
January
1921
Illustrated
Canadian Forestry
Magazine

Bureau of Canadian Information

The Canadian Pacific Railway has established a Bureau of Canadian Information as a branch of its Department of Colonization and Development, with the object of disseminating reliable and up-to-date information as to agricultural and industrial openings in all parts of Canada.

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The Company has yet for sale several million acres of choice farm lands in Western Canada, at low prices and on long terms of payment. In certain districts lands will be sold without settlement restrictions, but the Company is prepared to grant special concessions to those who will settle upon and develop their farms.

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INDUSTRIAL OPENINGS

Reliable information as to sites for new industries in all parts of Canada, and of special business openings in the growing towns and cities along the lines of the Canadian Pacific Railway in both Eastern and Western Canada, will be gladly furnished on request.

CANADIAN INTELLIGENCE SERVICE

Well equipped Canadian reference libraries have been established by the Department at Montreal, New York, Chicago, and London, England. These libraries contain the fullest information on all matters relating to Canada and her undeveloped resources, and are kept supplied with the latest information pertaining to new developments through the medium of a news service organized through the co-operation of the other departments of the Company's service. The information on hand in these libraries is available without charge to those interested, and inquiries addressed to any office of the Department will receive prompt attention.

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.....1921

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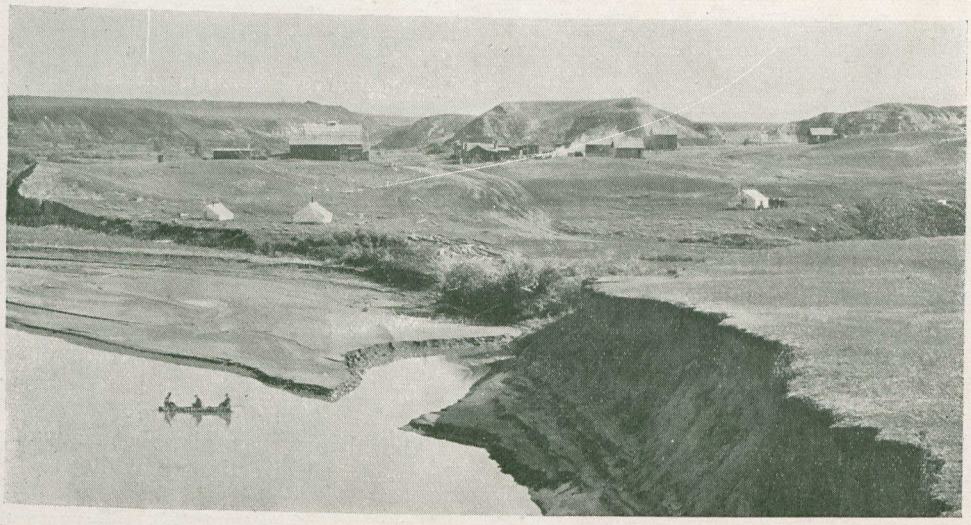


Wanted! A few groves of trees for wind-shelter, for beauty, for fuel. Scene taken at Steveville, Red Deer Valley, Alberta.

Why the Prairies are Treeless

By R. H. Campbell

Director of Forestry, Ottawa

The chief onus of blame laid at the door of fire.

IN the western part of the North American continent and mainly to the east of the Rocky Mountains is an immense extent of land almost bare of trees, representing the western plains and prairies. Distinction is usually made between the districts represented by the two terms—the term "plains" being confined to the arid tracts destitute of grass and sod such as are found in part of Colorado, in Arizona, in New Mexico, and in Southern California. "Prairies" on the other hand is confined to those great land areas covered by grass and sod which are characteristic of the Canadian western prairies.

In his poem on "The Prairies," William Cullen Bryant describes them as follows:—

"These are the Gardens of the Desert, these
The unshorn fields, boundless and beautiful,
For which the speech of England has no name—
The Prairies. I behold them for the first,
And my heart swells, while the dilated sight
Takes in the encircling vastness. Lo! they stretch
In airy undulations, far away,
As if the ocean in his gentlest swell
Stood still with all his rounded billows fixed,
And motionless forever—Motionless?—
No—they are unchained again. The clouds
Sweep over with their shadows, and, beneath
The surface rolls and fluctuates to the eye;
Dark hollows seem to glide along and chase
The sunny ridges."

So far as I am aware, the question of why the Canadian prairies are generally treeless has not been given exhaustive scientific investigation. Theories have been put forward incidentally from time to time by different men from the viewpoint of special conditions they had in mind at the time, but these seem to be more in the nature of flashes struck off at high pressure in the consideration of some special condition instead of the statement of and the result of careful conclusions resulting from long and attentive study and balancing of all possible influences. For indication of the various theories on the subject therefore it is necessary to refer to studies made and publications issued in the United States of America.

Reference to such studies and publications shows that the following theories as to the causes have been supported by various authorities.

Is the Soil Responsible?

One theory is that put forth by Professor J. D. Whitney in his book "Plain, Prairie and Forest," who pointed out that the forests as a rule occupy gravelly or open soils and avoid the fine deep sediments, and from that argued that the prairies are treeless because their soil is too fine and close to properly nourish the roots. This theory is not however thoroughly well based. As a matter of fact, there are all varieties of soil throughout the prairies, and trees have been grown successfully on the Canadian prairies in practically all conditions of soil.

Another theory proposed by J. W. Redway is that the prairies occupy an ancient inland sea and never were forested, but this theory is uncertain and is insufficient considered alone, to allow for the present existence of bluffs of trees and of fringes along streams throughout most of the prairie region.

It is also suggested that the trees were driven out during the last glacial period, but this is also rendered untenable by the fact of trees being scattered here and there on the prairies as indicated in the last paragraph, and by the extensive forested areas to the north of the prairies.

The claim was also made that the close prairie sod is a barrier to the establishment of tree growth and this claim is to a large extent true. Thorough cultivation of the soil is generally found to be a necessary preliminary to the establishment of a tree plantation. This however does not seem a sufficient explanation of the vast extent of treeless prairie as in favorable seasons and conditions the trees begin to creep out on the prairie.

Insufficient Rain?

The theory has also been advanced from several directions that the treelessness of the prairies is the result of insufficient rainfall. While this is undoubtedly true of the arid plains in the south western states it is not in itself a sufficient cause for the lack of trees on the Canadian prairies. The precipitation is cerainly lighter than in the forested districts but is generally sufficient to support tree growth where it exists on the prairies.

"Chinook" winds have also been suggested as a reason for the treelessness of the prairies but this cause by itself does not seem to be sufficient. The warm chinook winds in winter often cause the formation of ice on the ground and, if long enough continued may, especially towards spring, start growth which will be destroyed by the inevitable return of winter weather. Some species of trees that succeed well in Manitoba and Saskatchewan cannot stand the effect of the Chinook winds in Alberta where their influence is more marked than farther east.

Trees taking possession of the prairie north of Oxbow, Saskatchewan. Thirty years ago the land covered by the photograph was totally bare.

The denudation of trees from the prairies has also been ascribed to prairie fires and as the struggle between prairie and forest has been studied in the debatable land just west of the Mississippi, where the prairies have in comparatively recent times been clearly extended by fires, the conclusion has been reached that this element must be given a large place in the accomplishment of the result of formation of prairies. It is found that the border lines between prairie and forest are very irregular. The prairies stretch into the forest land in long tongues in the shapes in which they would occur if caused by fires.

Our Prairies Once Tree Covered.

Turning now to Canadian conditions it seems quite clear that in remote geologic time the districts which are now prairie were covered with heavy forest. In southwestern Manitoba and southern Saskatchewan extensive beds of lignite coal are found, and good coal exists throughout Alberta up to and into the Rocky Mountains, and is largely mined. This fact seems to establish definitely that at one time extensive forests existed in the prairie districts, though generally of species of trees not now existing in the territory.

So far as the theory that treelessness results from the country having been an inland sea is concerned it may be pointed out that a great part of southern and central Manitoba was for a long time covered by a great lake, Lake Agassiz, which followed the glacial epoch. But the area which was included in this lake carried the forest which lay along each side of the Assiniboine River and the well wooded district west of Lake Manitoba and around Lake Winnipegosis so that it is not entirely treeless. West of the Pembina Ridge and the Brandon Hills was another lake, Souris Lake, covering what is now south western Manitoba and eastern Saskatchewan.

Thus in a report made in 1859 by Professor H. Y. Hind, Professor of Chemistry and Geology at Trinity College, Toronto, the following statement is made:

"Putting out fire in the prairies is a telegraphic mode of communication frequently resorted to by Indians. Its consequences are seen in the destruction of the forests which once covered an immense area south of the Qu'Appelle and Assiniboine. The aridity of those vast prairies is partly due to this cause. The soil, though light, derives much of its apparent sterility from the annual fires.

In low places and in shallow depressions where marshes are formed in spring, the soil is rich, much mixed with vegetable matter, and supports a very luxuriant growth of grass. If willows and aspens were permitted to grow over the prairies, they would soon be converted into humid tracts in which vegetable matter would accumulate, and a soil adapted to forest trees be formed. If a portion of prairie escapes fire for two or three years the result is seen in the growth of willows and aspens, first in patches, then in large areas, which in a short time become united and cover the country; thus retarding evaporation and permitting the accumulation of vegetable matter in the soil. A fire comes, destroys the young forest growth and establishes a prairie once more. The reclamation of immense areas is not beyond human power. The extension of the prairies is evidently due to fires, and the fires are caused by Indians, chiefly for the purpose of telegraphic communication, or to divert the buffalo from the course they may be taking."

