extends northeast along the whole course of the Metishto river and appears, in fact, to blanket almost the entire watershed in this region, between the Saskatchewan and Grass river systems.

From Setting lake to Cross lake by way of Paint, 'Wintering, Landing' and Sipiwesk lakes, we traversed some two thousand square miles of the so-called clay belt, which contains upon the whole from fifty to seventy-five per cent of arable land, and probably will have a good agricultural future.

#### OBJECTS SOUGHT.

In accordance with instructions received, the central object of the party was to make a rapid reconnaissance survey of the country adjacent to the proposed route of the Hudson Bay railway, between The Pas and Split lake, the work of such a survey being in this case to locate, estimate and map in the areas of commercially valuable timber that could be made use of in the work of constructing the railway. Any such timber within eight miles of the line was classed as available, and beyond this distance, wherever waterways gave access, timber under eight inches in diameter at breast height was considered not merchantable, as being too small for industrial use. All areas not timbered commercially, that is, carrying only young growth of no marketable value, were passed over with a general description of the existing growth as to species, size and quality. Areas of greater or less agricultural value were mapped in when possible, and a study made of their local flora, natural products, and probable cropping possibilities.

A second object, considered almost as important as the above, was that of fire ranging and patrol work. A constant lookout for forest fires was maintained, and the various travellers met with were urged to acquire the habit of extinguishing their camp fires. In addition, durable fire notices, written in English, Cree and Chipewyan, were posted at trading posts, portages and camping places along our route.

#### METHODS.

All along the chain of watercourses and lakes which we followed, inspection lines by compass were run back into the adjoining country at three to six-mile intervals, and tied in to the railway survey to locate them upon our map. The men inspecting the strips worked singly, and were able to travel from four to eight miles from the line and return each day. Field glasses were carried, and by climbing tall trees at advantageous points it was possible to examine in a sufficiently thorough way the surface of the country and nature of the tree growth. That region is specially favourable for rapid and accurate descriptive work, being so uniform in character. The men while on field work also took notes on the forest types, drainage, soil conditions and reproduction.

#### GENERAL DESCRIPTION OF THE COUNTRY.

*Topography—Drainage.*—The surface of the country is undulating to nearly level, almost monotonously so. However, away from the railway line in places there are areas of rough rolling granite. Wherever exposed, the bedrock has been rounded, polished, worn down nearly to a general level by prolonged weathering, and the subsequent erosion of the ice age. The divides between watercourses are low and poorly defined. The general exposure north of Moose lake is toward the north-east. This slope is very slight, only twenty inches per running mile. Furthermore, this fall is not uniform; one half occurs in the form of three rocky escarpments.

each of which produces cataracts on rivers flowing into the Hudson bay. The above facts clearly explain the presence of the vast muskegs and sluggish drainage which obtain in that country. The whole region is intersected by a network of lakes and streams, large and small, at least ten per cent of the gross surface of the country being water.

#### ROCKS AND SOILS.

The bedrock for one hundred miles northeast of The Pas is limestone, largely dolomite, and it frequently obtrudes through the muskegs or shallow soil which blankets it. These outcrops form low, narrow, flattened ridges, rising just above



PLATE 8.—Spruce and larch (tamarack), of pole size, between The Pas, N.W.T., and Lake Winnipeg. (Spruce flat type). [Photo J. R. Dickson, 1910.]

the general level of the muskegs and nearly always running northeast and southwest.

In the area of gneiss and granite farther north, the whole future, so far as agriculture or forestry is concerned, depends upon the general depth of the boulder clay. From the mere fact that it is a 'drift' deposit, this depth constantly varies. There are large areas of almost pure rock outcrop and muskeg of little value, even for timber production, but in general the soil, which is almost uniformly a very tenacious boulder clay, but nearly free of boulders, averages from four to twelve feet in depth; deep enough, therefore, for cultivation.

It must be understood that no hard and fast boundary lines can be laid down as showing the confines of this clay belt. The change is often so gradual, and so many as yet unknown factors enter, such as soil depth and the chance of drainage, that any estimate of the bounds, area and average arable content of this belt could, with our present very limited knowledge, be given only in general terms.

#### NATURAL RESOURCES.

*Minerals.*—According to our observations the region we covered is not well supplied with economic minerals. The dolomite limestone north of The Pas would doubtless furnish a good quality of building stone for use on the prairies. Farther north is the Laurentian country of granite, gneiss and schists. Here traces of

copper and iron ore were seen at two points, and possibly further prospecting might discover valuable deposits.

*Fisheries.*—The deeper lakes all abound in white fish of the finest size and quality. Sturgeon also are abundant in Split and Sipiwesk lakes, while pickerel, pike and suckers are caught everywhere. Only the railway is needed to furnish a market for this industry.

*Game and Furs.*—Beaver are scarce, but the other fur bearers are still fairly numerous. Wolves, moose and caribou are plentiful. More stringent game laws will shortly be needed when the country is opened up to white hunters. Under proper regulation this region should furnish a large permanent revenue from hunting and trapping.

*Timber.*—In the region we traversed only five species, viz., spruce, poplar, tamarack, birch and jackpine, are of any possible commercial value, and of these only the spruce is large enough for sawmill purposes or railway ties. Poplar, birch and pine are too short, spindly, limby and crooked for any use, save fuel or pulpwood, and the tamarack has been killed by insect attack. We found only a remnant of green tamarack large enough for ties on an island in Sipiwesk lake. Black spruce is the predominating species in all that region, but only on occasional well drained spots does it exceed four to eight inches in diameter. The jackpine is similarly useless for tie material.

The white spruce, therefore, is the only species large enough to furnish construction timber, saw logs or ties, and the supply is very limited. In the first place this species occurs only along well drained river and lake margins, and in the second the fires of the past hundred years have destroyed nearly all the old stand.

To sum up, less than half of one per cent of the area we surveyed now carries merchantable timber, a fringe along parts of the lower Metishto and upper Minago rivers, and on a few islands and points in the larger lakes. There is probably enough timber available to build the rough construction work of the Hudson bay railway. During the scummer we found, all told, on Crown land, some 360,000 ties and 9,500,000 feet, board measure of lumber.

*Pulpwood.*—Just at present the timber is too young and small upon the whole to be cut at a profit for pulpwood, but in the absence of fires for twenty years the now eighty-year old stands of four to eight inch timber can be profitably cut for this purpose, and it is probable that within the next quarter of a century one or more mills will be established along the Nelson river.

*Fuel.*—From the mere size of the country and density of the oncoming stands of young timber, the supply of firewood is enormous. Being so remote from settlement, however, it has no present commercial value.

*Piles.*—As a result of past destruction by the saw fly and bark beetles, almost no green tamarack large enough for piling now remains in the whole region. Unless by importation, the only local choice left is between dead tamarack and the largest black spruce.

*Young Growth.*—As a general rule, to which, however, there are endless local exceptions and variations, the young growth is approximately either forty or eighty years of age, the former being now one to four inches in diameter, and the latter four to eight inches, but none yet large enough for ties. Scattered trees from older stands occur in this second growth, but not in sufficient number to repay the cost of lumbering. In general, because of the dense stands and poor drainage, the growth rate is very slow. It varies directly with the drainage conditions.

*Forest Enemies.*—Fire, insects and wind in the north country are all very destructive agents, and all inter-related. The fire loss and danger are appalling. Within the past century, two great general fires along with numerous intermediate ones have reached every part of the region we traversed. These great periodic fires accompany each cycle of dry seasons. Where the soil is thin the fire is disastrous, the root-zone being destroyed.

The bark beetles have not only completed the destruction of the large tamarack, but are everywhere at work to-day killing off the scattered patches of mature spruce which have escaped past fires. These beetles work in colonies, destroying the trees, and the moment they create an opening in the close growing stand, each following wind storm enlarges it. Then a fire inevitably follows and the destruction is complete.

*Climate and Natural Products.*—The climate and the soil conditions are the two basic factors which largely determine the agricultural possibilities of a region, and a study of the existing flora answers many questions as to the climate and soil. On well drained spots as far north as Split lake, the flora is almost identical with that in the Riding mountains of Manitoba. Yet, the country just south and east of Split lake is four hundred miles due north of the Riding mountain reserve. These localities, therefore, must lie under the same summer isotherm, or nearly so, and the total heat received during the growing season will be nearly the same in each district.

Two other factors which hasten vegetation in this northern clay belt are first the low elevation, only 500 to 700 feet above the sea, and secondly, the large proportion of sunlight during the growing season, because of the very long day. No doubt, also, the large relative area of water surface has an important influence in preventing late spring and early fall frosts. At Cross lake post in the summer of 1910, no damaging frost occurred during a period of ninety days. To me the climate seemed most favourable for farming operations; showers fell every week and the growth to maturity of the native vegetation was amazingly rapid.

Barley and oats mature there in fifty days, and this rule of early maturity is general, applying also to fruits, roots and vegetables; so that there would appear to be little difficulty from a climatic standpoint in growing all the hardier products of the temperate zone. The average temperature of the growing season is about 60° F. The size, yield and quality of the many species of wild fruits enjoyed during the last week of July in the vicinity of Split lake were remarkable. Vegetables flourish. At Cross lake post we ate potatoes weighing 1½ lbs. each, dug on the last day of August.

As the timber is cleared off and the land broken up the growing season will become longer and more dependable and the insect pest will abate or disappear. The winters are enjoyable and the proximity to Hudson bay should mean a good market and cheap supplies. A colony of pioneer settlers from northern Europe should, if possible, be induced to locate in this clay belt upon completion of the Hudson Bay road.

The soil is similar to that around Cochrane, New Ontario, which is yielding large returns under right treatment. Better drainage is the first and great requisite. However secured, aeration is necessary to change the present cold, sour, impervious soil to a warm, porous, friable one of the right texture, full of bacterial life, available plant food and resulting fertility.

#### THE FIRE PROTECTION PROBLEM.

The Indians, the constant winds, the severe electrical storms, the enormous area of the region, the lack of any means of rapid communication, and the highly inflammable nature of the dense stands of small coniferous timber which prevail, combine to make the problem a very difficult one.

Summer travel through the region is practically all confined to the several main canoe routes, and it may be assumed that all the local forest fires caused by the agency

of man start from unextinguished camp fires along these water highways. Against lightning, of course, no protection is possible, nor can the country remote from the waterways be patrolled. Probably all that can be done at present is to organize a more or less complete patrol of the main travelled canoe and transport routes. The construction and operation of the railway to Hudson bay will add a new element of danger from which the forest should be adequately safeguarded.

#### SURVEY IN EAGLE AND BEAR HILLS, SASKATCHEWAN.

Acting under the inspector's instructions I went next, in early October, to study and report on existing conditions in the Eagle and Bear hills, which lie some fifty miles west of Saskatoon; and, further, in case conditions pointed to the need of it, to project a tentative boundary for one or more forest reserves in that district. This survey, together with some office work at Dauphin, occupied the month of October, and reports, maps and recommendations covering same were then forwarded to the inspector at Brandon.

#### EAGLE HILLS CONDITIONS.

This range is located in townships 35 and 40, inclusive, of range 13, west of the third meridian, with a fringe in the adjoining ranges; these hills are rough, rolling and vary between 1,800 and 2,400 feet above sea level. There is no bedrock within two hundred feet, but fifty to sixty per cent of the surface is more or less thickly sown with granite boulders, which fact practically forbids cultivation. The soil is in general a light, sandy loam over a gravelly loam subsoil. Being a glacial deposit, however, it varies in places almost to a stiff boulder clay.

*Timber.*—Twenty-six years ago there was not less than one hundred and fifty square miles of thrifty half-grown poplar in the north end of these hills; to-day only a badly culled remnant of some two square miles remains. Two great general fires, in addition to many smaller ones, destroyed the rest.

Over these brulés a many-aged forest of young poplar has sprung up, as conditioned by the fires, but none of it is even of fuel value yet. This scrubby growth, mixed with willow, now covers about one hundred and ten square miles of area outside the Indian reserves. All told, there is perhaps 25,000 cords of fuel wood, which is the sole source of local supply for fifty to one hundred miles in any direction.

Within easy reach and dependent upon it are the famous Tramping lake and Cut-knife districts, now rapidly being settled; likewise dependent is that well settled prairie along the main line of the Canadian Northern railway from Warman to Battleford, and also the vast plains west and southwest of Saskatoon, in round numbers ten thousand square miles of country, which looks and must look to the Eagle Hills for timber.

*Game.*—If this area of woodland were protected from fire and extended over the entire hills it would form an urgently needed game haven. The fires of recent years have driven out the elk, but numbers of mule deer and some antelope still find shelter in the scrub. This is the only band of deer in all that part of Saskatchewan, and only the immediate creation of a reserve will save them from extinction. Moreover, I found chicken and grouse abundant, and the many small lakes literally covered with ducks and geese.

*Alienations.*—A sprinkling of homesteaders have come in within the past two years, most of them during 1910, but practically no land has yet been broken nor permanent improvements effected.

*Climate and Water Supply.*—The beneficial effect of this belt of scrub on the local climate and water supply is remarkable; in fact, in itself is a sufficient argument for a permanent forest reserve on these hills. The claim of local settlers that

'the rain follows the scrub' was well borne out this dry year (1910), by their large yields as compared with the crop failure seen fifty miles south. Then, also as a summer resort where picnic parties could escape from the heat and monotony of the plains and refresh themselves in the cool enjoyment of the forest, such a reserve would do much to make life more pleasant and attractive in all the country round. Finally, every resident spoken to was strongly in favour of creating such a reserve and urged that the matter be undertaken at once.

*Recommendations.*—I located a boundary for two forest reserves on these Eagle hills, of 284 and 40 square miles respectively, and strongly recommended that they be forthwith set aside, rangers appointed, effective fireguards ploughed where necessary, and the remaining timber used without waste, under careful supervision.

*The Bear Hills.*—In the Bear hills, a bleak, boulder-strewn range, just south of the Eagle hills, conditions are quite similar. On some twenty-five square miles there is a scrubby growth of willow and poplar, all under two inches diameter, but the rest of these hills are bare. Here provisional boundaries were run for three small reserves, to include in all 121 square miles. This land is hilly, stony, sandy, or all combined, and, upon the whole, more suitable for forestry than agriculture. It should be reserved and handled as grazing land until such time as the afforestation work can be proceeded with. Several species of forest trees would flourish there if once started and protected from the inroads of prairie fires.

*Locating Sawmill Sites in the Riding Mountains.*—The first half of November was spent in the Riding mountains just south of Gilbert Plains, locating suitable sites for two sawmills inside the reserve there. Ranger Robertson assisted me with the first one, a poplar proposition on Ranch creek in 10-23-22 W. principal meridian. An excellent location was obtained here, with easy grades for logs and lumber, and having five to ten years' cut of poplar in sight.

White spruce in merchantable quantity is getting scarce now west of the Strathclair road, and it took some exploring to locate a good spruce site. Finally a bluff containing some 1,200,000 feet, board measure was found in 16-22-21 W. principal meridian, also a suitable spot for a mill close by, on southwest fork of the Vermilion river. Reports and maps covering above work were sent the inspector, who instructed me to continue this mill site location work north of Erickson and Elphinstone on the south side of the reserve. Proceeding to Erickson, a good spruce location was obtained on the Whirlpool river in township 18, range 19, where a square mile was cruised, containing 900,000 feet B.M.

In the Lake Audy locality, however, only some 150,000 feet of much scattered timber could be found, not enough for a mill, and it would seem that the only remaining area of commercially valuable spruce on the south slope of the reserve is that lying just north of Clear lake.

The first half of December was spent at office work in Dauphin, and the rest of the month on annual holiday leave. During January and first half of February, I was working in Ottawa under your instructions, completing a report and map of the work done by my party last summer, north of The Pas.

The remainder of the fiscal year was spent partly in the Dauphin office obtaining data for the annual report of the department, and partly in driving with Supervisor McLeod into various parts of the Riding Mountain reserve, to study on the ground the existing forest conditions and the necessary steps to more efficient protection and management.

Up to the present time the products of the reserve have been freely used to secure the immediate convenience and welfare of the inflowing settlers, and this is necessarily the case in any newly opened country, and most desirable; only, let us no longer allow removal of the mature timber in a haphazard way, but direct it with a view to ensuring the future welfare and permanence of the forest. Cutting opera-

tions can be systematized so as to secure a thrifty natural reproduction.

A plan for introducing such a system of silviculture in spruce and poplar on this Riding Mountain reserve is now being worked out under direction of the supervisor, and will shortly be submitted for your consideration.