Professor John Macoun in remarks made before a meeting of the Canadian Forestry Association in 1902 made the following statement:—

Prof. Macoun's Verdict.

"The whole of the land in the Northwest was made prairie by fire, with the exception of a few square miles. There is wood at Turtle Mountain, Moose Mountain, Wood Mountain, Cypress Hills, West Butte and Three Buttes. These hills are not high, but they are more or less covered with wood, and when you examine them you find the country is undulating, with ponds and lakes in the hollows. These ponds prevented the destruction of the timber, but when the fires got away from the hills on to the level land they could not be stopped. The fire burnt on and left a margin of burnt timber and grass, and next year the fires started afresh, and the result was when the fires were stopped two hundred miles north of the Saskatchewan, there was a margin of burnt trees always to the south, and outside of that margin a margin of young trees growing up out of the grass, and still farther you would find little poplars of a year old which had sprouted from the roots of the dead ones, so that it is evident the whole of that country was covered with forests at one time, but through the agency of fires it became a prairie. What is to hinder it from being covered with timber again? What is needed is water. I make that statement —it may be contradicted, but in later years, after I am dead, it will be proved. The land is there and all that is required is water to make it grow anything."

While the geological record is not sufficiently complete, or has not been sufficiently studied with that object in view, to establish what condition or catastrophe is primarily responsible for the treelessness of the prairies, it would seem reasonable that, after the upthrust of the Rocky Mountains and the consequent interruption of moisture laden winds from the Pacific Ocean, the climate of the prairie districts became much dryer and this and subsequent forest fires gradually and steadily reduced the forest area and extended the prairie till finally it stretched unbroken for hundreds of miles from west to east.

The Example of C. S. Noble.

Mr. C. S. Noble, owner of the largest farm in Canada, 35,000 acres, at Nobleford, near Lethbridge, Alberta, is planning to put 82 acres into trees next Spring.

Mr. Noble has made a remarkable record. Twelve years ago he arrived at the site of Nobleford with $1,000—and plenty of imagination and muscle.

This year, one field alone, planted to wheat, measured 9,000 acres, and averaged forty bushels to the acre. Fifty-six binders were cutting at one time. The total yield of the Noble farm this year exceeds in value $1,250,000.

It is not surprising that Mr. Noble is likewise a leader in establishing small woodlands as a balance-wheel to his great estate.

Wood and Its Distillation

The first of a series of articles by Dr. Alfred G. Macintyre, Ottawa

THE importance of forest reserves was fully illustrated during the recent war and it may be accepted that these, in the future, will be considered one of the "key" resources which must be built up and conserved for any untoward possibilities which may arise.

Early in the war a large number of scientific and technical men predicted that, with a good blockade, the Central Powers could not continue the war for more than twelve months, because, by that time, their enormous reserve of cotton, for the manufacture of smokeless powder, would then have become exhausted and they would have no further supply of raw material to produce the necessary propellant powder.

Such persons were evidently unfamiliar with the fact that, as early as 1909, one of the German Imperial powder factories had made excellent smokeless powder by the substitution of the cellulose of wood pulp for that of cotton and thus, when the supply of the latter was cut off, the explosion factories had recourse to the employment of wood-pulp manufactured from their 25 million acres of forest reserves. The Central Powers, as a result, did not suffer through lack of raw material for making propellants and carried on, in this way, with an ample supply until crushed by other means than the cotton blockade.

Besides the pulp industry there exists another important "key" industry associated with forestry products namely: that of the distillation of wood. The acetone necessary, as a solvent, in the manufacture of cordite, in pre-war times, was solely made from acetate of lime, a product of the destructive distillation of hardwoods. The acetic acid and acetates required for aeroplanes and such like were also obtained in the same way. It is true other methods of preparing these substances were developed, owing to the great shortage, but most of them ceased to be employed as soon as the war ended.

Charcoal an Ancient Product.

No one can say when and where the first primitive method was introduced for the manufacture of charcoal from wood, but it is certain that this substance was made more than 5,000 years ago. The same uncertainty exists regarding the place and date of the first recovery of the condensable gaseous products obtained by the charring of wood. It is probable that it commenced with experiments at the early part of the 18th century, carried out by the phlogistonists in an endeavour to separate the "active spirit" of wood. The earliest British works, for the distillation of wood and recovery of the pyroligneous acid, were erected between 1790-1800 and these existed in connection with the supply of charcoal for the metal industries of the districts of Sheffield and Glasgow, and the production of acetic acid and acetates for the dyeing and calico printing industries. The Scottish works date from the beginning of the nineteenth century and are interesting for two reasons: first, that some of the original factories are operating under the same firms today, and second, that these works sent forth the pioneers who built up this industry on the American continent. Messrs. Turnbull, of Glasgow, who have possessed, at different times, a considerable number of works in Scotland and Ireland, built a plant early in the last century on a small brook called the "mill burn" which flows into the river Leven just south of the town of Alexandria, Dumbartonshire, and it became known as the "Millburn" works. This firm, in 1848, decided to build a plant in America, and early in 1849 men and material were sent from Scotland, the workers largely from Millburn to a site near Binghampton, New York, to erect and operate a factory. The place received the name of Millburn from the home works. This was the first plant for the distillation of wood in America and from it developed the industry in the United States which today comprises 100 factories with a total capa-

city of consuming more than one million cords of wood per annum.

Canada's First Factory.

The first plant for the distillation of wood in Canada was not that erected at Fenelon Falls, Ontario, in 1897 as has been repeatedly stated, but was the one built at Anagance, Kings county, New Brunswick, in 1880 and operated until 1886. It consisted of seven iron retorts and manufactured gray acetate of lime, methyl alcohol and charcoal. The retorts and also the first supply of stills, were imported from Scotland.

There are about thirteen factories in Canada engaged in the distillation of wood and these consume about 130-140,000 cords of wood per annum and produce, approximately, 13,000 tons of gray acetate of lime, 60,000 tons of charcoal and 1,000,000 gallons of methyl alcohol. These may be termed the prime products of these factories. In eastern Canada hardwoods are exclusively employed, and the greater percentage being birch, beech and maple. Preference is given hardwoods, for distillation, because the yields of acetic acid and methyl alcohol are higher, compared with that obtained from softwoods, and the distillates are more easily refined. With the increasing demand and higher prices offering for some of the products of the distillation of soft woods, more attention is being directed to the possibility of utilizing these woods in America.

Dry wood is chiefly composed of carbon, hydrogen and oxygen and the quantities of each calculated to ash and nitrogen—free wood, averages about 50 per cent. carbon, 6.2 per cent. hydrogen and 43.8 per cent. oxygen. The nitrogen content of wood varies between 0.05 and 1.5 per cent. Spruce contains 0.05-0.10 per cent.

Cellulose in Wood.

The chief constituents of wood are cellulose, lignin and carbohydrates. The percentage of cellulose, in general, is in the vicinity of 50-60 per cent. There is about 25-28 per cent of lignin in soft woods and 20-26 per cent in hardwoods. The carbohydrates, in the form of pentosanes, vary from 10-13 per cent in soft woods to from 22-26 per cent in hardwoods. The percentage of hexosanes also differs with various kinds of wood. The general composition of wood varies with locality of growth, age and different parts of tree.

The chemical structure of the cellulose molecule, the principal constituent for pulp manufacture, has not as yet been determined. Many theoretical structures have been proposed but all are hypothetical. The average chemical composition of cellulose is 44.4 per cent. carbon, 6.2 per cent. hydrogen and 49.4 per cent. oxygen. It would appear as if cellulose, from different sources, were not a chemically individual compound, but rather a generic application for very similar compounds. This is indicated by the yield of acetic acid obtained, under the same conditions, from the various celluloses.

The following is the respective percentages of acetic acid from the cellulose of cotton, spruce, birch and beech—1.4; 2.8; 3.9 and 3.5 per cent. The structure of the lignin molecule is equally as uncertain as that of cellulose. The composition of socalled lignin varies between 56.-60. per cent. of carbon and approximately 5.8 per cent. hydrogen and 38.0 per cent oxygen, much depending upon the degree of purity. The lignin molecule contains at least four methyl or methoxy groups which are important in the distillation of wood as sources of wood alcohol, while cellulose and carbohydrates are members of what is known as the aliphatic series, lignin is generally accepted as belonging to the cyclic compounds, and possibly containing an aromatic nucleus. There are those, reasoning by analogy and certain degradation products, who view lignin as a condensation product of coniferyl alcohol, a substance found combined with glucose in the form of the glucoside coniferin, in the cambial sap of trees. Others entertain the opinion that it is a cyclic hexenone united through acetyl residues with a pyrone ring compound containing methoxy-groups. This latter contention has some experimental evidence supporting it, but does not explain the many degradation reactions of lignin.