Respectfully submitted,

J. R. DICKSON,

*Assistant Inspector.*

### No. 5.

#### REPORT OF G. H. EDGECOMBE.

DEPARTMENT OF THE INTERIOR, FORESTRY BRANCH,  
OTTAWA, December 27, 1910

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry,  
Ottawa.

SIR,—I beg to submit the following report on the work which I have carried on under your instructions during the past summer.

#### NATURE OF THE WORK.

The work, which was to determine the southern portion of a line which should be fixed as the eastern boundary of a forest reserve to be established on the eastern slope of the Rocky Mountains, was of the nature of a reconnaissance survey and included the mapping of the forest type and physical features. In following instructions to exclude all agricultural land, a line at about 4,100 feet altitude was found to divide the agricultural from the non-agricultural and true woodland. However, on account of local conditions a line at an elevation of 4,800 feet and over was often followed.

#### DISTRICT TRAVERSED.

The district traversed was from the Elbow river, in township 22, range 4, west of the 5th meridian, southward to the international boundary in township 1, range 27, west of the 4th meridian.

#### TIME IN SURVEYING DISTRICT.

The party, which was at first composed of six members, but in August was increased to eight, started work June 10. A loss of three weeks time was caused in July and August by forest fires. On account of this delay and to hasten the work, two members of the party, H. C. Belyea and C. H. Morse, spent most of September in collecting data along the Crowsnest branch of the Canadian Pacific railway, while the rest of the party continued the work southward. The international boundary was reached October 10, when the party broke up.



PLATE 9.—Riding Mountain Forest Reserve—Fire-line on East Boundary of Reserve, showing Iron Stake marking Boundary. [Photo A. Knechtel 1910.]

## THE BOUNDARY LAID DOWN BY ORDER IN COUNCIL, MAY, 1910.

In May, 1910, an order in council established a line as the eastern boundary of a reserve on the above slope. Upon examination it was found that for a large part of this southern district this boundary would not fulfill the object of the reserve, which is to supply timber and wood to the prairies and protection to the watershed. It includes only an Alpine country, a large percentage of which is above the tree limit, and the remainder inaccessible as regards timber supply for years to come. Large portions of it have been burned over, leaving bare eroded hillsides which were formerly covered by a thin soil and coniferous wood growth.

Again, eastward of the line established by order in council extended a district (in the northern part as far east as fifteen miles) the topography, altitude, nature of the soil and wood growth of which would warrant reservation. This country, on account of its light soil and elevation, is unfit for agricultural settlement, and is strictly woodland with its valleys of open grazing. It is in this district that, on account of local demand and transportation, wood will be first used in preference to that in the interior country, and by the present methods of lumbering will become deteriorated as regards future supply and protection to the waterflow.

## TOPOGRAPHY.

The topography of the country examined varies greatly, from a foothill region in the north to the Rocky Mountains proper, which change abruptly into the rolling prairie in the south.

North of the Oldman river the foothills extend east of the Rocky Mountains proper from six to eighteen miles; long, bare ridges, such for instance as the Fisher, Highwood and Livingstone ranges, intervene and reach an altitude from 6,500 to 7,500 feet. Going southward these ranges and hills gradually decrease in altitude, merging into the prairie; and the mountains, which reach in their eastern summits an altitude of 6,800 feet and over, break abruptly into it. In the very south the Wilson range extends eastward for about nine miles along the international boundary. Just south of the boundary it reaches an elevation of 9,000 feet, but on this side the elevation ranges from 5,000 to 6,500 feet.

The trend which the eastern edge of the foothills takes is the same as that of the Rocky Mountains; that is, from the international boundary northward to the south fork of the Oldman river, the trend is N. 35° W., from this point north to the Highwood river it is N. 12° W., and thence goes north in a direction of N. 35° W.

The hills reach an altitude above their valleys of 400 to 1,500 feet. West of the proposed line the valleys become more deep and the slopes which east of this line are moderate become very steep.

The rivers, the Elbow, the Highwood, the Oldman, the Waterton and the Belly, cut at right angles to the ridges and have their sources well up in the mountains, while the creeks find their sources in the first range of hills. The creeks are numerous and supply a large amount of water to the prairies. Last summer, both the rivers and the creeks were fordable at all times, but they are subject to floods, especially in the month of June, which result from the sudden melting of the snow on the mountains and ranges above timber lines.

All the above named rivers with the tributary creeks join the South Saskatchewan river, and are thus a large factor in the water supply of the prairies hundreds of miles away. The maintenance of an equable waterflow is thus desirable, and the importance of the protection to the watershed is evident.

## ( ROCK AND SOIL.

The geological formation of the foot-hills is mainly cretaceous, with infoldings of shale and coal, while that of the mountains is of the older paleozoic rock.

Above timber line, which can be placed at an altitude of about 6,100 feet, the hill-tops and mountains become bare, exposing sandstone and cherty and silicious limestone. Most of the hills at lower elevation have stony outcrops.

In the valleys the soil is a sandy loam with a subsoil of gravel. It is deep, but light. As the elevation increases the soil becomes thinner, verging into gravelly and stony, the depth of soil varying with the moisture and slope

#### TREE GROWTH.

The principal trees found on the eastern slope are:—

*Picea Engelmanni* (Engelm.) Engelmann spruce.

*Picea canadensis* (Mill B.S.P.) White spruce.

*Pseudotsuga mucronata* (Sudw.) Douglas fir.

*Pinus Murrayana* (Murray.) Lodgepole pine.

*Populus balsamifera* (Linn.) Balsam poplar.

*Populus acuminata* (Rudb.) Cottonwood.

*Populus deltoides* (Marsh.) “

*Larix Lyallii* (Parl.) Lyall larch.

The Engelmann spruce is one of the chief timber trees. It is found on the northern exposures and along river bottoms, where the loam is fresh to moist. The maximum diameter noticed was 42 inches, breast high, while the height was 130 feet. Young spruce seedlings require shade, and thus the more light-requiring lodgepole pine and poplar are apt to obtain possession of the land, forming a temporary type. Thus along the slope are large areas, where fires have destroyed the former spruce forest, which is now replaced by one of lodgepole pine and poplar.

Like Engelmann spruce the white spruce was chiefly associated with northern exposures, and also on stony slopes. Of the merchantable spruce, however, Engelmann spruce appeared to be the chief timber tree, but the white in favourable conditions produces excellent saw material.

Black spruce comes in on the edge of muskegs and on barren stony slopes. Southward it gradually disappears.

Douglas or red fir was found mostly on southern exposures and only on the lower slopes. It occurs in small groves in the open, likely caused by the protection of its thick bark, while other species have been killed by fire. The quality is variable. In seeding qualities it appears very much like the spruce. The diameter ranges to 34 inches and the height to 90 feet.

Lodgepole pine, like spruce, was found mostly on northern exposures, but also on the dry sandy soils. The seed is especially adapted for seeding up fire burnt areas; and on the eastern slope where repeated fires have traversed, lodgepole pine predominates, and thus will become in the future the principal commercial tree. It is now much used for mine props. It rarely exceeds 18 inches in diameter, and in height 85 feet. In close stands it grows very tall and straight, with little taper and free from branches, thus producing excellent poles.

The poplars apparently come in anywhere from rich river bottoms to thin stony soils of the upper slopes, but they are favoured by the southern exposures. On the river bottoms and lower slopes, the balsam poplar becomes a merchantable size from 8 to 28 inches in diameter, and up to 18 inches is apparently sound. The poplars are, however, mostly small in size, forming a fire or temporary type.

The larch was noticed only near the international boundary, where it was found on the upper rocky exposures of Table mountain at an elevation of over 5,500 feet. It was of a stunted, scrubby growth.

The forest type on the eastern slope is a temporary type, caused by the repeated fires. Merchantable spruce occurs in a comparatively few small blocks, which are mostly under license. Lodgepole pine from 5 to 40 years old covers over 40 per cent of the area.

Prairie chicken are very numerous on all the reserves. Partridge are also in evidence but cannot be said to be numerous. Duck fly up from the lakes like swarms of bees from their hives. Geese are reported as being very plentiful on the Riding Mountain and Beaver Hills reserves.

It will be observed that the game reported from the Saskatchewan reserves are few. The reserves there are not large and they are only four in number. Game animals were formerly abundant upon them but they were hunted so hard that they were very likely to become extinct. The department set aside the Moose Mountain as a game reserve and the Saskatchewan government in 1910 prohibited the taking of game on any of the forest reserves. It is therefore hoped that the reports of the rangers as the years go by will show a gradual increase in the number of game.

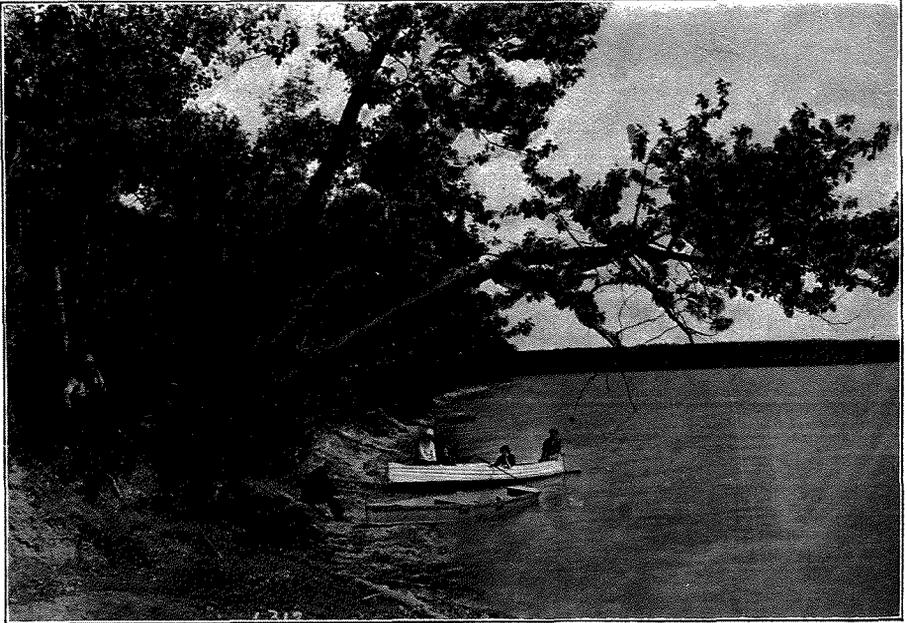


PLATE 7.—Moose Mountain Forest Reserve, Sask. Shore of Fish Lake. [Photo A. Knechtel.]

#### SUMMER RESORTS.

During the year a summer resort of 115 lots was laid off on the shore of Fish lake in the Moose Mountain reserve, and one of 43 lots on Arbor island in Lake Max in the Turtle Mountains.

#### FORESTRY LECTURES.

For three years the inspector of forest reserves has devoted some time each year to lecturing upon forestry subjects in the towns and cities of Canada. During the year just closed two lectures were presented, one entitled 'The Forests of Canada' and the other 'The Forests of Europe.' Each lecture was illustrated with one hundred lantern slides, coloured as nearly true to life as it was possible to have them made.

The following places were visited:—

Lachute, 1 lecture; Ottawa, 2; Brockville, 1; Toronto, 2; Stratford, 1; London, 1; Strathroy, 1; Norwich, 1; Lindsay, 1; Barrie, 1; Collingwood, 1; Huntsville, 1;

each of which produces cataracts on rivers flowing into the Hudson bay. The above facts clearly explain the presence of the vast muskegs and sluggish drainage which obtain in that country. The whole region is intersected by a network of lakes and streams, large and small, at least ten per cent of the gross surface of the country being water.

#### ROCKS AND SOILS.

The bedrock for one hundred miles northeast of The Pas is limestone, largely dolomite, and it frequently obtrudes through the muskegs or shallow soil which blankets it. These outcrops form low, narrow, flattened ridges, rising just above



PLATE 8.—Spruce and larch (tamarack), of pole size, between The Pas, N.W.T., and Lake Winnipeg. (Spruce flat type). [Photo J. R. Dickson, 1910.]

the general level of the muskegs and nearly always running northeast and southwest.

In the area of gneiss and granite farther north, the whole future, so far as agriculture or forestry is concerned, depends upon the general depth of the boulder clay. From the mere fact that it is a 'drift' deposit, this depth constantly varies. There are large areas of almost pure rock outcrop and muskeg of little value, even for timber production, but in general the soil, which is almost uniformly a very tenacious boulder clay, but nearly free of boulders, averages from four to twelve feet in depth; deep enough, therefore, for cultivation.

It must be understood that no hard and fast boundary lines can be laid down as showing the confines of this clay belt. The change is often so gradual, and so many as yet unknown factors enter, such as soil depth and the chance of drainage, that any estimate of the bounds, area and average arable content of this belt could, with our present very limited knowledge, be given only in general terms.

#### NATURAL RESOURCES.

*Minerals.*—According to our observations the region we covered is not well supplied with economic minerals. The dolomite limestone north of The Pas would doubtless furnish a good quality of building stone for use on the prairies. Farther north is the Laurentian country of granite, gneiss and schists. Here traces of

capacity of the pine. As we came east near the prairie, aspen takes the place of pine in this type.

The most common species found are:—

*Pinus Murrayana*—Lodgepole pine.

*Picea Engelmanni*—White spruce.

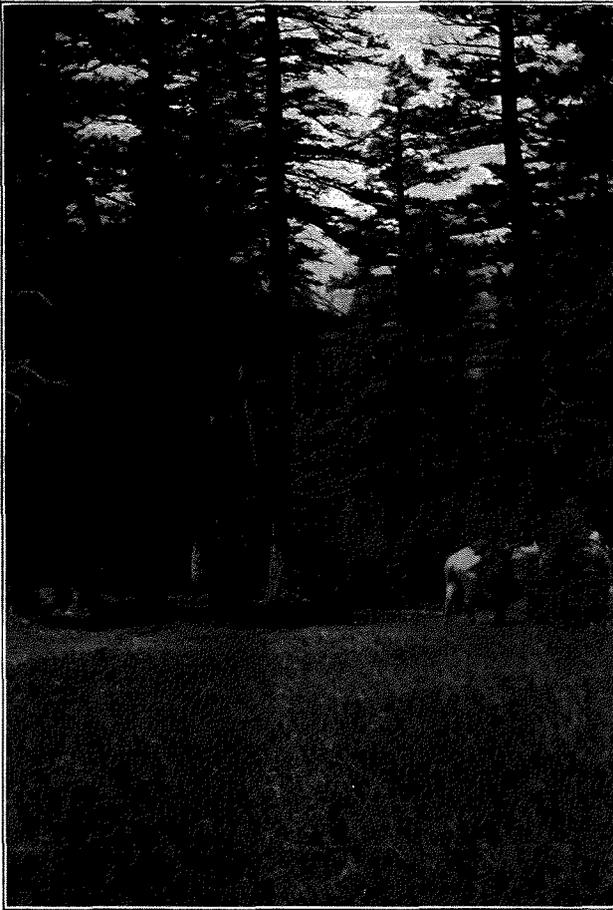
*Populus tremuloides*—Aspen.

*Populus balsamifera*—Balm.

*Pseudotsuga mucronata*—Douglas fir.

*Picea mariana*—Black spruce.

Besides these are found in limited quantities *Abies balsamea*, *Larix americana* and *Betula alba* var. *papyrifera*.



[Photo P. Z. Caverhill, 1910.  
PLATE 10.—Douglas Fir in the Bow River Valley, Alta.

#### FISH AND GAME.

Fish abound in all the streams and lakes. The following varieties were noticed: Cut-throat trout, bull trout, grayling, pike and suckers. These in many cases reach a large size. Bull trout are caught weighing seven to eight pounds and much larger ones were reported.

no further examination was made. If portions of the land seemed to contain less than 5,000 feet B.M. per acre a further and detailed inspection was made of each forty by paced or chained traverses from the points previously marked on the compass lines. On account of the sudden changes in the character of the timber the usual method of narrow strips and plots was not considered sufficient for an estimate of the timber, so strips five chains wide or large plots were estimated by counting all the trees on them and measuring one tree out of every five. By comparing the density and size of the timber on these strips with that of the rest of the forty an esti-



[Photo G. Cromie, 1910.  
PLATE 11.—New Road to Squatter's Ranch, Adams Lake, B.C.

mate was made of the timber on the forty. In all cases the deduction for cull was determined by cutting into occasional trees showing signs of defect and by noticing stumps on lumbered areas or surveyed lines, and this was checked by consulting local cruisers and lumbermen as to their practice in the district.

The point of the amount of cull in timber is very important in this district, the amount having to be deducted as unsound varying as much as from 10 per cent to 80 per cent in cedar and hemlock. In fact, this alone is largely responsible for the difference in estimates of the same timber often found even among the most experienced cruisers here.

The data taken on each forty acres in this detailed inspection were as follows:—

1. Elevation above sea level and adjoining lakes or rivers.
2. Slope and roughness of the ground.
3. Character of soil and subsoil.
4. Water content of the soil.
5. Amount and character of young forest growth.
6. Amount of firewood, slash and dead timber.

1. Description of general character of land elevation, slope, soil, &c.
  2. Description of timber species, stand, condition, &c.
  3. In cases where persons are located on the timber berth in question all information which would be useful to the department in deciding on the action to be taken in dealing with those persons and their claims.
  4. My recommendation as to such lands which I considered should be withdrawn from the berth, stating the reasons therefor and the time for withdrawal.
- A map or sketch of the examined berth should accompany the report.
- I also received instructions to examine unsurveyed boundary lines of certain

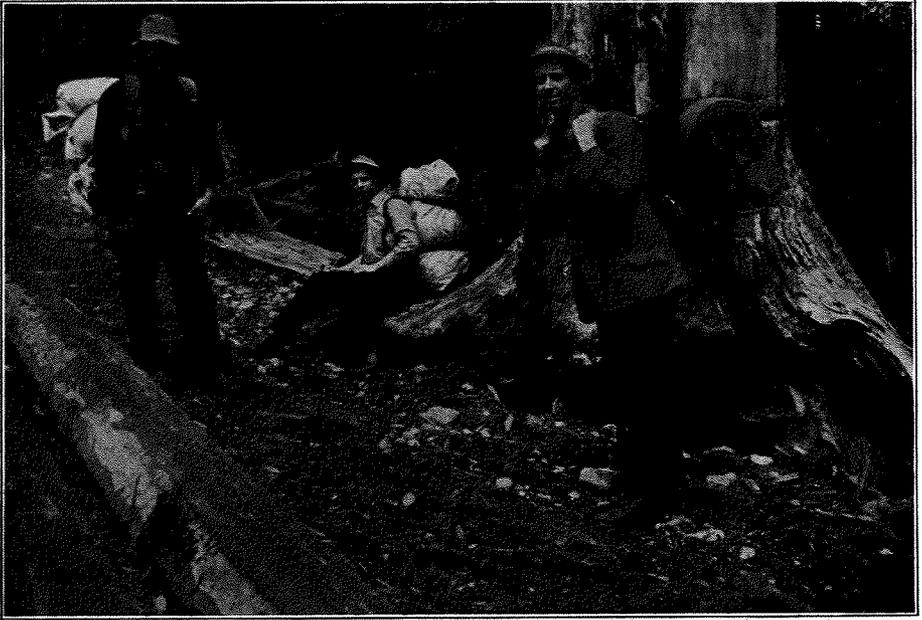


PLATE 12.—Packing on the Trail, Coast District, B.C. [Photo H. C. Wallin, 1910

timber berths where the survey had not been completed, the surveyor stating that the country was inaccessible.

Three forest students were employed as assistants, one from May 1 and the others from the beginning of June. The work was carried on without interruption from May 1 to the last day of September, when my assistants left the employ of the government to return to their respective colleges. From that time on I have either travelled alone or engaged a temporary assistant to accompany me on my trips of examination. During the months of January, February and the first half of March the weather conditions have been very unfavourable for any field work and I have had to devote most of my time to writing reports, work on volume table, &c.

During the past year I have examined:—

All the limits south of the Fraser river from the Pacific coast east to Cheam mountain, not including the limits situated on the Chilliwack river.

All the limits north of the Fraser river from the Pacific coast east to the Harrison lake, which are coming into contact with settlement.

Seventeen limits have been examined in regard to uncompleted surveys of boundary lines and reports forwarded to Ottawa.

Altogether about 100 square miles were cruised, which area I would classify as follows:—

## 1. As regards timber:—

	Sq. Miles.
Land covered with green timber, approximately. . . . .	72
Land which has been burned over; forest cover established. . . . .	23
Land which has been burned over; forest cover not established. . . . .	5
Total. . . . .	100

Approximately 12 square miles of the examined area had been logged over or were at the time of examination under logging operations.

## 2. As regards soil:—

	Sq. Miles.
Lands only suitable for silviculture. . . . .	67
Lands which from the character of soil or from other reasons such as location were considered more valuable for other purposes than silviculture. . . . .	33
Total. . . . .	100

Of these 33 square miles, letters patent have been issued on 8 square miles, with a reservation of the timber to the Crown.

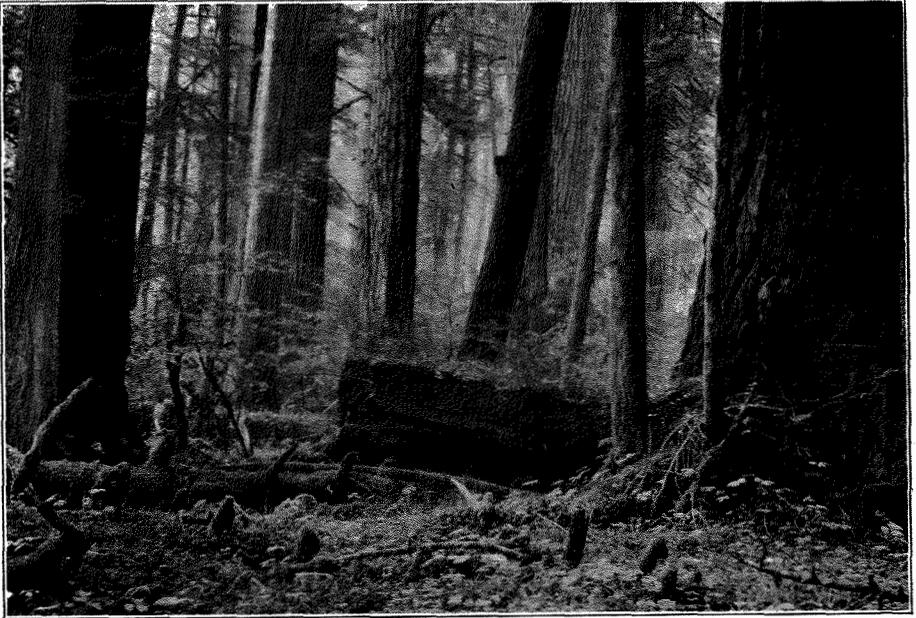


PLATE 13.—Douglas Fir and Cedar Timber in Coast District, British Columbia. [Photo H. C. Wallin, 1910.]

## SQUATTERS.

It is obvious that in a country like British Columbia, where comparatively little land is available for agricultural purposes, it is a very difficult undertaking to keep home-seekers away from timber limits and in particular from such limits as are

partly or entirely surrounded by homesteaded or patented lands. A considerable number of squatters were found on limits so situated and their number is increasing steadily.

Some of the squatters have quite extensive clearings, good buildings and other valuable improvements, and live permanently on their 'homesteads' as they often call the land they claim; others build only a small shack, where they only stay occasionally, generally when out of work, the main object of their buildings being to show that the land is taken up.

It is not only that the squatters cut and destroy timber belonging to the government, but the danger of fire is always greatly increased on a limit that is inhabited by squatters. It is my opinion that very strict measures have to be adopted to stop the squatting on timber limits. The fact that all these settlers have the opinion that, when the land is thrown open for settlement, they will have prior claim, has greatly encouraged the practice of squatting within timber limits.

I would respectfully recommend that it should be plainly pointed out to them in future that such claims would not be recognized. It is often a dangerous thing for the lumberman to attempt to evict men who are liable to set fire to the timber.

#### TIMBER.

The predominant species of coniferous trees on the examined area were Douglas fir (*Pseudotsuga mucronata*), red cedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*). These three species generally form the stand. The distribution varies. Pure stands of any of these species occur only occasionally. Fir sometimes forms

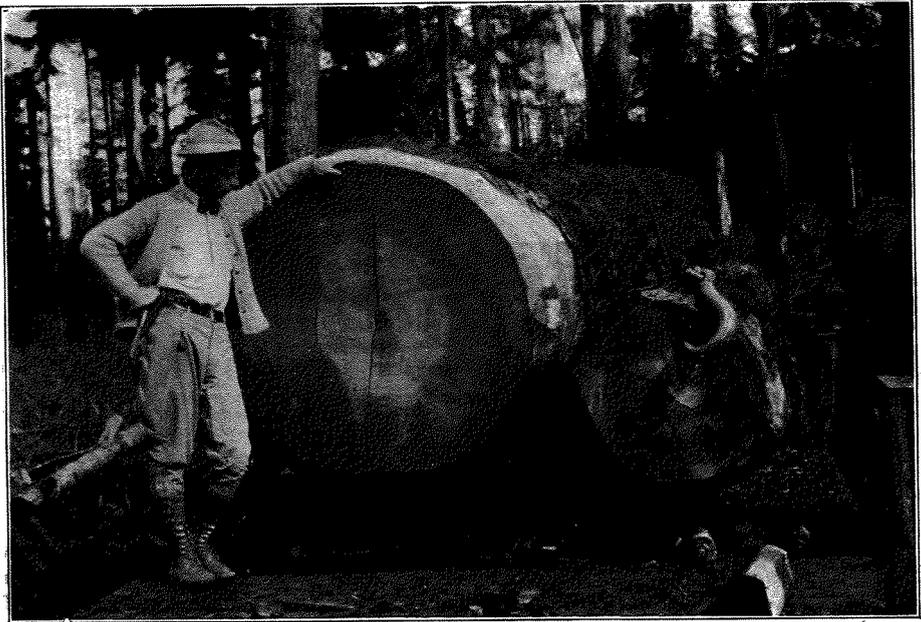


PLATE 14.—Large Douglas Fir Log (small end) near Raskin, B C. [Photo H. C. Wallin, 1910.]

nearly pure stands on rocky mountain slopes. On most flats or in creek bottoms cedar is generally the dominant species, with hemlock or sometimes Sitka spruce as a common associate.

Viewing the examined area as a whole, however, I would say that the average stand consists of 60 per cent Douglas fir, 30 per cent cedar, 9 per cent hemlock and 6213—6½

has been badly burned over, leaving very few seed trees, I have found that the fir reproduction predominates, while on cut over lands which have not been burned or



PLATE 15.—Timber in Coast District, British Columbia. Photo H. C. Wallin, 1910.

burned only lightly the tolerant hemlock is predominating. The reproduction of cedar depends more, it would seem, on soil and location than other factors of site.

Your obedient servant,

H. CLAUGHTON-WALLIN.

No. 9.

REPORT OF JAMES LEAMY, CROWN TIMBER AGENT.

DEPARTMENT OF THE INTERIOR,  
DOMINION LANDS AND CROWN TIMBER OFFICE,  
NEW WESTMINSTER, B.C., November 29, 1910.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry,  
Ottawa, Ont.

SIR,—I have the honour to submit herewith my report for the season 1910, covering the protection from fire of the forest in that part of the railway belt under the control of this office. In the eastern part of the district, during the months of

time, and as this is the class of tree most suitable for windbreaks under our conditions, it is hoped to encourage this planting to some extent by such a distribution. But very limited stocks of evergreens are propagated by the commercial nurseries in the west and the average farmer cannot afford to purchase more than a few specimens, at the current prices, which does not permit the setting out of a closely planted windbreak, which would be of inestimable value on the farm.

Your obedient servant,

NORMAN M. ROSS.  
*Chief of the Tree Planting Division.*

### No. 14.

## REPORT OF ARCH. MITCHELL, ASSISTANT IN TREE PLANTING DIVISION.

FOREST NURSERY STATION,  
INDIAN HEAD, SASKATCHEWAN, March 9, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry,  
Ottawa, Ont.

SIR,—I have the honour herewith to submit my third report as assistant in the Tree Planting Division of the Forestry Branch.

After finishing the office work in connection with the distribution of trees from the nursery, I went on May 5 to Calgary to plant the demonstration plot in Victoria Park, the exhibition grounds there. The main plot is situated at the entrance to the grounds, and will be seen by every one who comes to the exhibition, and cannot fail to be beneficial to the country as an object lesson in prairie planting. It consists of both deciduous and evergreen trees suitable for that portion of Alberta, and arranged so as to demonstrate the best methods of mixing the varieties. There are besides, seed beds of maple and ash, and of the conifers likely to succeed on the prairie, and also cutting beds of willow and Russian poplar.

The whole has been well fenced by the corporation, and the plantation will no doubt in time be very useful in demonstrating what can be done in the way of tree planting on the prairie.

Besides the main demonstration plot, there are two other smaller ones illustrating the grouping of hardy shrubs and perennial flowers. This is a subject very few people know much about, and no planting demonstration is more necessary than this in Alberta.

After finishing this planting I went about a week with a new inspector, Mr. W. Macdonald, down the Soo line, to give him some idea of the actual work in the field. About June 25, I went again to Calgary to take charge of the forestry exhibit at the fair there. This was similar to last year and created a great deal of interest. After Calgary, I went to the Brandon exhibition as in previous years. This year the Brandon exhibit has also been improved by the addition of two demonstration plots in the grounds close by the building, in which the forestry exhibit is held. One of these is used to demonstrate methods of propagation, and consists of seed beds of conifers, maple and ash, and cutting beds of willow and Russian poplar. The larger plot is really a test of various conifers as well as a demonstration. The trees are arranged in irregular groups with a curved walk passing through the plot to admit of their being studied, and the arrangement will no doubt in time be of much interest to the visitors at the exhibition and of value to the province.

After Brandon I entered on my usual inspection trips. My district this year was along the Grand Trunk Pacific in Saskatchewan and Alberta, and the Pheasant Hills branch of the Canadian Pacific railway, west of Saskatoon, as far as Cadogan, Alberta.

There were 537 men on my list, and of these 253 will get trees in 1911, making a percentage of 47 who had land ready for planting. This is a little less than last year, and the slight decrease may be safely ascribed to the very dry season, which tended to cripple the farmer's resources and induced him to postpone his planting operations.

The prosperity of a locality has usually a very direct influence in stimulating tree planting.

The planting conditions of 1910 were without a doubt the worst ever experienced in the history of the Planting Division. Spring opened early, but was followed by a sharp freeze, which delayed packing quite considerably, and this was followed by a rapid thaw, and when the young leaves were beginning to appear, a succession of heavy frosts destroyed them. To cap these unusually untoward conditions, the driest summer on record over the greater part of the country followed.

The percentage of living trees in the 1910 plantations is consequently considerably lower than other years, and yet, considering a season when very little else than the trees grew in many localities, it was wonderful.

Among deciduous species the percentages were: Maple, 71 per cent; ash, 76 per cent; elm, 87 per cent; cottonwood, 8½ per cent; willow, 65 per cent; Russian poplar, 49 per cent.

The elms were probably the best ever sent out by the forestry branch, and yet only 87 per cent were living. In a normal year it would have been 97 per cent or over. The cottonwoods did very badly, but fortunately the number sent out was not very great, only about 10 per cent of the whole.

Quite a percentage of the willow and Russian poplar cuttings failed to strike, but this was possibly attributable in many cases to faulty planting as much as to the dry weather. Instead of planting cuttings deeply in the ground and leaving about an inch sticking out of it as directed in the printed instruction sent them, some men seemed to read the directions the reverse way, and planted the cuttings about two inches in the ground, leaving five or six inches sticking out. Loose planting, too, had a good deal to do with keeping down the percentage.

Quite a number of conifers were sent out this spring, and it is unfortunate that the first trial distribution should have been in such a dry season. They were sent only to men who had already succeeded well with their deciduous plantations, and who could consequently be expected to plant and take good care of the trees. They thus were cared for just as well as could be looked for in such a widespread distribution. The jackpines and tamaracks probably suffered more than the others, as they are the first to commence growth.

The following is the percentage of living trees among the conifers:—Tamarack, 47 per cent; Scotch pine, 61 per cent; white spruce, 68 per cent. A very small quantity of Norway spruce was distributed, and very few of them were in my district, but 100 per cent were living. The Norway spruce usually has a good root system, and bears transplanting well, and of course a good deal depends on the planter.

I returned to the office on October 28. On November 28, I took part in a series of institute meetings west of Saskatoon, in connection with the extension work of the University of Saskatchewan. There were nine meetings altogether, and the attendance was very good, and a good deal of interest was manifested in tree planting and kindred subjects.

Your obedient servant,

ARCH. MITCHELL,

*Assistant in Tree Planting Division.*

## No. 15.

## REPORT OF A. P. STEVENSON.

DUNSTON, MANITOBA, February 1, 1911.