A great deal more is known of the

carbohydrates—pentosanes and hexosanes—particularly products of their respective hydrolysis—pentoses and hexoses. The bark of the coniferae, and to some extent that of the deciduous woods, contains tannin associated with a large percentage of substances called "nontans" including carbohydrates, such as glucose, etc. Tannic acid is a member of the aromatic (cyclic) series, and the tannin obtained from barks is generally classed as belonging to one or both of the following groups—pyrogallol and catechol. Derivatives of these compounds are found among the degradation products formed by the distillation of wood, and in a measure the presence of these substances explain the hypothetical contention that lignin is built up from coniferyl alcohol and besides the analogy between the bark and lignified wood.

The chemist, in considering the products of the distillation of wood, has his attention almost entirely directed to the substances formed by the pyrogenic degradation of cellulose, lignin and carbohydrates which constitute his raw material and the conditions most favorable for the highest yields of the economic products which he desires to obtain from his wood. Some of the methods and results will be the subject of future communication.

New York to Alberta by Wing.

From New York State wild ducks drift north-westward to Alberta, according to the inscription found on a band on the leg of a pintail shot on the outskirts of Camrose, Alberta, recently. The inscription bore the wording: "Released by the American Museum at New York. Will the finder of No. 35793 please notify us." Carl Jensen, who shot the bird, is communicating with the museum authorities and is having it mounted.

Roughly speaking, it would be about 2,500 miles from New York to Camrose. The discovery of the New York bird so far north-west will open up a new field of speculation as to the wild ducks' migratory habits.

Daylight Encouragements

Books are night birds. Most printing reaches the ultimate consumer by lamplight. Only school books, directors, telephone books, maps and telegrams are read by daylight.

So says Dr. Frank Crane. The doc slights the newspaper writers, however, in overlooking the fact that some of the most impressive literature we get reaches us in the morning mail to brighten up the day and encourage us in our work. It generally concludes with a jovial threat to take the usual legal proceedings if not attended to within a specified date.—Ottawa Citizen.

The Rats-and-Matches Theory

In the lengthy category of reasons and excuses for fires, that of friction due to the gnawing of match heads by rats and mice has had to bear its full share. When all else could prove an alibi the rats were blamed. The increasing number of fires attributed to this cause emphasized the necessity of establishing the possibility of it being bona fide.

The Underwriters' Laboratories, Inc., of Chicago, after careful and prolonged experiments by its fire prevention engineers, has reached the definite conclusion that rats would rather starve to death than eat the modern match heads.

Match Concern Reforests

Bryant & May, a big British match firm, have purchased a large estate in Scotland and are reforesting land to supply their own wood for the making of matches. The land secured is at present quite bare, the tree chosen is the aspen, and it will be thirty years before the firm manufacture the first matches from the new supply.

A Subscriber's Opinion.

I am delighted with your Forestry Magazine, and am pleased to be a member of the Forestry Association. Being a wood ranger myself, you can imagine how these articles appeal to me.

Wishing the association every success,

H. J. D. HAMMOND,
Dryden, Ont.

A Policy Where All Opinions Meet

IN both Canada and the United States it has long been recognized that progress in the administration of the forest resources, whether publicly or privately owned, must be along the lines of co-operation and compromise. While in this country, the 'way out' will probably be found through the machinery of the provincial governments which are the chief timber owners, the American plan as now evolved under the name of "A National Forest Policy" gives leadership and authority to the Federal Government in carrying out a nation-wide plan which eventually would provide an adequate timber supply for the people of that country. It is well to bear in mind, also, that four-fifths of the timber lands of the republic have been alienated from public control while in the Dominion exactly the reverse of this condition obtains. Not more than ten or fifteen per cent. of the total timber area of Canada has been deeded to private ownership.

After long negotiation final agreement was reached between representatives of the American Paper and Pulp Association, National Lumber Manufacturers Association, National Wholesale Lumber Dealers Association, the Association of Wood-using Industries, the American Forestry Association, American Newspaper Publishers Association, the United States Chamber of Commerce and the Chief Forester of the United States. In the legislation proposed, authorization is given to the Federal Secretary of Agriculture to approve proper state policies covering fire prevention, reforestation and, where necessary, the cutting and removing of timber crops. Other clauses call for:

A survey to obtain necessary information as to forest resources, forest production and forest requirements of the nation.

Provision for studies and experiments in forest reproduction methods, wood utilization, timber tests, wood preservation, development of by-products and other steps to bring about the most effective use of the nation's forest resources.

Provision for more rapid replanting of the vast areas of denuded lands within the National Forests.

Appropriation of ten million dollars a year for five years for the purchase of lands which should be added to the National Forest system, whether or not on the headwaters of navigable streams as such purchases are now limited.

Authorizing acquisition of similar lands by exchange of land or timber when clearly in the public interest.

Authorizing the addition to National Forests of lands now in other forms of government ownership but found chiefly suitable for permanent forest production.

It is contended that a National Forest Policy should observe the following principles and provisions:—

1. That all soil shall be made productive of the crop to which it is best adapted or for which there is the greatest public need.

2. That while agriculture and forestry are based upon soil production, the methods necessary in forestry and the time involved are so different from those of agriculture that forestry demands an entirely different form of administration.

3. That State Forest Policies shall be initiated and carried out in co-operation with the National Government and with private owners wherever and to the fullest extent possible.

4. That State Forest Legislation shall establish general principles and procedure only and vest in a properly constituted and non-political body, acting through technically qualified representatives, the responsibility for the fixing of regulations and enforcing them.

5. That the paramount and immediate consideration in any Forest Policy is the creation and maintenance of effective means for the prevention and control of fire on all forest lands of whatever ownership, and that every owner of forest land shall be required to conduct operations thereon in such a manner as to avoid creating a fire menace to adjacent property.

6. That forest surveys, land classification, forest research and forest education shall be provided for.

7. That there shall be such changes and adjustments in prevailing systems of taxation as will enable all forest lands to be equitably taxed thereunder, yet will not discourage the holding of private forest land for future crops without impairing local revenues.

8. That the state, upon request, shall assist the private owner of forest lands to make them continuously productive through the preparation of working plans, supplying of planting material and supervision of silvicultural operations free of charge or at cost.

9. That the state be empowered to take over at a fair valuation and administer as part of the system of public forests any land, which, after competent examination, is classified as suitable only for timber growth, in case the owner refuses to avail himself of the opportunities and assistance provided by the public to encourage forestry upon private lands.

10. That the acquisition of forest land by the state is essential to a sound forest policy.

11. That all state-owned forests shall be utilized for continuous production, both for direct returns in forest products and indirect returns in soil protection, game and recreation.

12. That all state-owned forest property shall be capitalized upon the records of the administrative body so that all expenses in connection with the development thereof and returns therefrom may be accounted for on a business basis to the people of the state who furnish the funds for the undertaking and enjoy its results.

Paper Textiles Make Headway

IN Chambers' Journal Frederick A. Talbot combats the still popular idea that paper textiles were a product of the war, doomed to disappear with the return of normal conditions. He declares that paper is capable of seriously challenging "the supremacy of generally accepted textiles, such as woll, cotton, linen, silk, hemp and jute." There will be a struggle for supremacy, ne thinks, between the paper products of Britain and Germany. "We have entered the paper textile age,' he says, "and the future of the trade on these islands is amply secured."

In his enumeration of the fabrics which can be and are being made from paper, Mr. Talbot gives a surprisingly long list in addition to the various uses to which it was put in war- time exigencies. To quote:

> "It provides excellent material for bootlaces, braiding, webbing and belting, being not only stronger than the ordinary materials therefor, but having the additional advantage of being fireprof and waterproof, so that it will neither contract with damp nor stretch with dryness. It is a first-rate insulator, and is employed for insulating, flexible electric wire. .It makes a capital stair carpet, while any desirable pattern and coloring can be obtained in the weaving. It not only offers a good upper for tennis and other shoes where canvas or jute is ordinarily employed, but can be used for soling purposes as a leather substitute with every success. It is an excellent art fabric for covering walls. . . At the moment it is being exploited for the production of art carpets, and in this respect holds out many inducements."

Lace curtains and table cloths that can safely be laundered, scrubbed and boiled are included in the list. The English speaking world laughed at the Germans and their paper clothes, but apparently paper textiles are to play a part in the industry and life of every nation beyond all previous imagining.

Courtesy American Forestry Association.

The Great Red Plague of Canada: One million square miles of our national forests already fire-swept, and fresh areas are added each year. These forests grew on non-agricultural soil—nearly every acre of which is owned by the State—upon which no crop except timber ever can be produced.

There is a way open to every Canadian citizen to revolutionize conditions that permit this stupendous public waste; membership in the Canadian Forestry Association. Your personal influence is multiplied a hundred fold by joining hands with 12,000 of your fellow-Canadians towards a common patriotic object.

Ontario's Plans for a Tree Supply

THE Provincial Forester for Ontario reports it is expected the Government nurseries will be able to handle any requests for young trees during the coming season. The nurseries at St. Williams, Ontario, are doing very well, and they will be able to produce trees in very large quantities within the next year. Great difficulty has been experienced in securing forest tree seeds, especially those of the Red or Norway Pine. Suitable Scotch Pine seed has not been obtainable from Europe, and the Provincial Forestry Department have doubted the wisdom of going too heavily into White Pine until the status of White Pine disease is settled. The seed of the White Pine and White Spruce, however, has been obtainable in sufficient quantity for the coming season. The Department hopes to import the other seed needed, and expects a heavy stock within the next two years.