R. H. CAMPBELL, Esq.,  
 Superintendent of Forestry,  
 Ottawa, Ont.

SIR,—I have the honour to submit the following brief report on my work as tree planting inspector in connection with the work carried on in Manitoba by the Forestry Branch of the Department of the Interior during the season of 1910.

On June 1, I visited the Forest Nursery Station, Indian Head, Saskatchewan, to see Mr. Ross and discuss with him the lay out and management of the inspection work in my district for the coming season and also to receive lists of persons to be visited, together with writing case and all necessary papers used in connection with the work. It was also a great pleasure while there to note the valuable work being carried on at the Forest Nursery Station, in the way of object lessons, in the testing and growing of all the hardy varieties of trees, in order to prove their suitability for western conditions. Without doubt it is an inspiration to the inspectors and will encourage them in their work of instruction and inspection among the people during the summer.

Inspection work commenced on June 4. This was ten days earlier than in previous years and was found necessary on account of the very early spring and the increased number of persons on the list furnished to be visited during the season.

The winter of 1909-10 was a fairly average one, with rather less than the usual amount of excessive cold weather. In the southern part of the province of Manitoba the snowfall was light and on this account a considerable amount of killing back was noticed among the trees that were planted out the previous year, especially on knolls or high locations that were exposed to the full force of the wind.

Where a fair depth of snow lay no injury was noticeable, showing conclusively the great benefit a good covering of snow is to young plantations of trees, and in fact to everything of a perennial nature planted in the ground in this country.

Conditions were just right in spring for the planting of young trees, everything looked favourable and during the early part of June I never saw the young plantations looking better, but dry weather set in about the middle of the month and continued almost unbroken for three months.

The district assigned to me for the inspection of tree plantations was the Canadian Pacific main line in Manitoba, and all south of that to the international boundary. The Canadian Pacific Pembina branch and the Carman-Hartney sections suffered most from drought. To the north of these lines conditions as to rainfall gradually improved.

On the Canadian Pacific Pembina Branch and Canadian Northern Carman-Hartney sections I would estimate that barely 50 per cent of all the trees set out, spring of 1910, are alive at the present time.

On the Glenboro' branch 65 per cent are alive, on the Canadian Pacific main line 75 per cent are doing well, and when the conditions as to rainfall are considered this showing is remarkably good and could only be accomplished when trees were planted in well prepared land.

Maple were the best drought resisters, and cottonwood the worst. The drought appeared to have no injurious effect on trees set out in previous years, well established plantations showing as good results as to growth and vigour as in previous years. Insect pests were scarce and did no damage worth noticing. Even the vagabond gall, so troublesome in other years on the cottonwood, was entirely absent.

The care and attention given the young plantations during the past season are fully equal to that of any other year, and planters are realizing as never before how necessary it is to have their land thoroughly prepared before planting, and years of experience in inspecting forest tree plantations under almost every condition have only deepened the conviction that this is one, if not the main, essential to the successful growing of trees on the prairie.

We find the Russian willow to be still growing in favour, its quick, sturdy, vigorous growth, when thoroughly established, being very much in its favour. Too shallow planting is often the cause of considerable loss with this tree, more than with some other varieties, on account of its being usually propagated by cuttings, and the advice has to be repeated time and again as to the necessity of sinking the cutting deeply into the ground so that only one bud is left exposed.

Occasional inquiries were also made, in the newer districts, about the Russian poplar. I strongly advise against the planting of this tree in southern Manitoba, principally on account of its liability to disease. On the other hand I notice it is doing well in some parts of Saskatchewan, being so far exempt from disease. Where this condition exists the tree is well worth planting where quick results are desired, as it is certainly the hardiest quick growing variety we know of.

I notice also the increasing interest taken by our tree planters in the laying out and growing of a snow-break in connection with their shelter belt proper. The necessity for a snow-break becomes more and more evident as the trees in the shelter belt grow older, and the danger increases of their liability to be injured and broken down by heavy snowdrifts among the trees. Russian willows are perhaps the trees best adapted for the purpose of a snow-break, on account of their tough, pliable limbs bending under the weight of snow.

The number of applicants on my list to be visited during the season was 640 and of these 200 were persons applying for the first time to get trees.

All inspection work for the year was completed by November 16. During parts of the months of November and December, 1910, and January, 1911, a series of Farmers' Institute meetings were addressed in the province of Saskatchewan. The meetings were all held in the prairie districts of the province. A series of Farmers' Institute meetings will also be held in the province of Alberta during the month of February, at which I will speak. At all these meetings the subjects dealt with are the outlining and explaining of the co-operative tree planting scheme of the Forestry Branch, the proper preparation of the soil before planting trees, their proper management after planting, right distance of trees from buildings, and all further advice that may be necessary for the successful growing of a tree plantation on the prairie.

Your obedient servant,

A. P. STEVENSON.  
*Inspector Tree Plantations.*

## No. 16.

## REPORT OF ANGUS MACKINTOSH, TREE PLANTING INSPECTOR.

HEADLANDS, SASKATCHEWAN, December 26, 1911.

R. H. CAMPBELL, Esq.,  
 Superintendent of Forestry,  
 Ottawa, Ont.

SIR,—I have the honour to submit to you a brief report on the tree planting inspection work with which you intrusted me in 1910.

The territory allotted to me was that intersected by the Pheasant Hills branch of the Canadian Pacific railway from Kirkella to Saskatoon, and the Prince Albert railway from Saskatoon to Regina. I had about 680 names on the lists given me and I began work on June 7 and finished on November 7.

I found that quite a number of the plantations between McAuley and Tantallon were injured by the severity of the previous winter, but as the trees were not killed outright most of them will spring from the ground again. There were also a good many failures amongst the trees planted out in that district last spring, mainly on account of the dry state of the soil at the time of planting, and lack of rain after. As I worked westward, however, matters began to improve, and both the old and young plantations looked better. That satisfactory state of things continued until I got to the northeast side of the Last Mountain lake, when short crops and many failures amongst the last planted trees again told their tale of lack of rain. The country from there to Saskatoon, and from Saskatoon to Chamberlain also suffered more or less from drought, and the percentage of failures amongst the young trees was larger than usual. I estimate the average loss amongst the trees planted last spring, over the territory that I inspected, at 12 per cent. In places it was more; in other places less. I may here remark that the failures would have been fewer if all the recipients removed the trees from the railway stations on their arrival there, and either planted them right away or heeled the bundles into the ground and watered them, instead of allowing them to lie for days at the railway, and after that putting the packages unopened into cellars or outhouses until a convenient time for planting presented itself. The largest percentage of failures was amongst the cottonwoods, and next amongst the elms, maples, and willow cuttings. The ash with its tufty fibrous roots came out best.

The older plantations, excepting those already referred to in the eastern part of my territory, stood the winter well, and cases of cutting back or killing by the storms were few and far between.

To the delight of quite a number of the best tree-planters on our lists, a few conifers were distributed this year; but I am sorry to say the failures amongst them have been many. About 50 per cent of the tamarack and 35 per cent of the spruce and pines failed. The failures amongst the former are doubtless partly due to the trees having come direct from the swamps of Manitoba, and therefore did not have the fibrous roots of nursery raised trees; while the failures amongst the spruce and pine may be partly attributable to the planters who handled them as if they were the deciduous trees they had been accustomed to get. A few minutes' exposure of the roots of conifers to a hot sun or drying wind is the death of them and I think that some, at least, of the trees distributed have been lost in that way. Then, the drought in many cases was detrimental. I have tried to impress upon the recipients the necessity of great care, and I hope the next lot distributed will fare better.

It gives me pleasure to be able to give a very favourable report of the progress the plantations that were made four, five and six years ago are making. They have got hardened and acclimatized to their bleak and storm swept surroundings, and although the annual growth may not be so great or marked as in the case of younger trees, there is no headway lost. Many of them are now attractive features of landscapes much in want of the attractiveness that only trees can give to bleak and bare places. But much remains to be done yet before the homes of the settlers shall all have as their setting even a fringe of trees.

Your obedient servant,

ANGUS MACKINTOSH.  
*Inspector Tree Plantations.*

### No. 17.

#### REPORT OF WALTER B. GUITON.

FOREST NURSERY STATION,

INDIAN HEAD, SASKATCHEWAN, March 9, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry,  
Ottawa, Ont.

SIR,—I have the honour to submit to you my fourth annual report of tree planting inspection work as carried on through the co-operation of the Forestry Branch, Department of the Interior.

Since sending in my last report, I have been employed during the winter in the general routine of office work until March 28, when I went out to the forestry station to assist with the planting and the general spring distribution of trees until June 1, when I commenced inspection work.

The districts assigned to me were: Main line Canadian Pacific railway, from Regina west to Maple creek; Crownsnest line, Seven Persons to Cowley; Alberta irrigation lines, Stirling to Cardston, and New Dayton to Coutts, Alberta.

There were 1,099 applicants on my lists to visit this summer; 600 were new applicants, 347 of whom will receive trees. The others will be carried over another year, thus allowing them more time to cultivate their ground. The total number of both old and new applicants to receive trees in the spring of 1911 will be 577. The total number of trees recommended by me this year was 577,100, but owing to the scarcity of stock this has been reduced to 423,750, thus bringing the average of trees per man to about 750.

The idea of the applicant raising his own trees from cuttings and seed, was advocated this summer, and met with the approval of many.

On June 1, I commenced my tour of inspection at Pense on the Canadian Pacific railway main line. About this time we had an exceptionally heavy snowfall which seriously retarded the progress of the already well advanced tree growth. The tender shoots of young seedlings were slightly frozen, but this setback has apparently not injured the young trees to any great extent. I found the trees which had been planted several years doing exceedingly well, and shading the ground sufficiently to prevent a vigorous growth of weeds, which are such a menace to the younger plantations.

The conifers, especially the Scotch pine, have done very well in this district where instructions have been followed regarding the shading of plants until they recovered from the strain of transportation and replanting. From Grand Coulee to Pasqua the tamarack or larch were, when seen, very brown, but hopes were expressed at that time for another growth. The plantations already planted were one continuous example of the good work of the Tree Planting Division. Amongst this year's plant-

ings, I noticed repeatedly, cases where willow cuttings had been planted too shallow, with a consequent poor result. That the willow cuttings when properly planted will afford in a short space of time a splendid protection for the other trees when planted on the outside edge, is already illustrated in many places along my route. In the district from Morse to Moosejaw and extending 70 miles south, the country is quite bare of timber. There are places, however, where the efforts of settlers in the direction of tree planting are a pronounced success, provided the trees are suitably protected from stock, and the trees thoroughly cultivated between the rows during the growing season.

The remaining districts in Saskatchewan were from Swift Current to Maple creek. Here I found conditions altogether different from those in the districts already mentioned. Lack of rainfall accounted for a number of failures, but shallow planting was one of the chief causes.

On August 12, I commenced inspection work in Alberta at Seven Persons. This district, as in all parts of Southern Alberta, suffered to a large extent from drought. The trees planted in previous seasons have stood the winter well, but the growth this year has not been so good as in former years, averaging from 6 to 12 inches. Trees, like other crops in Alberta, suffered from lack of rainfall, but where planted on well worked summer fallow, the percentage of failures was small, illustrating what can be done even with a minimum of rainfall.

The coniferous trees did not stand the transplanting and rough treatment to which many of them were subjected. From lack of knowledge of these particular trees, they were frequently exposed to sun and wind when planted, but the chief cause of failure seems to have been in the process of planting, from allowing the roots to dry out, and this with coniferous trees does not take many minutes.

At Lethbridge, plantations are grown under two systems, namely, cultivation and irrigation, and while under the influence of the latter method trees are encouraged to make a larger annual growth, it has been the aim of the forestry branch to direct efforts towards raising trees by methods of cultivation for conserving moisture, rather than under irrigation. The results have justified these efforts in demonstrating that trees can be grown successfully in this district, and are not so liable to kill back during the winter. It had been found advisable by those following the irrigation method to turn off the flow of water during the second week in July, in order to allow sufficient time for the season's growth to ripen up before the frost comes. The land is irrigated again the last thing in the fall, so that it may freeze solid and lessen danger from winter evaporation.

The Mormon settlers, south of Lethbridge between Stirling and Cardston, have planted trees around their towns for a number of years, and many of these are now from 15 to 18 feet high. Behind them shelter many small plants such as gooseberries, raspberries and currants; even apples have been grown successfully for a number of years. The irrigation method is principally followed here.

A mistake often made by planters is that they would like to plant only fast growing trees such as Russian poplar, cottonwood and Russian willow. The advantage of having a good percentage of the more valuable but slower growing species is not yet fully appreciated.

This concluded my tour of inspection, and from close observation it is apparent that farmers already realize that the problem of affording suitable protection for house, buildings and stock from the bleak winds and heavy snowstorms of the prairie, besides providing a future asset in the matter of a home grown supply of fence posts and fuel, is easily solved with a little care and attention in the direction of tree planting. The trees, however, must not be planted too close to the buildings, and should be at least 40 to 50 yards away; the greater the number of rows planted, the sooner will forest conditions prevail.

Your obedient servant,

WALTER B. GUITON.  
*Inspector Tree Plantations.*

## No. 18.

## REPORT OF JAMES KAY.

FOREST NURSERY STATION,

INDIAN HEAD, SASKATCHEWAN, March 9, 1911.

R. H. CAMPBELL, Esq.,  
 Superintendent of Forestry,  
 Ottawa, Ont.

SIR,—I have the honour to submit my third annual report on my work as inspector of plantations with the Forestry Department.

On returning in the fall from inspection work I at once commenced work in the forestry office. Later, I assisted with the packing and distribution of trees, after which I helped in planting out trees in the demonstration areas in the nursery.

I started inspection work on June 1, finishing on November 4. The district assigned to me was the Canadian Pacific railway, Yorkton branch from Portage la Prairie to Jansen; the main line Canadian Northern railway from Gladstone to Lloydminster; the Prince Albert branch, including the Swan river district and the Goose lake branch from Saskatoon to Alsask.

Last year (1909) the number of applicants on my list numbered 854; of these 510 received trees to the number of 410,600. This year (1910) the number of applicants totalled 879, of whom 522 are to receive 382,500 trees.

I commenced inspection work at Portage la Prairie, Manitoba, working the Canadian Pacific railway, Yorkton branch to Jansen. Along this branch I found the old and new plantations doing well, and in most cases well cared for, and combined with ample moisture, good growth had been the result.

On the Canadian Northern railway main line from Gladstone to Lloydminster the trees did fairly well. From Gladstone to Humboldt there was ample moisture for plant growth and the plantations made good progress. From Humboldt to Warman the season was dry and plant growth was not so vigorous. From Warman to Battleford more satisfactory conditions prevailed. From Battleford to Lloydminster drought was again in evidence, but even in the dry stretches of the country the newly set out plantations held their own and made headway.

The older plantations, owing, no doubt, to their deeper root systems, suffered very little. On the Canadian Northern railway main line and the Prince Albert branch north, round by Melfort and Tisdale, I found Indian or sweet grass to be the worst enemy of the plantations. The grass is very common in the northern parts of the country. The higher rainfall, no doubt, encourages its growth to a certain extent; wrong methods of breaking and improper cultivation afterwards being the cause of its continued presence in the plantations.

I therefore gave no trees for backsetting in the north country owing to this cause, advising a thorough tillage of the soil for another year before any planting was done. To insure success and save future trouble it is absolutely necessary to get rid of this grass before planting. Working up the land infested with sweet grass with a cultivator after planting only aggravates the evil as it breaks up the rhizome or underground stems and spreads them all over and through the soil. Digging it out with a fork or mulching are the only practical remedies to use after the plants are set out. It should be carefully watched the first year; it generally appears in small patches; these should be forked out and all parts of the grass carefully removed, as the smallest piece will grow if left in the soil.

On the Goose lake branch of the Canadian Northern railway, trees have almost without exception done remarkably well. Some fine plantations are to be seen around the country adjacent to this line. From Rosetown to Alsask on this branch the country is just being settled up; all the applicants in this part are new. It is a bare country and from the interest manifested in the work of tree planting there will probably be a large demand in the near future for trees from this part of the country.

Little fault could be found with the setting out of the young plants, willow and poplar cuttings being the only exceptions. These were, in a large number of cases, too shallow planted. Various excuses were given for this, but the only inference that could be drawn from them was that the spade is the best implement to use in setting out cuttings and tap rooted plants. Some planters used dibbles so thick that they had to be driven into the soil with a weight; hence, the cuttings were loose and shallow planted, the soil only being in contact with the cutting at the ground line. The result was that many failed to strike root, or, if they did so, died off eventually as the cuttings had too little sap remaining to support a permanent supply of roots and leaves.