The Secret of Preventing Forest Fires

AT the request of the Canadian Forestry Magazine, Mr. H. Sorgius, Manager of the St. Maurice Forestry Protective Association, with headquarters at Three Rivers, P.Q., made the following statement as to his experience concerning the value of educational work in heading off the forest fire plague. Mr. Sorgius has one of the best organized forest protective systems on the continent, and speaks as one who has at his disposal every mechanical means of patrol and fire fighting and yet places his chief reliance on educational method. Says Mr. Sorgius:

"I can say that I am more than ever convinced that the chief method to be used in forest protection is a serious campaign of propaganda, and more money should be spent in educating the people to prevent forest fires. Through the experience and data obtained by this Association since 1912, it is proven that outside of a very small number of fires caused by lightning and fires caused by railway locomotives, all fires could be prevented. It is far more essential to prevent forest fires than to detect and extinguish them. I would suggest that greater effort should be made in educating the people, especially those whose work is in connection with the lumbering operations, also the fisherman and hunter.

"The settlers in our territory during past season caused four fires, burning an area of only 19 acres. We have no trouble whatever through this source, and the good results, we believe, were obtained through the educational efforts carried on by this Association since several years. It will be remembered that only a few years ago the settlers were the cause of 100 to 185 fires a year and damaging large areas, and this, we believe, is sufficient proof to show the value of publicity in forest protection."

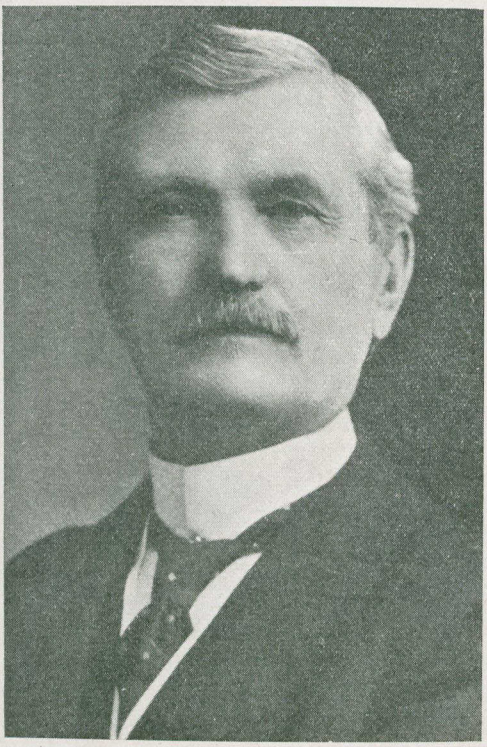
Sault Ste Marie, Ont.

Can. Forestry Magazine:

I enclose with pleasure cheque to cover 1920-21 for Magazine. It is the best value of any publication I receive. You are doing a splendid work in endeavoring to educate Canadians in the value of their timber heritage, for many still do not appreciate the worth of a growing tree.

Wishing you every success,

(Sgd.) L. A. GREEN.



Death of William Power.

In the passing of William Power, of Quebec, the Canadian Forestry Association loses a valued Director and a firm friend.

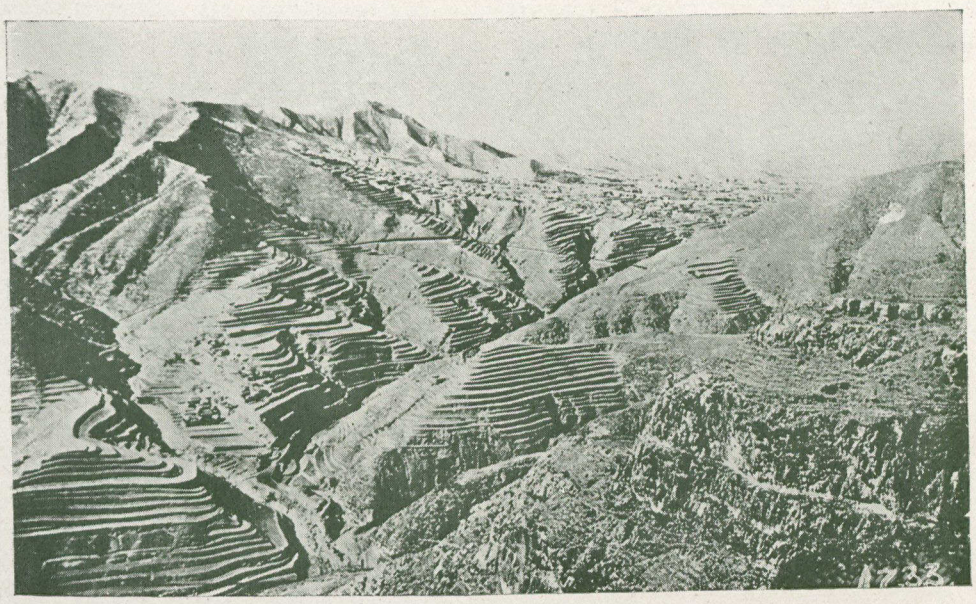
Mr. Power was President of the firm of W. and J. Sharples, timber merchants, Quebec, President and one of the principal owners of the River Ouelle Pulp and Lumber Company (recently changed to the Power Lumber Company), and President of the Lafontaine Lumber Co.

Born at Sillery, February 21st, 1848, a son of the late William Power, one of the managers of W. and J. Sharples, Mr. Power took his education at the Sillery Public Schools and the Quebec Commercial Academy, and in 1860 entered the business with which his father was associated and became a partner in 1906. In 1902 he was elected to the House of Commons for Quebec West bye election and re-elected at the general election of 1904. He engaged in many public activities, serving as a President of the Quebec Board of Trade and giving his time to such events as the Tercentenary Celebration. In 1914 Mr. Power was elected President of the Canadian Forestry Association, and never hesitated to devote himself whole heartedly to the advancement of its objects.

He is survived by his widow, formerly Miss Winifred Rockett; four sons, W. Gerard Power, of St. Pacome; Joseph Power, Charles G. Power, M.P., and Frank Power, of Quebec; two daughters, Mrs. Noel Barclay, of Montreal, and Mrs. F. A. Mosely, of Montreal, as well as two sisters, the Misses Alice and Annie Power, of Bridgewater Cove, Sillery.

BIND YOUR 1920 COPIES

Those wishing a title page and index for 1920 Can. Forestry Magazine should write at once to the office of publication, 224 Jackson Building, Ottawa, for a post-free copy.



The price that nature demands for forest destruction: with the hillsides robbed of all traces of tree cover, the erosion of the soil, which was an inevitable result, compelled the wretched population to laboriously terrace the slopes to hold the soil in place. Many "farms" have just enough fertile earth to carry two rows of corn.

China Pays the Price of Ruined Forests

by Bailey Willis, U.S. Geological Survey

CHINA, like other long innabited lands, has been deforested wherever the condition of climate or topography are not such as to make it impossible to destroy the forest. In this respect the empire divides naturally into a southern region on the one hand, in which semi-tropical conditions of rainfall and temperature are exceedingly favorable to vegetation, so that shrubbery and trees have renewed themselves wherever there is opportunity; and on the other hand, northern China, where severe winters and limited rainfall are unfavorable to growth, and the great need of mankind for fuel has rendered his destructive activity especially effective.

In Central China there lies between the north and the south a great mountain range, 8,000 to 12,000 feet in altitude and approximately 300 miles across, which, stretching east and west, separates provinces as distinct as are those on opposite sides of the Cascade Range in Washington. In this great mountain range, the Ts'in-ling-shan, there is a meeting of the vegetation of the temperate and semi-tropical zones. In the more southern and lower valleys one finds the bamboo, growing in a single season to heights of 30 and 40 feet, the Chinese sumac or lacquer tree, and varieties of the araucarian pine, together with many trees and shrubs unfamiliar to an American; but ascending the mountains, one passes up into extensive coniferous forests, where trees as much as five feet in diameter and perhaps 200 feet tall may still be found. One would scarce perhaps credit the primitive methods of lumbering employed by the Chinese, with ability to destroy the forests of a densely grown mountainrange, but such is the case. Along the more accessible foothills, shrubbery or bare hillsides replaced the forest which we were told flourished there within forty or fifty years. Villages, whose prosperity had depended

upon the lumbering industry, contained many deserted houses, which, in their ruinous condition, reminded one of an abandoned lumber camp of our own Northwest; and the steep slopes from which the soil was rapidly being washed in deep, red gullies told how recent had been the removal of the protective forest cover. Yet here the only implements of destruction are a primitive axe and saw, and the only means of transportation for the lumber is men's backs. The trees are commonly cut with a small axe, and are sawed with a whip-saw into boards two and a half to three inches thick, with an average length of eight feet. Three or four such boards make a man's load, and are carried out, it may be a journey of ten days or two weeks, over the roughest mountain trails, by men whose average day's journey is ten to fifteen miles, and who crawl over the path, steadying themselves under a load of 180 to 200 pounds by carrying in each hand an iron-shod pole. The use to which these boards are put is limited to the single purpose of making coffins. Usually an entire coffin, consisting of a top, bottom, two sides and ends, all shaped and hewn to be put together, makes two men's loads. Small logs, which are used for house building and other purposes, are sometimes run in streams, and the Chinese then use a stout canthook and methods not unlike those of our own lumbermen in mountain regions.

The use of posts and beams for the better houses and temples is general throughout China, and second-hand beams are commonly sold. They consist of tree trunks stripped of their bark and somewhat smoothed. A post of this kind 30 feet high is of very unusual dimensions and the cost is correspondingly great. In a new temple at one of the great monasteries, to which the Empress Dowager had given largely, the posts averaged 30 odd feet in height and were covered with red lacquer which concealed the undressed surface. There were about twenty of them and their cost had been a very considerable part of that of the entire structure. How such trunks are obtained and transported I do not know, as I did not see any lumbering operations in progress. They must be brought from a long distance by the most primitive methods.

Big Prices For Small Sticks.

In north China, lumber is a very rare commodity. The severity of the climate creates a demand for fuel, which long since exhausted the natural supply and drove the people to ingenious expedients for burning twigs and grass. Sticks of wood an inch in diameter and 8 inches to a foot long are to be had, but their cost is beyond the reach of any but the well-to-do. They are obtained by cutting off branches of quick-growing trees. Huge bundles of brush are brought in by the mountain men, who gather them on the least accessible mountain summits; and charcoal, made in districts of scanty population where willow and other underbrush has a chance to grow, is the common fuel of those who can afford the luxury. But the average farmer of the country burns grass or stubble. The grass is gathered by boys, who are sent out to crop it with sharp, crooked knives with which they scratch it up by the roots from among the rocks of the mountain sides. One will meet groups of the little fellows working like beavers several miles from their villages, up on the heights where there is not sufficient soil to justify the farmers in building terraces on which to plant a crop.

Grass For Fuel.

It seems as though the two great needs, that of food and that of warmth, here come into competition. To supply food every square yard of arable land is tilled, and the soil from slopes which can not well be cultivated is gathered on terraces and there made to yield a crop. By building walls and scratching the surface a system of terraces is carried high up on the mountains, and there seems to be scarcely any place where grass or shrubbery can grow for fuel. But there are some hardy grasses and some shrubs which the most persistent rooting will not destroy, and among these the people gather their crop of fuel. The fields yield stubble and not a scrap of it is lost. When the harvest has been gathered and the fields look bare, at least to a foreigner's eye, the Chinese goes over them with an automatic rake, which not only rakes

The price that China pays for ruined forests: mountain sides dumping their rocky debris on the once fertile Plains. Over thousands of square miles deforestation has evicted the population.

but gathers into itself every blade of dry grass or bit of corn stalk. He walks along with the handle hanging over his shoulder, and leaves a perfectly bare track about 30 inches wide, the width of the rake, behind him.

A Good Land For Trees.

In the rich province of Shan-tung, one of the eastern provinces of the Empire, which has been occupied by the Chinese for more than four thousand years, this process of soil gathering and of destruction of all vegetation except that which is grown as a crop, has progressed almost to its ultimate limit. Yet it is evident, from the old and vigorous trees which are found in the villages and in the temple grounds, that the climate is a favorable one for willows, cottonwoods, and elms, or trees which resemble them in generic character.

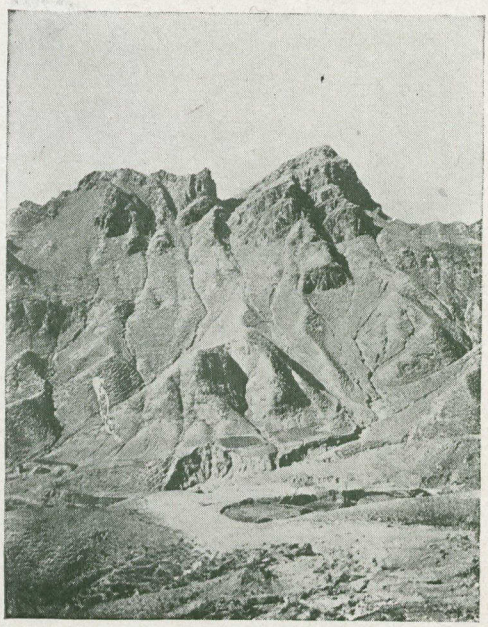
A still more striking instance of deforestation is found in the mountains of northwestern Chi-li, where the altitude of the valleys is 4,000 feet and the broad flat summits rise to 10,000 feet. These mountains have been occupied by wandering peoples and traversed by caravans for several thousand years. They harbor many monasteries of Buddhist priests, established since the introduction of Buddhism in China in the year 68 A.D., but a good growth of coniferous forests, of which a few remains are still to be found in remote gulches, is said to have covered the mountains up to the time of the Emperor Kang-hi, the first of the present Manchu dynasty 1665 to 1723, Kang-hi made several pilgrimages to the central shrine of Buddhism in these mountains, Wu-t'ai-shan, and conceived the idea that it would be well to populate the district with immigrants. He allowed the people whom he induced to settle there to cut the timber, and they probably found in it a good source of revenue for the time being. They did their work thoroughly—so thoroughly that at present one looks out over the mountain summits absolutely bare of vegetation, and one travels through valleys choked with the debris of torrents. In some-

thing less than two hundred years the aspect of the region has been utterly changed from one which old Chinese writers described as abounding in forests, with many springs and running brooks, to one in which there is scarcely a stick to be had. Living streams are found only in the larger valleys, and all the mountain slopes are scored with deep and ragged gullies. The condition has passed the help of man or nature, and it is rather a question of decades than of many centuries, before the soil will have disappeared and the mountains will stand out in utter nakedness.

In southern China, where the needs of man are few and where the luxuriant bamboo supplies most of them, trees continue to grow. In northern China, where the demand for wood is great and the climate is adverse, there is no longer any forest. Individual need has been indulged at the expense of public weal, and in the absence of any public opinion or reasonable foresight, the natural supplies have been exhausted and the forest laid waste.

Terracing the Hillsides.

There is but one saving clause in the situation, which though it does not affect the forest, does modify the results of the forest's destruction. *As they laid bare the mountain slopes, the Chinese realized, probably at a very early date, that the fields they cultivated where the trees had grown were being swept away.* They learned the art of building soil reservoirs —that is of terracing, and have become experts in that method to which the inhabitants of old Italy and Germany have also been driven; but in China the methods have been carried further than anywhere else, and one finds that there is but one limit to its development. As we would consider it useless to build a reservoir for water in a waterless country, so the Chinese find it of no avail to build walls to catch soil at a place where no soil can be obtained; but, provided it is possible to gather soil by scratching the surface and allowing it to wash into a reservoir behind a wall, or provided soil can be gathered in baskets and carried to a place where it can be held, they will build the wall and accumulate the soil.



The land of famine! North-western China, a country of bitterly cold winters, has so completely destroyed its sources of wood fuel that children are commonly found laboring in the fields after the scanty harvest grubbing up grass roots to help keep the tiny stoves alight. Only the very rich ever see a supply of real wood or charcoal.

One thus finds, high up toward the mountain summits, terraces adjusted to the contour of the surface, sometimes not more than fifty feet long and not wider than will accommodate two rows of corn. Thus the Chinese have saved their land from utter destruction, but the north Chinese live in a country where a tree is scarcely known outside the village compound or temple yard, and where the chief use for lumber is for heavy coffin boards.

Chinese refugees fleeing southward to escape the terrors of the famine.

Premier Drury on Ontario's Policy

(From an address to the Barrie Community Club)

MR. Drury proceeded to take up his subject—Conservation — dealing first with it as applied to our forest resources, which he divided into three heads, viz., the farm woodlot, municipal forests and provincial forests. In Simcoe county there are great possibilities for municipal forests, it being estimated that there are 120 square miles of land unfit for other purposes. Were this completely reforested, in 60 years it would provide marketable timber that could be cut at the rate of two square miles per year, which would keep busy a dozen sawmills, afford a big fuel supply, and yield a revenue that would pay a large part of the taxes. To leave these waste places as they are is a sin against posterity. The administration of the provincial forest wealth is a large and difficult problem. This wealth has been largely dissipated and we are coming to a period when, unless wise methods are used, we will be in sight of the end of it. In the north country large areas have been left littered with logs that are not first class and with accumulation of waste from lumbering operaions fire gets in and not only are the seeds in the ground destroyed but the soil itself, so that it will be hundreds of years before the area thus burned can reforest itself. The forest wealth has been seriously impaired. What is left must be wisely administered and protected from fire. This will cost money but it must be faced. Future concessions will provide for cleaning up the area from which the timber is taken so that the forest may have a chance to renew itself, which can be accomplished in 45 years. Forest reserves should be harvested when ready and the new timber given a chance.

At Rockland, Ontario, Senator Edwards, of Ottawa, planted 20,000 white pines and 15,000 red pines in 1914 as an experiment in reforestation. The red pines did exceedingly well. The average height of 200 trees is now 9 feet, and of the 25 tallest trees 11 feet.