Cuttings that appear to have rooted perfectly, frequently die off in light loose soils in the height or in the autumn of the first year. The reason for this is that in the early part of the season adventitious roots appear both upon the cortex and the callus of the cutting, and when the upper layers of the light loose soil dry up, the greater portion of the roots on the cortex, most of which are disposed horizontally, die off; that is, the tender rootlets nearest the surface shrivel up. When this is the case it often happens in the height of summer with a limited rainfall and great heat, that the roots which have originated in the callus of the wound, and which always penetrate the soil obliquely, are unable to supply water to satisfy the wants of the leafy shoots, which consequently wither.

In planting cuttings it is advisable to plant them with a slant, leaving just one bud above the surface, (as it is most essential to restrict evaporation from the cutting till it has an abundant supply of roots), to allow the plant to settle with the soil and render it more easily tramped and firmed; but care should be taken to see that the slant is not exaggerated, for if the cutting is brought too near the surface it will probably die off even after it has apparently become well established.

Maple and cottonwood have done well; the maple in all parts of my district. The cottonwood seems to have its limits as regards latitude. Too far north the texture of the wood is evidently too open to resist our early winter frosts. It does not ripen up the new growth early enough, and is therefore liable to be frozen back, with the consequent tendency to assume a bushy habit of growth. The fact of the stock coming from south of the boundary line may have something to do with this.

I saw many young cottonwood on the banks and sandbars of the North Saskatchewan river, much further north. They looked healthy and thriving enough, and I advised the planters in the vicinity to dig these plants up and use them for their plantations. They could get them in all sizes and quite easily, and much planting could be done in this way. Many people, no doubt, only require to have this pointed out to them to avail themselves of such material. Some have the impression that these plants and any seed of maple and ash growing in the locality are inferior and not worth troubling about, and many besides are often quite unaware that there is any such plant material near them.

Ash and elm have done well, and are giving satisfaction, the percentage of trees living being very high. It is gratifying to note that these trees find favour with an increasing number of planters. Willows and Russian poplars have done well when properly planted, but it is to be regretted that much slack planting is in evidence. It is highly important for several reasons that these plants should have a large place in prairie planting, for example, owing to ease of propagation, quick

growth, and, at least in the case of the willow, for the toughness of their branches in resisting snowbreak, which render them invaluable for the outside of plantations.

The question of pruning is perennial; it is cropping up all the time, but when the bad effects of pruning trees in a shelter belt are pointed out the planter admits the error of it. Still, much judicious pruning could be done in the way of removing badly situated branches which would eventually break off from the weight of the snow, leaving ugly wounds. As this only means the removal of a few branches in the plantation, it does not materially affect the soil cover. Branches removed from poplar or willow can be planted as cuttings.

Another matter requiring attention is planting too near the edge of the sod. The outside row of trees never makes the best growth when planted too near the sod. Besides, weeds and grasses, such as brome grass and sweet grass, gain an easy entrance into the plantation. Three or four feet should be allowed, as this width gives a horse and cultivator ample room to run between the fence and plantation.

Owing, no doubt, to heavy rain in the beginning of September, which caused a late autumn growth, many maples and cottonwood were caught by an early fall frost and nipped back.

Injuries from insect pests in my district were practically nil, no serious injury having occurred. Attacks from fungoid diseases were also slight. I found maple and cottonwood in the Yorkton and Saltcoats district (principally cottonwood) attacked with coral spot disease (*nectria cinnabarina*), and I advised the owners to cut off the diseased portions and burn them. As this is a disease which, as a rule, only attacks soft wooded species, ash and elm are unlikely to suffer from it.

Evergreens sent out this spring (1910) have in nearly all cases been well planted and carefully attended to after planting. They have done as well as could be hoped for with such a dry season. The tamarack had the lowest percentage living. Most of the other varieties did well, but results will show up better next year.

On reviewing results, the care given the plantations, the percentage living and doing well, with the increasing interest taken in tree planting, go to show that this work is being appreciated very fully throughout the country.

Your obedient servant,

JAMES KAY.  
*Inspector Tree Plantations.*

### No. 19.

#### REPORT OF JAMES N. B. MACDONALD.

FOREST NURSERY STATION,

INDIAN HEAD, SASKATCHEWAN, January 20, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry,  
Ottawa, Ont.

SIR,—I have the honour to submit the following report of my third year's work as plantation inspector in connection with the tree planting division of the Forestry Branch.

After spending the winter in the office, I assisted with the spring work in the nursery; the shipping of plants to the different districts, and the usual planting and other work in the nursery grounds.

I started inspecting the plantations on June 1, my district being in Alberta the same as the preceding years, viz.: Canadian Pacific railway main line from Walsh to Cochrane, with Langdon-Acme branch; the Calgary-Macleod line to Granum; the Calgary-Edmonton line with Lacombe and Wetaskiwin branches, and the Canadian Northern railway line from Edmonton to Kitscoty.

The number of places to be visited on my list was 989 and of these 492 are to receive plants next spring. The average number of trees allowed each man is 725, making a total of 341,600 trees. This number would have been much greater if enough trees had been available to supply all the land prepared, as a good many men had land ready for 2,000 to 5,000 trees.

I found the plants of 1910 suffering badly from drought in Medicine Hat district; many of these had made no start at all in June. Plants put in shallow were all dried out, especially where the land had been deeply ploughed in spring to prepare for trees. This is contrary to our instructions and the printed bulletins which call for all ploughing to be done the season before planting; merely harrowing the ground in spring to conserve moisture and kill germinated weed seeds.

Great interest is taken in the work by the new settlers west of Medicine Hat, as the country is quite treeless. I found most of the ground applied for there, in good cultivation by the middle of June, having been broken early and backset.

Owing to the new railway lines not being opened, a large tract of this country lying east of the Red Deer river and 120 miles north to the Stettler district has not yet been visited. It is expected, however, that by the summer of 1911 two of these lines may be opened.

Several of the older places round Medicine Hat were setback badly with frosts in May and June, which caught cottonwood and maple bursting into leaf two or three times in succession. The ash was untouched, being very late coming into leaf in that district this season. Such killing back, however, does not hurt a plantation permanently, as the root system is always developing and a shorter, firmer growth is established among the quicker growing species.

Some of the best plantations in my district are round Gleichen. All the trees do well if cultivated; most of the cottonwood now standing eight feet high with only three years growth. This is without irrigation.

The Canadian Pacific irrigation system supplies this country and water is now used in a good many of the young plantations with good results. The best plot I saw planted in 1910 was in this district. It is necessary, however, to give the ordinary amount of cultivation as well as irrigation.

There is a large increase in the number of applicants in Strathmore and Langdon districts; 41 are to be supplied with plants next spring while only 8 received plants in 1910.

As this part of Alberta is treeless for more than 150 miles square, the settlers seem to value the trees very highly and no doubt quite a number of good plantations will soon be seen in this district. Native willow and balm of gilead are already showing along the irrigation ditches from seed blown into the river and carried along the lateral canals.

I found conditions similar on the Calgary-Macleod line. The young plants of 1910 suffered much from lack of rain, but the older plantations were much better. They came through the winter well, starting fresh growths from the tips, and that had a marked effect where grass and weeds had gained some hold in the older groves. Many, especially the maple, seemed to have mastered the rank, objectionable growth with their dense foliage in early summer.

I was pleased to find that trees came through the winter well in the Airdrie and Crossfield districts. Several of the older places looked well, as there was very little winter killing and growth was good despite the dry season. Trees in this district have been badly killed back in previous years, especially cottonwood.

The policy of the planting division in the last two years has been to substitute the cottonwood with Russian poplar, and I was particularly pleased to find them doing so well. Further east from range 24 to the Red Deer river the trees are fine. A few of the groves can be seen for miles and are already giving good shelter.

Trees do well on the Lacombe branch extending east to Castor district. The young plants suffered from drought but the plantations of 1909 and earlier years were most satisfactory.

Conditions were also good on the Wetaskiwin branch, although the eastern part suffered from drought. There is more native bush along this line, and planting is not encouraged except in the open country. Fires have destroyed large tracts of native bluff since I travelled this part in 1909, changing the appearance of the country greatly. This is much to be regretted as this part of the country is being rapidly settled and the demand for fence posts, fuel and poles for many purposes is already large, not to speak of the shelter afforded by several good bluffs on a farm.

The young growth is very rapid after a fire, averaging two feet per year, and it is to be hoped that the settlers will protect a fair proportion of the young bluffs that are coming up. They will never get their farms furnished with trees at a cheaper rate, and it would pay each man to have ten acres of bluff on his farm.

The rainfall was better in the districts along the Canadian Northern railway line, and the effect of good cultivation was shown very plainly here in several cases. Where good care was taken the groves are healthy and making good growth, coming through the winter with very little damage. Plots of the same age which have been neglected and the moisture exhausted by grass and weeds or evaporated by minute cracks, seemed to suffer with the dry weather and with both summer and winter frosts, making little advance, although in some cases both places were on the same section.

Conifers sent to different parts of Alberta did very poorly. The long distance to transport, hot, drying winds during the planting season, and the lack of rain in May and June were the chief causes, as conifers suffer more quickly from any drying influence than the deciduous trees usually supplied. Russian poplar was supplied largely in the districts from Claresholm to Didsbury, but owing to the unusually dry season the cuttings made a poor start compared with other years. Some of the blame may be laid to careless planting, as quite a number were planted too shallow, and many not firm enough. This tree is doing well in all parts of the country, the wood ripening early in the fall and seldom being hurt by winter frosts.

Ash is doing very well except when planted in low spots, where it is liable to be caught with summer frosts.

After the third year the growth of ash is rapid and sure, as much as two feet being often made in one year.

Your obedient servant,

JAS. N. B. MACDONALD,

*Tree Planting Inspector.*

## No. 20.

## REPORT OF WM. MACDONALD.

FOREST NURSERY STATION,

INDIAN HEAD, SASKATCHEWAN, January 10, 1911.

R. H. CAMPBELL, Esq.,  
 Superintendent of Forestry,  
 Ottawa, Ont.

SIR,—I have the honour to submit herewith my first report on tree planting work as carried on by the forestry branch.

After assisting in the general work of the nursery for eight months, I was transferred to the office on December 6, 1909, and there was engaged drawing plans for the guidance of planters, making out distribution lists for 1910, and other office work. On April 6, I was again assisting in the nursery, making cuttings, distributing trees and other spring work.

Leaving Indian Head on June 6, I commenced my tour of inspection, being accompanied by Mr. Mitchell for a few days.

The territory assigned to me was the Soo line, Drinkwater to North Portal, the Estevan line to Gainsboro', the Outlook branch, the Grand Trunk Pacific main line from Welby to Bradwell. After finishing the latter I received instructions to proceed to the Regina-Prince Albert branch of the Canadian Northern railway from Condie to assist Mr. Mackintosh, who was working on this route from the north. I inspected as far as Findlater.

The number of farms on my list to be visited was 1,080; of these 494 were new applicants, 358 of whom will receive planting material next year, while the remaining 136, who had not their land in proper shape for planting, will again be visited next season. In all, 688 applicants will receive trees and cuttings to the number of 501,605.

There was not much killing back of trees in the winter of 1909 and 1910, but the effects of the early spring were quite noticeable. Opening up as it did in March, with severe frosts later, maple and cottonwood shot into leaf were frozen back along with, in many cases, the previous year's growth. Here again the green ash and elm proved their worth as the trees of the future, owing to the fact that they do not come into growth so soon as trees of softer tissue do.

It is gratifying to find such enthusiasm among the farmers, especially those who have made a success of the plantations already set out under the directions of the forestry branch; many had bought stock from commercial nurseries to the number of 10,000 trees of various varieties, having had land ready for planting to the extent of from three to five acres.

At one farm on the Soo line, I was surprised to find seventeen acres set aside with the object of planting. In regard to the amount of land being prepared in this way, quite a number of disappointments were experienced with the small quantities of trees allotted this spring, and I have been asked to notify the amount to be shipped next season, so that arrangements may be made to purchase stock in time to plant in the spring the area prepared, rather than put in a root or grain crop.

Owing to the excessive drought and hot southwest winds which were experienced the latter part of June, seedlings and cuttings which were planted out in the spring

were practically at a standstill, making little growth till well on in July, when a few showers and cooler weather set in. In a few cases I found the young plants and cuttings completely dried out, but this I attribute largely to delay at the various stations, although the applicants had received word from the department previous to their arrival. The feeling seemed to be one of disappointment to find the time lost in planting dead trees which might have been more profitably occupied on the farm during the busy season.

On the whole I am pleased to say that with few exceptions plantations visited were found to be well cared for and gave every satisfaction and that 70 per cent of the trees set out this spring are doing well, taking my district as a whole.

The conifers distributed this season did not make much growth, although most of the farmers who received them resorted to artificial watering; this I pointed out was not always to be recommended, as surface cultivation is usually all that is necessary for the conservation of the moisture.

Later in the season, owing to the continued dry weather, some discretion had to be used in the allotment of trees for new breaking. In many cases the sod was not properly rotted, and backsetting being delayed, the ground could not be worked into fit shape for planting next spring. In such cases it was sometimes hard to convince the farmer of the advantage of a season's delay.

One noticeable feature in the plantations this year was the absence of injurious insects, nor were the jack rabbits so destructive as they evidently had been in former years. I would say in conclusion that I almost invariably found the trees and cuttings planted with the spade do much better than where a furrow had been opened with a plough. The farmer usually has not the hired help sufficient to get the row planted closely after the plough, and the soil dries out badly before the work is finished, giving the young plants a poor chance to start growth. This style of planting is done with great success in the Forestry Nursery Station here, but there is a force of men on hand to get the trees planted as quickly as possible.

Very often the new settler cannot spare the time to open the ground with the plough, and plants with the spade in the evening with usually good results. Where practicable, I advise the use of the spade, thereby getting the plants firmer in the soil and more uniform in the rows.

I am, sir, your obedient servant,

WM. MACDONALD.

## No. 21.

### IRRIGATION SURVEYS.

#### REPORT OF JOHN STEWART, COMMISSIONER AND CHIEF ENGINEER OF IRRIGATION.

CALGARY, ALBERTA, March 31, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry,  
Ottawa, Ont.

SIR,—On April 20, 1910, I sent out four engineering parties into the field for the purpose of making inspections and surveys of all irrigation schemes in the provinces of Alberta and Saskatchewan, two parties in Saskatchewan, one in Alberta, and one taking in all scattered schemes in the two provinces. Mr. R. J. Burley was

in charge of party No. 1 in Saskatchewan, which included all territory from United States boundary to township 15, lying between ranges 18 and 27, west of the 3rd meridian. Mr. Fletcher was in charge of party No. 2 and covered all territory from the United States boundary to township 15, and from range 27, west of the 3rd meridian to range 28, west of the 4th meridian. Mr. Tempest had charge of the third party in Alberta and included the territory south to the boundary and east to range 8, west of the 4th meridian. Mr. MacKinnon took in all scattered work in the two provinces which could not be attended to by any of the regular parties without too much loss of time from their regular work. Each of these inspectors had written instructions to make inspections of all irrigation schemes in their respective territory, also to make surveys of all land applied for under the irrigation system to prove whether the scheme was a feasible one, or not, as to irrigation and water supply, before a recommendation for the sale would be made by me. Under these instructions Mr. Burley made 132 inspections of irrigation schemes authorized and licensed, 26 surveys of land applied for, 28 traverse surveys of creeks and ditches, 21 final inspections and valuations, 50 gaugings of streams, and sent in to this office 158 reports on the same.

Mr. Fletcher made 75 inspections of irrigation schemes, 18 surveys of land applied for under the irrigation system, 3 traverse surveys of creeks and ditches, 15 gaugings of streams and sent in to this office 93 reports.

Mr. Tempest made 188 inspections of irrigation schemes, including 129 licensed schemes, 10 final estimates of completed work, 24 proposed schemes, 9 surveys of land applied for, 48 gaugings of streams, and sent in to this office 161 reports. After completing his regular work in his territory, Mr. Tempest made a survey of ten miles of a coach road from Banff to Laggan in the Rocky Mountain Park. Owing to the great depth of snow in the mountains, he was compelled to drop the work and about this time he received an appointment on other work, which was a better position than held here.

Mr. MacKinnon made 10 inspections of irrigation schemes, 13 surveys of land applied for, a survey of a road in the Rocky Mountain Park, 3 inspections of railway tanks, 4 inspections of illegal dams and drains, and sent in to this office 30 reports. A very large extent of country had to be covered to get to some of these schemes. During the summer, I made several surveys and inspections of irrigation schemes, but owing to the large amount of work in this office requiring my attention, I could not spare the time to make surveys, or to even take the annual leave allowed me.