What Trees are Worth Repairing

By J. Franklin Collins

Most trees with only a few dead limbs are unquestionably worth attention. Others that have many dead limbs or decayed areas may not be worth the expense of repairing them, particularly if they are rapid-growing short-lived trees. This point should be considered very carefully before any repair work is undertaken. In any event a diseased or insect-infested tree should not be allowed to remain as a menace to near-by trees which are in a more healthy condition or entirely healthy. It should have all diseased or insect-infested bark, wood, or leaves removed and all freshly cut surfaces properly treated, or the entire tree should be removed. The diseased portions should be burned immediately. No one can decide better than the owner whether a tree is worth the expense of trying to save it, because the actual commercial value of an ornamental or shade tree usually has nothing to do with the decision. It is generally a question of esthetic value, or historic associations, or rarity of species. A man who has had experience in repairing mutilated or diseased trees may be able to say definitely whether it is possible to save the tree, but the owner, who has to pay the bill, is the one who will have to decide whether the tree is worth the cost of repairing it. Often the owner will be better satisfied in the end to have a badly diseased or mutilated tree replaced by a healthy perfect one. In expert hands the moving of large trees is no longer a hazardous undertaking.

The "Schoolmaster" on the Dining Car

An Editorial From the Noted Weekly "Printers Ink" of New York.

Members of the class have been repeatedly told by the Schoolmaster of the ravages of forest fires on the source of paper pulp, and the problem has interested all who believe that advertising is one of the cures.

During a recent visit to Canada, the Schoolmaster was handed a menu card in the dining-car.

His eye immediately caught a little green slip, neatly printed and illustrated, and attached to the card.

It was printed in dark blue ink, on the tinted stock, and the picture was of a hunter pulling his canoe up on the shore of a lake in the Canadian wildwood.

The hunter had a pipe in his mouth.

A camp fire had been started back from the water a short distance.

The text read:

"—A Little Talk on Forest Fires.

"Eighty per cent. of the habitable area of Canada is adapted for no other crop than Timber. That vast estate constitutes not a 'wilderness' but an incalculably rich storehouse of raw material for our 5,000 wood-using industries. Timber nowadays is precious stuff.

"The world has less of it and wants immensely more of it. For Canada to own great forests automatically clears the path for new factories, new towns, new population, new sources of public taxes—but—

"We Canadians have ruined the timber riches on 1,000,000 square miles in the past seventy-five years. We did it with fire. We did it with our own hands. Little things—like matches, lighted cigarette, camp fires, land clearing. These things did it.

"A forest tree usually takes 150 years to produce a sawlog—to grow twelve inches thick. Of every four dollars ob-

tained for lumber of one log, three dollars go for Wages and Supplies and one dollar to public taxes and interest on investment. To burn a forest is to burn a payroll. This is a good thing to call to mind the next time you are in the woods: Live forests mean live jobs, live sport, live times. There's nothing in a dead forest for anybody."

This advertising message, distributed in such a unique way, is issued by the Canadian Forestry Association. But why in dining-cars on menus? Because the American who is bound Canadaward on a hunting expedition is a man who dines well—who never misses a meal when travelling. The Canadian ors to the Dominion are cautioned without being lectured. It is done indirectly.

The Land We Live In

By Robson Black, Secretary, The Canadian Forestry Association

A review of the Dominion's timber wealth, and the progress towards forestry methods.

THE forest represents Canada's most widely disributed crop. Excluding the great tundras of the far north, equal to one-third of the naion's area, from 60 to 80 per cent. of the remaining lands are of non-agricultural character. Their economic value consists mainly in their stands of timber or timber-growing potentialities.

The marked enhancement of the value of accessible forest areas all over North America during recent years, since more accurate inventories have shown an impending scarcity of logs, has developed a keen public appreciation of the national value of the forest resources, and the productive possibilities of what was once termed "wilderness." For example, the manufacture of newsprint paper from spruce and balsam woods accounted thirty years ago for an item of $120 in the export business of Canada; to-day the sales of pulpwood, pulp and paper, mostly to the United States, exceed $120,000,000 a year. The Canadian paper factory provides for one-third of the newspaper requirements of the neighbouring Republic, which ordinarily are equivalent to 40,000,000 newspaper copies daily. Indeed, the exported products of spruce and balsam alone surpass those of any other department of Canadian industry. The Canadian lumber industry likewise has impressed a great object lesson in the economic advantages accruing from the possession of abundant forests. Canadian lumber production now amounts to 3,250,000,000 board feet annually, about five-sixths of which, valued at $93,000,000, goes into export channels.

Wood and More Wood.

Trade tendencies appear to be all in the direction of greater annual "cuts" for lumber and paper purposes. It is a fact of world-wide application that the advent of wood substitutes has been accompanied by an unparalleled employment of wood products. The present annual *per capita* consumption of wood in America is 500 board feet. Timber scarcity and mounting prices may gradually force down this *per capita* rate, already ten times that of some parts of Europe. The market quotations on substitutes, however, are gauged by the primary wood product, and the range of iron, cement and brick materials essential to any construction

are subject to the same cost-raising factors as lumber. The future market for the Canadian log and its manufactured derivatives does not seem to be under other than the most favorable auspices.

One may consider, as well, the increasing relative importance of Canada's forests on the North American continent. As a consequence of heavier domestic demand and greater accessibility of many timber tracts, the Eastern United States forests to-day are in a condition dangerously near the line of depletion. The President of the Southern Pine Manufacturers' Association said recently that the exhaustion of standing timber in the Southern States, where the lumber industry of the east is now centred, would force 3,000 mills out of business within eight years. The President of the International Paper Company, which dominates the newsprint industry of the United States, asserted last year that there do not remain two stands of spruce in the Eastern States that would justify the erection of two additional fifty-ton pulp-mills. To these may be added the testimony of the Chief Forester of the United States that the country annually cuts three times as much timber as is now provided by annual growth under the present wasteful methods generally in effect. The States of Maine, New Hampshire, Vermont, Massachusetts, for example, have but a tithe of their coniferous timber supply of fifty years ago when the population was very much smaller. The American States bordering the Great Lakes, as Michigan and Wisconsin, are in a general commercial sense "cut out" with little probability of timberland regeneration till long past the span of this generation.

Canada a Great Exporter.

Inasmuch as five-sixths of Canada's lumber production is taken up by foreign markets, the United States' situation as regards the raw materials of the forest, has vital bearings, for Canada more and more will be called upon to meet deficiencies in the republic's supplies. While such a prospect may at first sight appear wholly advantageous, one must also consider that the total timber contents of the Dominion would be incapable of meeting United States' demands for even twelve years.

Two pictures that refuse to agree; a busy lumber mill town and a stripped forest.

Dead forests kill off population. Canada's strongest bid for new industries, new population, new towns, lies in the protection of her forest areas which cover 80 per cent. of our national area.

The axe may destroy a tree, but it also creates a job. The fire fiend is at once a tree destroyer and a job killer.

The Stimulus to Forestry.

The new international status of the Canadian pulp and paper trade, achieved in a decade, and the recognition of severe limitations in the forest possessions of North America, have necessarily given significance to forest maintenance and development within the Dominion. Land classification, with a view to extracting from every square mile the utmost of its natural potentialities, is now favoured by all Domin-

ion administrations, and has been undertaken actively in several of the Provinces. This has brought to public attention the fact that not 10 per cent. of the whole area of British Columbia is useful for farming. About 30 per cent. of Alberta, Saskatchewan and Manitoba may be of agricultural value. From 60 to 80 per cent. of New Brunswick and Nova Scotia are best adapted to other than field crops, while in the Province of Quebec, the first portion of Canada to be settled by farmers, not ten million acres are under the plough to-day out of 250,000,000 acres included in the old boundaries of the province. A very high percentage of the lands now under wooded cover—fully 90 per cent.—will never be converted to agricultural purposes. It is possible that there are more square miles of the Dominion's surface that must be put back under forest crops, than there are square miles that intelligently may be taken from their wooded state and used for farming.

Our Canadian Trees.

The limits of botanical distribution of the commercial timber species of Canada are quite fully and finally marked, chiefly by the Geological Survey. Hardwoods, although representing an enormous volume of timber and comprising two-thirds of the forest cover in the region of highest industrial development in Central Quebec, may be left out of consideration, owing to their relative inconsequence under present commercial standards. Poplar, for example, represents half the forest tree volume of the three prairie provinces (totalling 24 billion feet of saw timber, but is not at present commercially convertible except to a slight degree. Poplar, however, is bound to assume great future importance. The coniferous, or so-called softwood species, which supply about 95 per cent. of Canadian mill requirements, are for Eastern Canada: white and red and jack pines, hemlock, spruce and balsam fir, in the West of Alberta and in British Columbia, Douglas fir, hemlock, yellow pine, various spruces and firs, cedar and larch.

Summarizing the extent of Canada's potential timber land, containing the afore-mentioned species, Dr. B. E. Fernow, Dean Emeritus of Toronto University College of Forestry, asserts that there are 150,000 square miles in British Columbia (modified to 135,000 square miles by the later survey of the Commission of Conservation), and another 150,000 square miles in the Eastern Provinces. "But this is not actual, only potential timber land, as far as not cut, occurs in both territories only in more or less scattered, larger or smaller, patches.: This mixture of non--productive and productive areas makes the attempt at estimating contents hazardous. But if we reduce the Eastern area involved by limiting it to the height of land, to 100,000 square miles,

HOW THE PROVINCES COMPARE IN TIMBER

Estimated stands of merchantable coniferous timber by provinces, including pulpwood:—

British Columbia	358	billion feet, board measure.
Alberta	21	„ „
Saskatchewan	14	„ „
Manitoba	7	„ „
Ontario	154	„ „
Quebec	212	„ „
New Brunswick	20	„ „
Nova Scotia	10	„ „

and accept as an experience figure over such a large area, an average of 2,000,000 feet, board measure, of saw timber per square mile, and hence concede 200 billion feet to the eastern forests, we shall probably have overstated the case. In the western mountain forest, the unproductive area is much greater, but the stands contain larger quantities. Applying an average of 3,000,000 feet to the productive area in the Rock Mountains of 25,000 square miles and of 10,000,000 feet on the productive 25,000 square miles of coast timber, we have altogether 325 billion feet. (The latter figure was increased to 349 billion feet by the recent survey of the Commission of Conservation.) "This," concludes Dr. Fernow, "would bring the total stand of commercial timber for Canada, leaving out pulpwood supplies, to between 500 and 600 billion feet. In addition, a very large amount of pulpwood that cannot as yet be estimated is in existence."

With Dr. Fernow's estimates, other expert opinion is in substantial agreement. Mr. R. H. Campbell, Director of Forestry for the Dominion, observes that the present stand of commercial saw timber is between 500 and 800 billion feet, board measure, covering an area of approximately 250,000,000 acres. This estimate of quantity and area refers only to timber of commercial value as saw timber. The quantity of pulpwood is estimated at from 80,000,000 to 1,000,000,000 cords. Firewood or tie and pole material of any description are not included in any of the figures given.

Wood Demand Increases.

As to the Dominion's' ability to maintain her present array of nearly 5,000 wood-using industries, with annually increasing consumption, some interesting, although far from conclusive, estimates have been made. Assuming that the country's supply of saw timber amounts to 600 billion feet, board measure, and that the annual cut is 3¼ billion feet, then with no change in existing conditions, the saw timber supply will be exhausted in 184 years. However, in five years of normal national growth prior to 1912, our lumber cut increased on an average by 200,000,000 feet per annum. Should such an increase become necessary in the future, as would seem very probable in the event of improved labor conditions, the national timber supply would by no means outlive another century.

Into any such calculation there enters the factor of annual growth, or increment, but upon that point so little data exists as to make general statements at present valueless. This is one of the research projects upon which the Dominion Commission of Conservation is actively engaged. Entomologists who have made extensive studies in many parts of Canada regard insect and fungous diseases as causing an annual loss equivalent to $75,000,000. Damage by windfall is another source of serious depreciation in timber stands. Forest fires, although now modified in their violence by Government and private protective agencies, yet manage to strip the country each season of several million dollars worth of merchantable wood, and in many instances do irreparable harm to the regenerative capacity of the forest lands. Taking together these destructive elements—fire, windfall, disease, both insect and fungous—it is open to question whether over a long period of years a net increment through timber growth can be claimed in the unregulated forest.

The forest resources of each of the Provinces of Canada are briefly sketched as follows:—

British Columbia.

Of the total land area of British Columbia, 355,855 square miles, approximately 200,000 square miles is incapable of producing forests of commercial value. About 145,000 square miles lies above the merchantable timber line, and on 55,000 square miles of the area below the timber line, the forest-growing conditions are unfavorable, or fires have destroyed the hope of any re-establishment for centuries to come. Of what remains, only about 28,000 square miles carries stands of from 5,000 to 8,000 feet, board measure, per acre, and another 23,800 square miles in the interior

of the province carries stands reaching between 1,000 and 5,000 board feet per acre. The Commission of Conservation states that through fire losses British Columbia has sacrificed approximately 665 billion feet, board measure, about equal to the total remaining stand of timber in the whole Dominion. The total of saw timber available in British Columbia is 349 billion feet, board measure. In the annual cut of the province, Douglas fir accounts for two-thirds. Fourteen species of wood are reported in the annual returns. The lands of the province are under the administration of the Provincial Government, with the exception of the Railway Belt, consisting of a strip twenty miles wide on either side of the main line of the Canadian Pacific Railway across the province which is administered by the Dominion Government. The latter authority also controls the Peace River Block in the north-east corner.

Alberta.

The Province of Alberta, the forest resources of which are held by the Dominion Government, has a total land area of 161,872,000 acres, of which about 5,416,000 acres are regarded as containing more or less saw timber estimated to be about 21 billion board feet. Four timber reserves have been set apart, and contain 12,500,000 acres. Spruce, jack pine and poplar preponderate in the annual cut. With the exception of birch and poplar, Alberta's forests are wholly coniferous.

As concerns the North-West Territories and the Yukon as a source of timber, the ravages of fire have already been enormous and large sized trees in heavy stands are not commonly met with. The greater part of the northern area is composed of treeless tundra and population is sparse. Beyond meeting local demands for rough construction, fencing, mining, etc., the timber supply of this portion of the Dominion is not important.

Saskatchewan.

Saskatchewan has a total land area of 155,764,000 acres, and although more than two-thirds of this is probably unfitted for uses other than timber production, the area actually timbered with merchantable trees is only about 750,000 acres. The Province cut in 1915 62,-864,000 feet of lumber, over three times as much as Alberta, but has not operated on as large a scale since. Spruce is practically the only wood taken out. The forest reserves of Saskatchewan cover 6,197,707 acres.

Manitoba.

Manitoba, with a land area of 148,-432,640 acres, is to-day about 70 per cent. wooded. Only 1,920,000 acres, however, contain saw timber of commercial dimensions, and the total stand of the latter is given by the Dominion of Forestry Branch as 6,850,000,000 feet. Manitoba's forest types not only cover the coniferous trees associated with the northern forest type of Saskatchewan and Eastern Alberta, but include as well an amount of red and white pine, cedar, black ash, white elm and basswood, which are associated with what is called the Southern Laurentian type of Ontario and the other eastern Provinces. Manitoba's cut averages about 90 per cent. spruce. Small quantities of poplar, tamarack, jack pine, birch, oak and elm are also produced. Manitoba has five forest reserves, maintained by the Dominion Government, containing 2,606.400 acres.

Ontario.

Ontario won its great reputation in the lumber trade by exports of white pine. This splendid wood remains the dominant species in annual production, but, as regards the Crown Land areas, is rapidly being displaced by other woods, as a consequence of the limitation of supply. Taking the Dominion as a whole, spruce now has a heavy lead in the amount cut each year, with Douglas fir second and white pine third. Ontario's white pine stands are estimated at 40 billion feet.

Of Ontario's total area of 234.163.200 acres, the greater part of the northern lands is wooded, mostly with spruce, jack pine, poplar, balsam fir and tamarack. South of this comes the Southern Laurentian type covering 100,-

000,000 acres in Ontario and Quebec, supposed to contain about 200 billion feet of saw timber in both Provinces. From 70 to 90 million acres is regarded as the productive forest area of Ontario, including forest reserves of 11,539,200 acres.

Quebec.

Of the 442,153,000 acre of Quebec, since the extension of its boundaries, 367,000,000 acres belongs to the northern forest type of pure conifers, 50,000,000 acres to the Southern Laurentian type of mixed conifers and hardwoods, and 5,000,000 acres to the hardwoods. South of the St. Lawrence in Quebec, the type resembles closely that of the Maritime Provinces and covers about 20,000,000 acres. Spruce has top place in the annual cut, accounting for more than half, balsam fir is second and white pine third. Birch forms an important hardwood, making up about 4 per cent. of the total cut. The conifers in 1915 formed 93 per cent. and the hardwoods 7 per cent. of all the wood taken out.

New Brunswick.

New Brunswick has a land area of 17,863,000 acres, and two-thirds at least may be regarded as productive or potential forest land. The standing timber is estimated at 22 billion feet, red spruce and balsam accounting for about 60 per cent., pine, hemlock, cedar and hardwoods for the remainder. The conifers make up 98 per cent. of the annual cut. In 1919, the Province's lumber production amounted to 220,000,000 feet.

Nova Scotia.

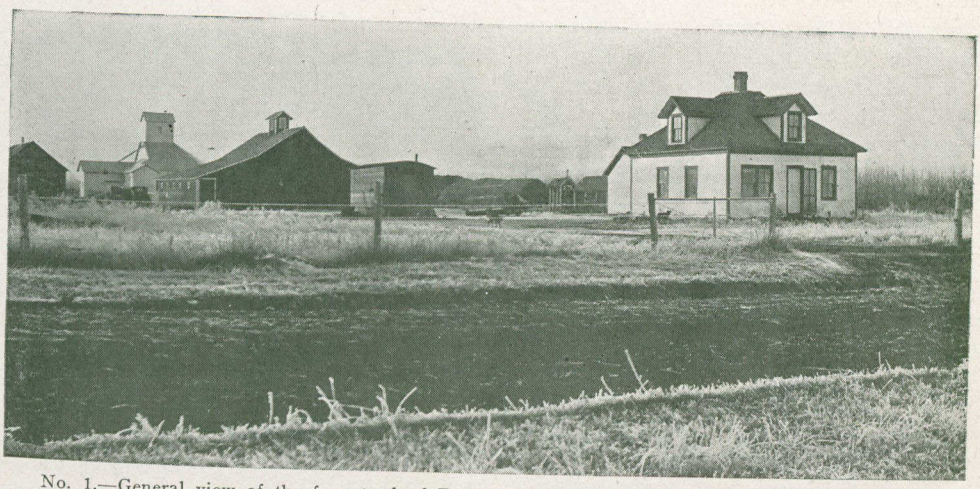
Nova Scotia has a forest area estimated as 5,744,000 acres out of a total land area of 13,483,000 acres. An estimate of 10 billion feet has been given for the coniferous saw timber, with about 5 billion feet of hardwoods. Red spruce and hemlock account for about 8 billion feet of the total.