The work of this office was made up as follows, and was all handled by a staff of four clerks:—

Letters received. . . . .	6,116
Letters sent out. . . . .	7,819
Agreements for water in quadruplicate. . . . .	637
Applications for water rights, in duplicate. . . . .	88
Plans with applications, in duplicate. . . . .	88
Applications to drain roads, &c. . . . .	13
Railway easements, in triplicate. . . . .	89
Transfers of applications for water. . . . .	10
Railway plans recorded, in quadruplicate. . . . .	9
Notices of cancellation of water rights. . . . .	44
“    transfers of water agreements. . . . .	63
Applications to cross road allowances. . . . .	66
Applications for railway over Crown lands. . . . .	42
Notices prepared for publication. . . . .	99
Plans prepared for applicants. . . . .	23
Number of certificates under section 20. . . . .	83
“                    “                    33. . . . .	49

Number of licenses recorded in triplicate.....	68
Number of reports received from R. J. Burley.. . . .	158
“ “ J. S. Tempest.. . . .	161
“ “ F. T. Fletcher.. . . .	93
“ “ J. A. MacKinnon.. . . .	30

From the above records of the office work and the reports of the several inspectors, it will be seen by comparing the work of the past year with that of 1907, when 984 communications were received and 2,163 sent out, that there has been a large increase both in the field work and office work. In 1907 all hydrographic work was handled by this office as well as irrigation work.

JOHN STEWART.



PLATE 17.—Headgate on Alberta Railway and Irrigation Company's Scheme, Milk River District, Southern Alberta. [Photo L. J. Gleeson, 1910.]

No. 22.

REPORT OF J. S. TEMPEST.

THE PAS, KEEWATIN, March 17, 1911.

JOHN STEWART, Esq.,  
 Commissioner of Irrigation,  
 Calgary.

SIR,—I beg to submit the following report of my work during the year 1910-11, as Irrigation Inspection Engineer in southern Alberta.

I started out from Calgary on April 26, 1910, with a small outfit to inspect all licensed, authorized and proposed irrigation schemes and diversions of streams for

other purposes in southern Alberta, to observe the discharge of streams and springs, and to make such further surveys, plans and inspections as instructed from time to time by you.

During the season, I made 188 inspections and surveys, including 129 licensed schemes, 16 authorized schemes, 24 proposed schemes, 10 estimation of cost of works, and 9 surveys. I also took 48 gaugings of streams and springs en route, using Price's meter and weir boards.

The summer of 1910, on account of the long continued drought, will long be remembered in southern Alberta. Although ranchers and farmers, both, suffered great loss on account of failure of hay and grain crops and deficiency of pasturage, the experience will no doubt lead many to adopt methods that will ward off or minimize the possibility of a similar failure should there be a recurrence of another such season. Not only was the rainfall practically nil, but the snowfall in the preceding winter was exceptionally low. In many places there was no growth at all, and much of the hay that was cut consisted of the dried up grass of 1909, usually poor in quality. The sources of supply of many irrigation schemes either failed entirely or were reduced so low as to be quite inadequate for the requirements of the irrigable areas.

It has been the custom of many irrigators to defer using their schemes until after the usual spring rains. Many following this custom suffered a great disappointment, for although there was water available in the early spring, the sources of supply failed in early summer, so that the land received neither the spring rain nor benefited by irrigation. The common intention of those who suffered from this cause is to put on water in future whenever available unless the land be already sufficiently saturated. Although late fall is admittedly the best time to apply water, many of the schemes deriving their supplies from the smaller creeks and springs often have very little or no water available at this time of the year. In consequence of the drought many new applications for water rights began to be made, and many of these were for the irrigation of lands owned by the applicants. Several of the inspections of these proposed schemes disclosed the fact that though the source of supply was probably sufficient in normal years the gaugings in 1910 showed a deficiency and the matter had to be deferred for further investigation. There were many cases, too, of owners of land refraining from putting in application to divert water for irrigation purposes on account of the sources of supply, usually sufficient, being temporarily reduced too low.

Many of the schemes deriving their supply from the smaller creeks and springs, although very satisfactory in average seasons, will always be subject to failure in times of great need, such as was experienced in the summer of 1910.

I strongly advocate combination amongst farmers and ranchers to introduce larger schemes having a more reliable supply than is to be found in any but the larger streams. Any one travelling through the foot-hills and the adjacent prairie, and viewing the parched pastures of the ranches and the suffering arable land of the farmer on the one hand and on the other hand the large volume of water running to waste, naturally wonders why the land owners do not wake up and do something. If, as Bacon says, 'A wise man makes more opportunities than he finds,' what must be said of the unwisdom of a community that does not grasp the opportunities at hand? There are Fish creek, Sheep creek, Highwood river, Willow creek, Oldman river, Crowsnest river and others, practically untouched. Being large and turbulent streams, and difficult to control, the average land-owner feels that these utilities are beyond his reach. Holdings are now comparatively small, as a rule, and in the hands of many. When the unaided land fails to produce sufficient feed for the flocks and herds, the owner cannot, as of old, drive his stock to fresh fields and pastures new. In the present circumstances he is compelled to reduce his stock, often at a great sacrifice, to meet the situation instead of combining with his neighbours in the construction of efficient dams, canals and other necessary works to utilize the vast volume of water now running to waste and so putting himself beyond the fickleness of seasons. This is a matter, I think, in

which the irrigation office might take the initiative and thoroughly investigate, considering the water available, the lands irrigable (whether Dominion or private lands), suitable points for diversion and cost of works.

As I have mentioned in a former report or bulletin, the advantages of irrigation even in southern Alberta's wettest years are very considerable, hay lands producing probably double the crop and alfalfa producing two or three crops in the season, aggregating as much as 6 tons per acre.

In addition to the inspections and surveys of schemes for diverting water for different purposes, I located 10 miles of the proposed coach road from Banff to Laggan, but for private reasons, I was compelled to leave this work unfinished.

I am, sir, your obedient servant,

J. S. TEMPEST.

### No. 23.

## REPORT OF RALPH J. BURLEY.

IRRIGATION OFFICE,

MAPLE CREEK, SASKATCHEWAN, June 10, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry and Irrigation,  
Ottawa, Ont.

SIR,—I beg to submit the following report upon the work done under my direction, and the progress of irrigation development in the Cypress Hills district during year ending March 31, 1911, together with a few suggestions which might improve our service there.

Owing to the large increase in the number of applications for water rights throughout the Cypress hills it was found necessary to divide the district into two parts, the division being roughly along the township line between ranges 26 and 27, and Mr. F. T. Fletcher was put in charge of the work in the western portion, while that in the eastern part was done by myself. The instructions issued were to inspect all schemes in the district, running such levels and traverses of the various schemes as possible, without taking too much time from the regular work of inspection, and to do whatever hydrographic work we could without interfering with or overlapping what was done by the hydrographic surveys.

In pursuance of these instructions the hydrographic work done was mostly of an experimental nature and measurements were taken more with the view of adding to our knowledge the value of the Kutter & Chezy formulæ as applied to the high water flow in the streams than with the idea of supplementing the measurements taken at the regular stations by the hydrographic surveys.

In carrying out this work a cross-section was taken at some suitable place and a careful meter measurement made, so that by substituting the known values in the formulæ it was possible to work out the coefficient of friction for the low water cross-section. Levels were then run about a mile above and below this central cross-section and tied to some permanent mark, such as a section corner, and new cross-sections made at each point. This gave the average slope of the stream for a distance of from one to two miles, and the levels obtained could be used at some future date in the determination of contours in the stream valleys. Owing to the great number of irrigation schemes this work was little more than started last season, and the progress made was not great enough to determine to what extent it will be of value in our work. So far as the work has gone, however, it appears that the values of the friction factor as determined for various conditions of the stream bed in the larger streams in the United States are too low for the small streams here in low water

and it was proposed to attempt to get results at high water when possible to see if the greater depth would lower this factor. This, however, was impossible last year as there was not at any time water high enough to make the experiment.

The past season was so extremely dry throughout the district that very little water was available for irrigation purposes and the majority of the streams were almost dry during the irrigation season, bringing out very forcibly the necessity for the establishment of storage reservoirs wherever possible.

Another fact illustrated was that even one flooding in March or April will materially increase the chances of a fair yield in a dry year, and at one place visited this was very noticeable. In this case the ditch had been almost completed but no headgate had been constructed, so that when the run off from snow occurred in March the water flowed through the ditch and broke over the sides on to the ploughed ground below it for a day or so before it could be shut off. In July at the time of inspection the wheat on the land was some fifteen to eighteen inches high where the water had been over it in March, while on the other parts it was only three to four inches in height. This would appear to show that even flood water irrigation will make a decided improvement in the value of the land in a semi-arid district.

The majority of applicants for water rights in this district appear to be realizing that irrigation is in some years a necessity and in all years a great asset if they expect to continue in their present business or even if they are forced to commence farming operations, and although the influx of settlers in the last two years has practically extinguished the large rancher, the small stockman still finds it possible to run his stock if he can grow winter feed, and a large number of them are beginning to see that the conservation and proper application of water to their land is the only solution of the problem. This probably accounts for the fact that considerably better progress was made last year on the various ditches than was made during the previous dry years, and while the ground was very dry and hard and hay difficult to get, nevertheless a great deal of good work was done on the majority of the schemes.

Since becoming more familiar with the conditions of stream flow in this district, it has become apparent that a ditch sufficiently large to carry the amount of water called for by our present duty of water will but poorly serve its purpose in the greater number of schemes constructed or projected in the Cypress hills. For example, take a scheme that irrigates three hundred acres of land requiring two second feet of water where a ditch three feet on the bottom, one foot deep and five feet on top with a moderate fall will easily carry the two second feet. But this amount is required continuously during the irrigation season and the water in the stream only flows, say, two months, therefore it is apparent that in order to get the total quantity of water required it will be necessary to enlarge the ditches in proportion and to divert a greater amount of water for a shorter time. This fact has been recognized by some and pointed out to all irrigators, and for some years they have been urged to build larger ditches or to enlarge those already built so that their systems would be adequate for the proper irrigation of the land included under them. In a great many cases the applicants have recognized the necessity of this enlargement and have gone ahead with it, but in some cases it appears difficult to satisfy them that the advantages will be proportionate to the increased cost. However, it will only be a matter of time until all will realize that they must either reservoir or put a larger volume of water over the land during the short flood period and even where the flow is constant the larger ditches are better because the land can be watered in far less time and with less work and waste of water.

#### RESERVOIR SYSTEM.

Probably one of the most important factors in the irrigation of the irrigable areas in the Cypress hills is the development of reservoir systems, and there can be no question but that every encouragement should be given by the department to any

applicant who wishes to store water. The regulations governing the leasing or granting of land for this purpose should be made as lenient as possible, so that the applicant can feel safe in going to a considerable expense without feeling that there is any danger of losing his scheme if he is forced to cease the operation of it for a short time owing to some unforeseen circumstance.

A system somewhat similar to that used among the irrigators near Fort Collins and Greeley, Colorado, might be recognized and encouraged here, and it would undoubtedly increase the effectiveness of irrigation. There, by a mutual arrangement among the irrigators themselves, the water is stored in the reservoirs owned by the later applicants near the head of the streams, and the early appropriations, that is, those having the right to the low water flow, are satisfied by the water let down out of these reservoirs during the summer. By this means the larger companies having appropriations calling for high water only near the head of the streams are enabled to store enough during high and flood stages in reservoirs at an elevation too low to be of use to them on their own lands, but which can be used on the land of the prior applicants lower down, enabling the companies to use the low water flow at their intake.

Another system which is being used to some slight extent here is that of trading water, that is, two applicants entitled to, say, one second foot each will exchange and allow one to take the whole flow for a certain time until his land is thoroughly watered, when he will turn it over to the other. This system has many advantages to commend it if it can be amicably worked, the greatest being the saving of water and the speed with which the land is covered, as it can be easily seen that the losses due to evaporation and seepage will be much smaller proportionally in a large swift flow than in a small slow one.

Wherever possible, it is much better that reservoir systems be constructed outside the stream bed, as experience has shown that the storage of water in the bed of the stream gives rise to a great many difficulties in the handling of both the stored water and the natural flow of the creek. The greatest difficulty as it affects parties other than the applicants is the trouble of passing the natural flow to a point below the dam, the applicant usually claiming that he should not be made to stand all the evaporation and seepage loss, as it would have occurred in any case, and the parties below claiming that the whole natural flow as it is above the dam should be passed through. It would appear that there is a measure of truth in both of these claims, as there is an undoubted loss in the natural channel, but it is also true that the loss is increased owing to the greater area exposed to the effect of evaporation and a greater pressure to cause a seepage loss. So far there does not appear to be any satisfactory way of passing the natural flow through the reservoir, as the overflow wasteway will at least partially cease to operate when the ditch is being used, and a pipe through the dam will vary its discharge constantly as the level of the reservoir changes, and the adjustment of the controlling gate or valve must be constantly changed. It is, however, probably the only practical way of letting water through, and it will be necessary to devise some method whereby a fair degree of control can be obtained and by which either the owner of the reservoir or the other interested parties can tell at once how much water is passing into and out of the reservoir. This presents a problem of much difficulty, and one which will take considerable time to solve experimentally.

In conclusion, I would suggest that, whenever time permits, the engineers in charge of the irrigation and hydrographic parties make rough reconnaissance surveys of such small reservoir sites as they may find from time to time, and if they appear to promise results, should submit rough plans, so that if they were considered of sufficient importance they could be thoroughly investigated by a party on reservoir work.

Your obedient servant,

**RALPH J. BURLEY.**

## No. 24.

## REPORT OF P. M. SAUDER, CHIEF HYDROGRAPHER.

DEPARTMENT OF THE INTERIOR,  
HYDROGRAPHIC SURVEYS,

CALGARY, ALBERTA, March 31, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry and Irrigation,  
Ottawa, Ont.

SIR,—I have the honour to submit the following brief report on the work of the Hydrographic Survey during the past year.

With an increased appropriation at our disposal we were able to extend the work of the survey very much during the past year. Considerable reconnaissance work was done, and a number of new gauging stations were established. In the spring of 1910, we commenced field operations with 68 regular stations, and at present we are studying the regimen of flow at 98 regular stations distributed along the various streams in southern Alberta and Saskatchewan.

The summer of 1910 was exceptionally dry, and records of last year will be very valuable as a basis for low water estimates. Very few of the streams have been as low for many years, and many were much lower than the oldest residents had ever seen them.

The methods of carrying on the survey were similar to those of the previous year. Local residents were engaged to observe the gauge height at regular gauging stations. These observations were recorded in a book supplied by the survey, and at the end of each week the observer copied the week's records on a postal card, which was sent to the chief hydrographer by the first convenient mail. The district hydrographers made regular visits to the gauging station, usually once in every three or four weeks. They examined the observers' records, made discharge measurements and collected such information and data as would be of use in making estimates of the daily flow at the station. The results of the gaugings were transmitted by a postal card to the chief hydrographer. The records of the gauge height observers and the hydrographers were copied from the postal cards to regular forms in the office of the survey and filed. At the close of the season the engineers returned to the office and assisted in the final computations and estimates of run-off. Gauge height-area, gauge height-mean velocity and gauge height-discharge curves were plotted and rating tables constructed. Tables of daily gauge height, daily discharge and monthly discharge were also compiled. These records are being re-copied and will be embodied in the second annual report of the survey, which will be completed in a couple of weeks.

The organization in 1910 was very similar to that of the previous year. The territory covered by the survey was very much increased during 1910, and the staff was therefore increased to include eight assistant engineers, a clerk and a draughtsman. The irrigation tract was divided for administrative purposes into five districts, viz., Calgary, Macleod, Milk River, Maple Creek and Moosejaw, and in each district there were one or two hydrographers. Each hydrographer had at least one assistant, and was equipped with a team, light wagon, light camping outfit and the necessary gauging and surveying instruments.

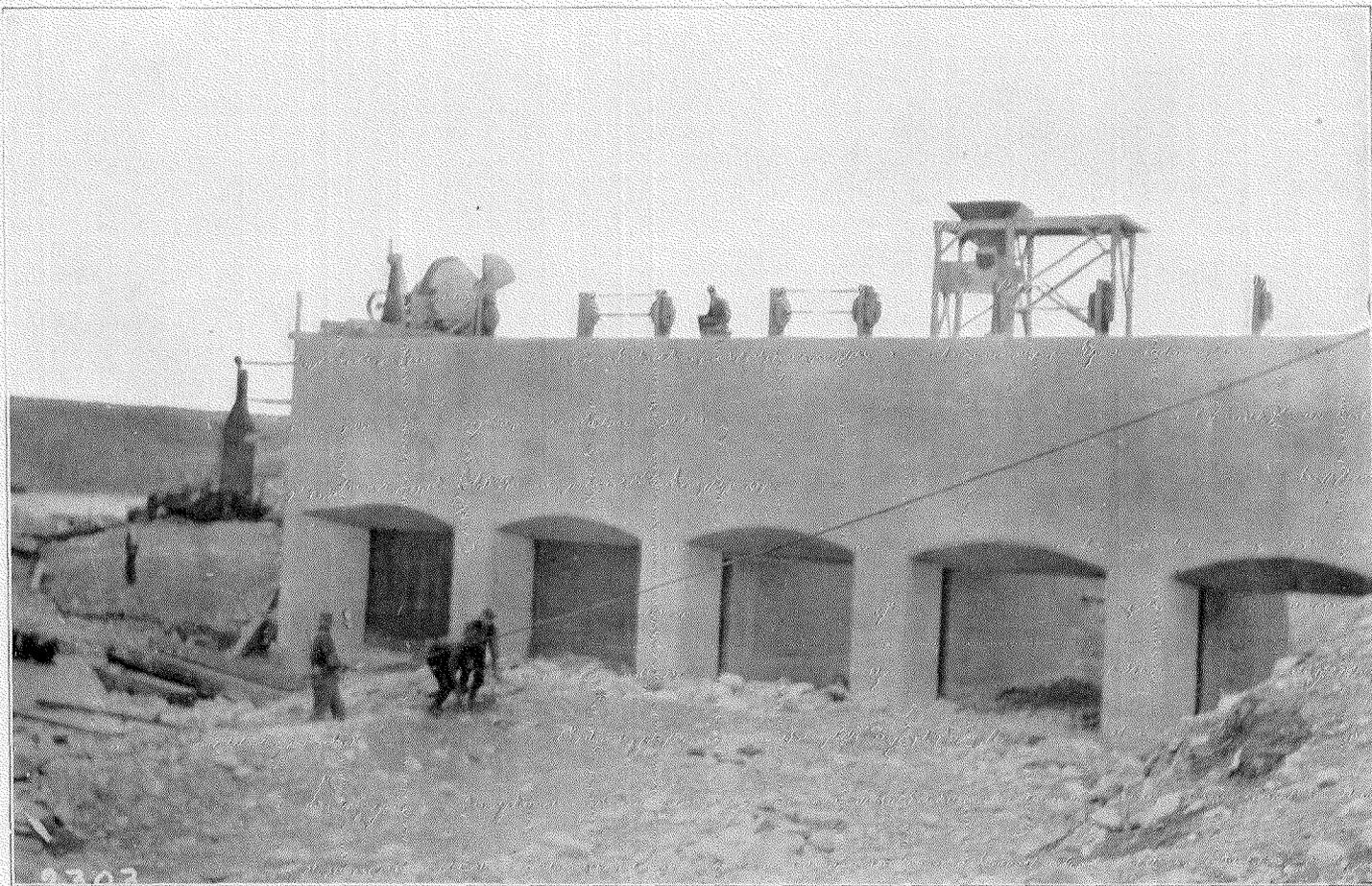


PLATE 18.—Headgates on Southern Alberta Irrigation Co's ditch. Sec. 31, Tp. 21, Range 25 west of 4th meridian. [Photo J. C. Keith, 1910.] 1

## CALGARY DISTRICT.

J. C. Keith, a graduate of the School of Practical Science, and who had previous experience with the survey as an assistant, was placed in charge of the field work in this district. He commenced his duties about May 5.

The district was fairly well reconnoitred in 1909, but the proposed regular stations had not all been established. Regular gaugings were, therefore, made at those stations which were already established, and new stations were added from time to time during the season, as opportunity afforded.

Records were obtained at the following regular stations during 1910:—

Stream.	Location.
Bow River . . . . .	N.E. 26-25-12-5
“ . . . . .	S.E. 13-24-1-5
“ . . . . .	S.E. 31-21-25-4
Canadian Pacific Railway Company's canal . . . . .	S.E. 13-24-1-5
Elbow River . . . . .	S.E. 15-24-1-5
Fish Creek . . . . .	S.W. 26-22-3-5
Highwood River . . . . .	Sec. 6-19-28-4
Jumpingpound Creek . . . . .	“ 30-24-4-5
Mosquito Creek . . . . .	“ 30-16-28-4
Nanton Creek . . . . .	“ 20-16-28-4
North Branch of Sheep River . . . . .	“ 12-21-3-5
Sheep River . . . . .	“ 22-20-29-4
South Branch of Sheep River . . . . .	“ 17-20-2-5

The following gauging stations were established during 1910, and records were obtained at them from the time they were established until the end of October:—

Stream.	Location.
Bow River . . . . .	Near Laggan.
“ . . . . .	Stony Indian Reserve.
“ . . . . .	Blackfoot Indian Reserve.
Devil's Creek . . . . .	Sec. 29-26-11-5
Little Bow Ditch . . . . .	“ 6-19-28-4
Red Deer River . . . . .	“ 6-36-28-4
Spray River . . . . .	Near Banff.

At the end of September Mr. Keith was given leave of absence for five months to return to the School of Practical Science to take a post graduate course in hydraulics and theory of construction. Mr. Carscallen was therefore placed in charge of the field work in this district on October 1.

Early in November, when additional funds were provided, it was arranged to continue field work in this district during the winter and records of the flow were obtained from that date to the present at the following regular stations:—

Stream.	Location.
Bow River . . . . .	Near Laggan.
“ . . . . .	At Banff.
“ . . . . .	On Stony Indian Reserve.
“ . . . . .	At Calgary.
Devil's Creek . . . . .	Sec. 29-26-11-5.
Elbow River . . . . .	S.E. 15-24-1-5.
Spray River . . . . .	Near Banff.

A large number of miscellaneous measurements of the discharge of tributaries of the Bow river and other streams in this district were also made during the year, and will be valuable as general information.

I was assisted in the final computations and report for this district by H. R. Carscallen and H. C. Ritchie.

Records of the flow of Bow river are of very great importance. A study of the flow of this stream indicates that the whole of the normal flow of this river has already been granted for irrigation purposes, and any further development must be based on the storage of high and flood flow. Already this river is being harnessed for power, and as industries increase and a larger market is created there will be more power development. For this purpose records of minimum flow are essential. Minimum flow occurs during the winter season and the records obtained during the past winter are very valuable. The flow was, however, somewhat less than anticipated and it is very important that further studies be made. The regimen of flow in the Bow at Calgary varies from 700 second feet in midwinter to an estimated 60,000 second feet at extreme flood stage. There are a number of feasible storage sites in the mountains which can be utilized to augment the winter flow sufficiently to keep up a continuous flow several hundred second feet higher than the natural minimum flow. Bow river is by far the most important stream in the irrigation tract, and a comprehensive study of the hydrography of this stream and its tributaries is of direct value in the commercial and agricultural development of the country. I am therefore of the opinion that one engineer should spend all his time on the main stream and its immediate tributaries.

I would also suggest that the Calgary district be extended to include the Red Deer river and its tributaries, and that two hydrographers be placed in this district at an early date. As soon as time and funds permit, regular stations should also be established on branches of Highwood river and included in this district.

#### MACLEOD DISTRICT.

H. C. Ritchie, graduate of the School of Practical Science, was in charge of this district in 1909 and again in 1910. The district has been fairly well reconnoitred by both Mr. Ritchie and myself, and gauging stations have been established at almost all the important points. The Oldman river and its tributaries are very important and several additional gauging stations were established on these streams during the past year.

Records were obtained at the following regular stations during 1910:—

Stream.	Location.
Belly River. . . . .	S.E. 21-6-25-4.
Connelly Creek. . . . .	S.E. 36-7-2-5.
Cow Creek. . . . .	N.E. 14-8-2-5.
Crooked Creek. . . . .	S.E. 22-2-29-4.
Crowsnest River. . . . .	N.W. 26-7-2-5.
Muddypound Creek. . . . .	Sec. 27-11-28-4.
Oldman River. . . . .	N.E. 34-7-1-5.
Pincher Creek. . . . .	N.E. 22-6-30-4.
Southfork River. . . . .	S.E. 2-7-1-5.
Todd Creek. . . . .	S.W. 19-8-1-5.
Trout Creek. . . . .	S.E. 12-12-28-4.
Waterton River. . . . .	N.E. 8-2-29-4.
Willow Creek. . . . .	S.E. 26-9-26-4.

The following gauging stations were established during 1910, and records were obtained at them from the time they were established until the end of October:—

Stream.	Location.
Canyon Creek. . . . .	N.E. 14-6-2-5.
Crowsnest River. . . . .	N.E. 36-7-4-5.
“ . . . . .	S.W. 12-8-5-5.
Mill Creek. . . . .	S.W. 18-6-1-5.
Oldman River. . . . .	Sec. 10-9-26-4.

A large number of miscellaneous measurements which will be very valuable as general information were also made by Mr. Ritchie during the year.

About December 1, when additional funds were provided it was arranged to carry on field work in this district during the winter. W. H. Greene was placed in charge of the field work in this district during December, January and February. Early in March Mr. Greene was employed in reconnaissance work on the North Saskatchewan river, and J. E. Degnan has been in charge of the field work in the Macleod district during the past month.

Winter records were obtained at the following regular stations:—

Stream.	Location.
Crowsnest River. . . . .	N.E. 36-7-4-5.
“ . . . . .	N.W. 26-7-2-5.
Oldman River. . . . .	N.E. 34-7-1-5.
Southfork River. . . . .	S.E. 2-7-1-5.
St. Mary River. . . . .	S.W. 25-1-25-4.
Waterton River. . . . .	N.E. 8-2-29-4.
Belly River. . . . .	S.E. 21-6-25-4.

I was assisted in the final computations and report of the work in this district by H. C. Ritchie and Jos. Cawthorn.

Mr. Ritchie did not use a camp at all last summer, and many of the gauging stations can be reached by train. It is proposed to include the stations on Belly and Waterton rivers in the Western Milk River district in future. The engineer in charge of the Macleod district can then travel by train and hire liveries by the day. His monthly expenses will be a little higher than formerly but he will accomplish a great deal more work and the actual cost of the individual gaugings will be less.

It is very important that winter observations should be continued in this district.

#### MILK RIVER DISTRICT.

F. H. Peters, C.E., D.L.S., who was engaged on special investigations on Milk and St. Mary rivers, also had charge of the hydrographic work on these two rivers and their tributaries. In 1909, Mr. Peters reconnoitred most of this district and established almost all the gauging stations necessary to obtain complete records of the flow of these two streams. Therefore, very few new stations were established during 1910, but very complete records of the flow at the regular stations were obtained.

One engineer could not cover the whole of this district, and it was therefore divided and two engineers were employed on hydrographic work. L. J. Gleeson, B.Sc., was in charge of the field work in the western portion of the district, and N. M. Sutherland, graduate of the Royal Military College, was in charge of the field work in the eastern portion of the district.

Records were obtained at the following regular stations during 1910:—

Stream.	Location.
Lee Creek. . . . .	N.W. 10-3-25-4
Lodge Creek. . . . .	Sec. 6-1-28-4

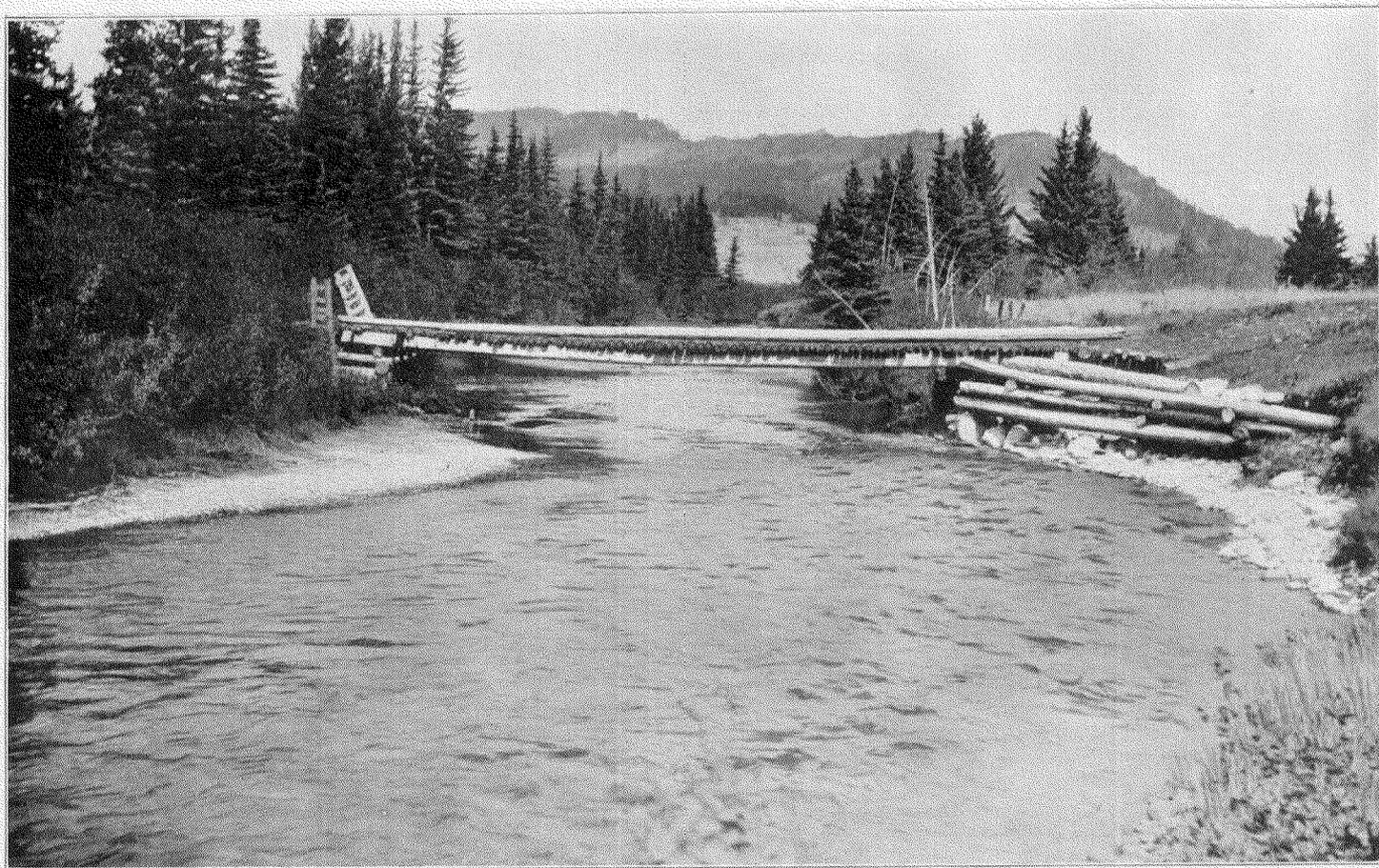


PLATE 19.—Bridge Used as Regular Gauging station on Crownest River, at Coleman, Alta.

[Photo H. C. Ritchie, 1910.]

North Branch of Milk River. . . . .	N.E. 13-1-23-4
“ “ . . . . .	Sec. 18--2-20-4
“ “ . . . . .	S.W. 19-2-18-4
Milk River. . . . .	Sec. 28-2-16-4
“ . . . . .	N.W. 35-1-13-4
“ . . . . .	S.W. 21-2-8-4
“ . . . . .	Sec. 3-1-5-4
South Branch of Milk River. . . . .	Sec. 31-1-18-4
St. Mary River. . . . .	S.W. 95-1-25-4
Sage Creek. . . . .	Sec. 9-1-2-4

The following gauging stations were established during 1910, and records were obtained at these from the time they were established until the end of October:—

Stream.	Location.
Alberta Railway & Irrigation Company's canal. . . . .	Sec. 21-4-24-4
Battle Creek. . . . .	Sec. 3-3-27-3
Frenchman River. . . . .	Sec. 5-5-14-3

The work in the western end of this district is not very heavy, and it is therefore being arranged to have the engineer in this portion of the district include Belly and Waterton rivers in his route, so as to make a more equal division of the territory, and relieve the engineer in the Macleod district of a long drive from Macleod.

#### CYPRESS HILLS DISTRICT.

A large irrigation development in the Cypress Hills has caused an urgent need for very complete records of the flow of the streams in this district. In 1909, H. R. Carscallen, B.A.Sc., was in charge of the field work in this district, and established a large number of regular gauging stations. In the spring of 1910, it was realized that one engineer could not cover the whole of this district, and it was therefore divided by a north and south line into two districts. The eastern district was fairly well reconnoitred by Mr. Carscallen in 1909, and almost all the necessary gauging stations were established during that year. There was, however, considerable reconnaissance work to be done in the western district, and only a few regular stations had been established. Mr. Carscallen was, therefore, placed in charge of the field work in the western portion of the district, and R. G. Swan, B.A.Sc., was engaged to take charge of the field work in the eastern portion of the district. Mr. Carscallen commenced field work about April 1, and Mr. Swan about May 10.

Records were obtained at the following regular stations during 1910:—

Stream.	Location.
Battle Creek. . . . .	Sec. 33-5-29-3
Bear Creek. . . . .	“ 18-11-23-3
East Branch of Bear Creek. . . . .	“ 21-10-23-3
West Branch of Bear Creek. . . . .	“ 32-10-23-3
Belanger Creek. . . . .	“ 18-7-25-3
Blacktail Creek. . . . .	“ 31-6-23-3
Bone Creek. . . . .	“ 34-8-22-3
Bridge Creek. . . . .	“ 11-11-22-3
Bullshead Creek. . . . .	“ 16-12-5-4
Davis Creek. . . . .	“ 29-6-25-3
Enright and Strong's Ditch. . . . .	“ 36-6-22-3
Fairwell Creek. . . . .	“ 30-6-24-3
Frenchman River. . . . .	“ 31-6-21-3
Gap Creek. . . . .	“ 3-10-27-3

Hay Creek.. . . . .	“	30-10-25-3
Jones Coulee.. . . . .	“	5-8-20-3
Lonepine Creek.. . . . .	“	27-7-26-3
Maple Creek.. . . . .	“	N.E. 16-11-26-3
Middle Creek.. . . . .	“	30-5-29-3
Mackay Creek.. . . . .	“	N.W. 26-11-1-4
MoShane Creek.. . . . .	“	4-10-27-3
Oxarart Creek.. . . . .	“	20-6-27-3
Piapot Creek.. . . . .	“	18-11-24-3
North Branch of Frenchman River.. . . . .	“	16-7-22-3
Ross Creek.. . . . .	“	N.W. 21-11-2-4
Sixmile Coulee.. . . . .	“	29-7-28-3
Skull Creek.. . . . .	“	10-11-23-3
Sucker Creek.. . . . .	“	24-6-26-3
Swift Current Creek.. . . . .	“	22-7-21-3
Tenmile Creek.. . . . .	“	33-5-29-3

The following gauging stations were established during 1910, and records were obtained for part of the year:—

Stream.	Location.
Battle Creek.. . . . .	S.W. 2-6-28-3.
Boxelder Creek.. . . . .	Sec. 2-12-30-3.
Gap Creek.. . . . .	Sec. 31-11-26-3.
Lindner's Ditch.. . . . .	Sec. 10-6-29-3.
Manyberries Creek.. . . . .	Sec. 3-5-6-4.
Maple Creek.. . . . .	N.E. 28-11-26-3.
Middle Creek.. . . . .	Sec. 4-2-29-3.
“ . . . . .	S.W. 35-5-1-4.
Sevenpersons River.. . . . .	Sec. 30-12-5-4.
South Branch of Swift Current Creek.. . . . .	Sec. 18-10-19-3.
Swift Current Creek.. . . . .	Sec. 17-10-19-3.
“ “ . . . . .	S.W. 30-15-13-3.

A large number of miscellaneous measurements were also made for purposes of general information.

About the later part of September, owing to Mr. Keith leaving temporarily, and for purposes of economy, Mr. Carscallen was placed in charge of the Calgary district and Mr. Swan took charge of the field work in the whole of the Cypress Hills district.

Mr. Swan resigned about the end of November and I was assisted in the final computations and estimates of daily discharge by Mr. Carscallen and G. H. Whyte.

There is still a portion of the district which is not covered by the survey. A reconnaissance of the country surrounding Old Fort Walsh and including the heads of Battle, Lodge, Mackay, Ross and Bullshead creeks will be made during the present year.

#### MOOSEJAW DISTRICT.

For some time it has been realized that as the country becomes more thickly populated and towns spring up, there are portions of the west which will not have a sufficient water supply for domestic and industrial purposes.

The council and board of trade of Moosejaw for 1909 were among the first to realize that while there is a sufficient water supply in the district it is allowed to run off into the larger rivers in the freshets, and the district is left with an inadequate supply during the remainder of the year, and petitioned the government to investigate and report on the resources of the Moosejaw creek and the best methods for the development of the same.

This work was undertaken early in the spring of 1910, and a survey party was organized, with Mr. Chas. M. Teasdale, D.L.S., in charge, to make a hydrographic and topographic survey of Moosejaw creek. About May 1, Mr. Teasdale resigned. Mr. W. H. Greene, a graduate of the School of Practical Science, was then placed in charge of the field party and M. H. French was engaged as assistant.

Two gauging stations were established on the creek, one at a bridge on the N.W.  $\frac{1}{4}$  Sec. 16-16-26-2, and the other at a bridge on the road allowance between sections 14 and 15, township 15, range 25, west of 2nd meridian. Daily records were obtained at these stations and the total annual run-off computed. A careful stadia survey was made of the valley from Moosejaw to a point a few miles above Rouleau, and a map showing the configuration of the surface of the ground by contours of 10 feet intervals was prepared. While the topographic survey was in progress a careful reconnaissance was made to discover the most inviting places for the locations of dams and reservoirs. Cross-sections were taken at four dam sites offering the best opportunities for storage. The contour map shows the lands which would be flooded by the erection of a dam of any feasible height, and tables showing the flooded areas and capacities of the reservoirs were also prepared. A copy of the report of the survey of Moosejaw creek will be included in the Second Report of the Progress of Stream Measurements.

The water supply in the vicinity of Regina, Moosejaw and along the Soo line of the Canadian Pacific railway is limited and it is very important that we should continue a study of the regimen of flow of Moosejaw creek for several years. This district will be extended during the coming year to include the Souris, Qu'Appelle and South Saskatchewan rivers. Souris river which heads in Canada, crosses the international boundary into the United States and then recrosses into Canada, and finally empties into the Assiniboine river east of Brandon. This river traverses a large territory in Canada and is the only stream in that district. It is proposed to divert it for irrigation purposes in North Dakota, which may affect Canadian interests.

#### OFFICE WORK.

As above intimated, the reports of the gauge height observers and the hydrographers were transmitted to the chief hydrographer by postal cards. These were entered on office forms and filed in a suitable cabinet, where they can be referred to at any time without any trouble. As the engineers completed their computations, the results were entered on convenient forms and filed in the same cabinet.

The accounts of the survey were kept in a combined day-book and journal, approved by the accountant of the department. Statements of expenditures were prepared and sent to the Superintendent of Forestry and Irrigation at the end of each month.

Miss G. E. Corrigan acted as clerk in the office during 1910. Besides typing and filing the correspondence, she entered and filed the cards, posted the day-book and ledger and prepared the monthly statements.

When it was decided to continue two engineers in the field during the winter, it was found that the remaining staff of engineers could not complete the maps, curves and office computations before spring. Mr. Joseph Cawthorn was therefore engaged as draughtsman. Since joining the staff he has prepared the maps and assisted in plotting curves, checking computations and copying the records for the annual report of the survey.

There has been a slight tendency in the past to make a very big showing in the field work and to overlook the importance of the office work. Sufficient office staff should be provided to thoroughly check all the reports and field books as they are received. I therefore strongly recommend that the office staff be increased to include a computer. The chief hydrographer could then keep a much better check on the

work of his assistants and when the engineers return to the office their field notes would be ready to be plotted and the data for the report could be compiled in much better shape and at an earlier date.

#### FUTURE WORK.

A number of applications have been received for water rights on streams in the vicinity of Wood mountain and the lower part of Frenchman river. Very little information is available regarding the water supply or the possibilities of irrigation in this district. There do not appear to be any permanent or large streams in the district but there are indications of considerable run-off at certain seasons of the year and of possibilities of storing water for irrigation purposes. An engineer will be placed in the field as soon as possible to study and report on the water supply in this district.

During the past month, Mr. Greene made miscellaneous discharge measurements of the north and south Saskatchewan rivers, and arrangements are being made now to establish regular stations on these streams as soon as possible. These are large and important streams, for they carry almost all the run-off of southern Alberta and Saskatchewan. Records on them will be very useful, locally for power studies, and generally for statistical purposes, to show the conditions existing over large areas. They also may be used as primary stations, and their records in connection with short series of measurements will serve as bases for estimating the flow at other points in the drainage basin.

The records of the survey are being used quite extensively now by engineers and, I think, the time is near at hand when the field of operations should be extended to include other parts of the Dominion. I would like to make miscellaneous gaugings of some of the streams in eastern Manitoba, such as Winnipeg, Whitemouth and Red rivers. The United States geological survey have established a gauging station on Rainy river, at International Falls, and have records covering the period from March 1, 1907, to the present. This is an international stream and important for power purposes, and I would suggest that the department consider the advisability of taking records of the flow of this stream. I would also suggest that we might do some work in the railway belt of British Columbia.

In all investigations of water resources the most important factor is the available water supply. It is also the factor that requires the longest time to determine satisfactorily, owing to the great fluctuation in stream flow from year to year. The stream gaugings already undertaken should, therefore, be continued for a number of years, in order that the records may be long enough to show the extremes of flow as well as a reliable mean.

The low flow of 1910 has demonstrated the part that municipal water supply and sewage disposal have in the use of rivers, and therefore, data should be compiled to show the amount of such water supply and sewage and the source of the former (where in surface waters) and the disposal of the latter.

I do not think it necessary to elaborate on the importance of continuing observations during the winter on the more important streams. The minimum flow occurs during that season and should be determined for use in considering power schemes.

Next to importance to a knowledge of the available water supply is a knowledge of the fall of the streams, and the possibilities of storage. This is necessary to determine the value of the river for irrigation, water-power, as an outlet for drainage ditches, and as an available channel for flood prevention work. River profile and reservoir site surveys should therefore be commenced as soon as possible on the more important streams of the west.

Your obedient servant,

P. M. SAUDER,

*Chief Hydrographer.*

## No. 25.

REPORT ON THE MILK AND ST. MARY RIVERS INVESTIGATION, 1910-11,  
BY F. H. PETERS, C.E.

CALGARY, ALBERTA, April 1, 1911.

R. H. CAMPBELL, Esq.,  
Superintendent of Forestry and Irrigation,  
Ottawa, Ont.

SIR,—In making this report it must be pointed out in the beginning that although a large amount of information was gained, much of it was of a confidential nature, and does not properly find place in this report.

Very careful and frequent stream measurements were continued throughout all the season on the Milk and the St. Mary rivers and all their tributary streams that could be reached, and all of these records have been turned over to the chief hydrographer, and will be published as a part of his 'Report of Progress of Steam Measurements.' Two hydrographers were employed during the season on this work, and their routes covered all the territory along the international boundary, from Lee creek to Cardston, Alberta, to Battle creek, in Saskatchewan. The duration of the season's work was from April 5 until November 18. From the beginning of the season until the middle of August the writer was employed making a general reconnaissance of all of the watershed of the Milk river and the head waters of the St. Mary river. That section of Saskatchewan lying along the boundary to the south of Wood mountain, which it was intended to reconnoitre, could not be travelled, owing to the scarcity of grass and water caused by the great drought of the season. During the season the total number of regular meterings made was 311; miscellaneous meterings, 100; and the total number of miles travelled, 7,106. The whole season's field work, including all lost time and delays, comprised 519 hydrographer-days work, which shows a daily average of 0.6 regular meterings, 0.2 miscellaneous meterings, and 13.7 miles travelled.

Two of the stations on the north branch of the Milk river, viz., Mackie's ranch, section 19, township 2, range 18, west of the 4th meridian, and Knight's ranch, section 13, township 2, range 21, west of the 4th meridian, proved unsatisfactory, owing to the fact that no permanent gauge rod readers could be obtained at these points.

It is thought that this trouble will continue to exist in future, and for this reason it is recommended that the hydrographers' routes be somewhat changed during the season of 1911-12.

The observations at Knight's ranch could be discontinued altogether without impairing our records of the river flow, and Cardston, Alberta, would then be made the headquarters for the western division of Milk river. Operating from this point the hydrographer would observe only the north branch of the Milk river at Peters' ranch, and then would be free to spend most of his time on the St. Mary river at Kimball, Lee creek, at Cardston, and also cover all the territory westwards, towards, and to, Waterton lakes. With headquarters at Milk River station, the second hydrographer would cover the eastern division of Milk river from Mackie's ranch to the eastern crossing of the Milk river at Spencer's lower ranch, and also the district surrounding Pakowki lake, north of it. This would make a more economical procedure for the hydrographic observations in the Milk and St. Mary river districts.



PLATE 20.—C. P. R. trestle across Bow River, Alta., to be Used in Construction of Irrigation Dam.

Photo H. R. Carscallen, 1910.

Attention is called to the table 'Study of Conditions of Run-off Watershed of the Milk River,' included in the 'Report of Progress of Stream Measurements.' This table is similar to Table 'B' attached to my report on Milk river of 1909, and a study of it will appear to verify all the statements made in that report in regard to the run-off of the watershed, and also the sub-surface flow of the stream. It is noted that the column 'run off per square mile for additional area' must be read with caution, because the subsurface flow of the river makes these figures most unreliable.

The past season was an extremely dry one, and the records of stream flow for the season may be regarded as approaching the minimum probable flow, although old timers along the Milk river claim that in the past they have seen stretches of the river quite dry.

The tables of daily discharge show that at the eastern crossing (Spencer's lower ranch) the river almost went dry during all the month of August.

During the season's work a level-compass-stadia survey was made of each station on the Milk river. These surveys covered a length of the river at the various stations of from 200 to 1,500 feet, and it was endeavoured to cover from the controlling river section above the station to the controlling river section below the station. The surveys developed the topography of the river banks, and the two controlling sections above and below the station.

The surveys were made primarily to gain evidence which might be useful in the future to determine to what extent the river channel had changed, either by meandering or by cutting down into the earth, and the information will also be used in making a study of co-efficients for determining stream flow by 'slope' measurements.

The matter of getting records of stream flow along the Milk river has two exceptional peculiarities. The first is that there are no other streams requiring measurement along the Milk River valley, and therefore it is not possible to lay out a 'circuit' for the hydrographer; but he must of necessity continually travel up and down the same stream, which is to a great extent wasting time. The second is that the only existing reason requiring complete records of the stream flow in Milk river is constituted by the articles in the International Waterways Treaty concerning the Milk and St. Mary rivers.

At the end of next season's work, practically three seasons will have been covered with good and frequent stream measurements, and with the other information that has been gained sufficient will be known of the peculiar conditions existing along the river.

At the end of this time it would appear that the only places where accurate measurements are required are at the points where the two branches of Milk river enter Canada, and at the eastern crossing where it leaves Canada. It is thought that these measurements could be gained most accurately and most economically by establishing permanent weirs at the points mentioned above. Looking forward to the time when the United States government will turn extra water into the channel of the Milk river it would be wise to make these weirs all permanent and of concrete. Apart from this phase of the question, and if the expense is to be incurred solely by this government, it is thought that wood structures would be suitable and advisable. My estimate of cost of such a structure, in my report for 1909, at the eastern crossing was \$3,300, and the cost of the same style of structures on the south branch and on the north branch, near the boundary, would respectively be about \$1,800 and \$500, making a total cost of \$5,600.

After these had been established the curves for them could be developed at a probable cost of one party's work for one season, viz., \$2,600, and after this the only expense in gaining records of flow would be the cost of the gauge height observers, which has to be paid in any case.

Recapitulating, at the end of the season 1912-13, for a total charge of \$8,200, the measurements at these points could be carried on for, say, five years at least (before the weirs would require repairs) at no expense whatever save the cost of gauge height observers.

Under existing conditions it practically requires two parties to cover this river at an expense of about \$5,200 per year, so it can readily be seen how great the saving would be in dollars and cents if the weirs were established.

As was pointed out in my report for 1909, the character of the river bottom is of such a shifting nature that the curves developed on natural sections from one season's work are useless for the next season's work. And it was also pointed out that the proposed weir would give a better water measurement because it would bring up the water flowing in the sands of the river bottom, which water cannot be measured with a current meter.

Your obedient servant,

F. H. PETERS, C.E.