The Province of Prince Edward Island has such a small forest area as not to affect the total calculations for Canada.

A fact of important bearing upon the forestry problem in the Dominion is that the title to approximately 90 per cent. of the forest lands is vested in the Crown. Cutting rights are leased, nominally for one year in most parts of country, but renewable upon fulfilment of the conditions. The seigniories of Quebec, some large railway land grants, and instances of outright alienation of ground title and standing timber in British Columbia, Quebec, New Brunswick and Nova Scotia, account for most of the forest areas placed beyond the regulative jurisdiction of the Crown. The bulk of the annual cut of saw timber and pulpwood, however, comes from public-owned lands. It is true that the licenses have, in many cases, been transferred again and again for large considerations. This limits the degree of State interference with the present license holders, as radical restrictions on timber cutting might fall upon innocent investors.

Forestry Experiments.

The present stage of silvicultural practice in the Dominion, except for the Dominion Government forest reserves in the prairie provinces and the British Columbia "Railway Belt," 'may be said to be entirely experimental. Continuous timber production is everywhere recognised as essential to commercial safety. Until very recent days it was regarded as an assured fact. Forest surveys and investigations, however, hav e exposed the fallacies of the old time theory that "a new cut every thirty years" could be expected. The plain fact is that, except in British Columbia. the forces of destruction, by accident and exploitation, are accounting for three or four times the wood volume that the most



No. 1.—General view of the farmstead of D. H. Pruden, M.L.A., near Botha, Alta. The building to the extreme left is an old barn; then comes the blacksmith shop adjoining the elevator. The latter faces a road or driveway, and has 16,000 bushels capacity. Next is the barn proper, and then a small granary, of which Mr. Pruden has a number distributed at different points over his 1,280 acre farm, 800 acres of which are under plow. These granaries are on wheels, and can be moved here and there. Following the granary can be seen grain stacks, outhouse buildings, and then the home of the farmer. When Mr. Pruden located here in 1902 it was a barren spot as far as trees were concerned. There was not a house within 35 miles. He saw that trees could be grown in the section, and after being without them for a good number of years set to work to secure them.. The result of his efforts are told by the other pictures. To the right of his home the six year growth of trees (Russian poplar) can be noticed. From the trees eastward, through the planting of the trees, soil drifting in the yard has been overcome. For three years there has been no drifting in the place, although prior to that there had been drifts at times 10 feet high. Last winter there was no drifting, although outside the yard the snow was piled to a great height.

No. 2 is looking down the rows on the west side, through the windbreak on the west. The rows are nine feet apart and the trees four feet apart in the rows. The growth that has been made in the six years can be guaged by the figure of Mr. Pruden standing in the row, he being six feet tall.

optimistic guess credits to "annual growth" on the lands cut over. The displacement of rule-of-thumb methods by scientifically established facts is now proceeding through Dominion and Provincial Government agencies and by private corporation effort. Forest surveys have been completed in British Columbia, Saskatchewan and Nova Scotia, and are in progress in Ontario and New Brunswick. Studies of forest tree reproduction by the Commission of Conservation, the Dominion Forestry Branch and the New Brunswick Forest Service, and the establishment of experimental plots upon which various methods of silvicultural management may be tried out, are now in progress and have the thorough support and co-operation of the wood-using industries of Canada.

Tree Planting.

The planting of trees upon cut-over or barren lands is a project of lively popular interest, inasmuch as the layman commonly thinks of forest regeneration only in terms of new plantations. Such paper manufacturing companies as the Laurentide and Riordon of Quebec, have set out some millions of spruce seedlings from their own nurseries, and regard the procedure as sound commercial investment. Other pulp and paper companies are preparing their nurseries and will adopt a planting programme to supplement their wood supply. Obviously, the pulp and paper companies, having huge investments in million-dollar mills over a waterfall, have been the first to experiment with forest tree planting as a means of stabilising their wood supply. Some factors have militated against more general planting, as for example, the impossibility of establishing plantations on Crown Lands until the rights of planter and public in the ultimate crop have been made clear; the lack of experience in nursery and plantation enterprises under American conditions; the insecurity of most forest areas against fire and high labour costs. With the exception of the latter, these difficulties, particularly in Quebec, are fast being cleared away.—Reprinted by permission of the London Times.

How Tree Seed is Gathered

By Arthur Herbert Richardson, M.A., M.F.
Ontario Forestry Branch

FUNDAMENTAL to all reforestation problems is the growing of adaptable nursery stock, and prior to nursery stock is the securing of suitable seed. It is generally recognized by botanists as well as foresters, that seed collected from plants in one locality is best for sowing in that same locality. Consequently it has been the policy of this Department, in so far as possible, to collect seed from our native trees for planting in connection with its reforestation work.

Seed Years.

Most species of trees have seed each year, some bear an abundance, others a small quantity. Still others, chiefly conifers, have an abundance of seed every second, third or more years. When such an abundance of seed occurs in this way, it is said to be a seed year for that species. The season of 1920 was a good seed year throughout Ontario for the following coniferous species which are needed for the work of this Department, white spruce (picea canadensis), balsam (Abies balsamea), white pine (Pinus strobus) and white cedar (Thuya occidentalis). Accordingly then, collecting areas were established and large quantities of cones were gathered. The work carried on by the writer and on which the material for this article is based, was done in Simcoe County on property owned by the Federal Government and known as Camp Borden district. The species sought particularly were, white spruce and white cedar, and of these 275 bushels were gathered besides smaller quantities of balsam, white

Collecting seed for tree planting to help carry out Ontario's new reforestation programme. Some of this seed-collecting work is paid for at the rate of $8 a bushel.

pine, tamarac (Larix americana), red pine (Pinus resinosa) and hemlock (Tsuga canadensis).

Seasons for Ripening.

Gathering cones of these species might have been commenced during the last two weeks of August. Collecting did not begin however, until the second day of September. The first frosts here came on the nights of the second and third, followed by bright warm days which created ideal conditions for seed ripening and compelled prompt action if the seed was to be had still in the cones. But owing to what seems to be a generic difference in trees of some species, and in this particular case, white spruce, there was considerable variation in the time of ripening of different trees some being as late as the twentieth of the month. Any cones that were gathered after this date wer either partially opned and classed as seconds, or had been cut down by squarrels and taken from their hordes. Balsam exhibited more uniformity in ripening and after the fifth of September, it was practically impossible to secure any seed, as the cones fell to pieces as soon as one attempted to climb the trees. Tamarac, white pine and red pine were like spruce, although red pine cones were so scarce as to hardly warrant mentioning. Cedar and hemlock were much later in coming to maturity, the collecting of the former commencing on the fifteenth of September and lasting for a month.

The picking was done for the most part by local help, but in a farming community, such as this is, there were many demands for workers to assist in bringing in the fall grain. Few were left then, to help the tree farmer in gathering his seed. As a result of this, local help

The male picker preferred to gather spruce seed, and looked upon the lowly cedar as beneath his dignity. The Ontario Government then offered the job to women at a price of eight dollars a bushel. Then the women balked because "bushels" and "eight dollars" sounded unfamiliar. So the forester announced the pay for picking seed as "twenty-five cents a quart" (which is the same thing), and the women folk swamped him with applications.

was supplemented with men from the city. A camp was established, in which the equipment was supplied by the Department, and under its supervision; the board being left entirely with the men employed. In this way, four city men found it worth while to spend a vacation, varying from one to three weeks camping in the open and at the same time combining pleasure with profit.

In the case of cedar it was difficult at first to interest men in picking such small cones. Those who had worked at spruce did not wish to exchange the breezy height of that species for standing on the ground picking cedar, even though the offer was tempting as eight dollars a bushel. Accordingly then, the interest of the women was enlisted and to make the offer more appealing, the same price was put in a different way, namely—twenty-five cents a quart. This was something they could do. It was like picking berries. The women commenced gathering cedar, and bless me, we could hardly stop 'em.

Equipment for Picking.

Each man who gave all his time to the work was supplied with a picking bag which was big enough to hold all the spruce cones he wanted to pick from a tree at one time. It had a wide open mouth to facilitate filling and allowing two hand picking, and an adjustable top. When a workman had finished picking high up on a swaying spruce, it was found difficult to descend in such a way as not to upset the bag—not to mention himself. To remedy this, a special top with a draw string was inserted. This hung inside the bag out of the way during the time of picking, but if the workman wished to move about in the tree, he lifted the top and pulled the string. Or if he wished to descend, he did likewise and dropped the bag to the ground and came down unencumbered. Each man was also supplied with a tree rope, an arrangement similar to that used by telephone linemen. With this equipment, all the spruce, balsam and tamarac cones were collected as well as some of the cedar.

Prices Paid For Seed.

When cones were picked from healthy, open grown spruce trees, a man could average three bushels per ten hour day. This was the amount on which the price, two dollars and twenty-five cents a bushel was based. For seconds, the price was reduced to two dollars a bushel. For the small quantity of balsam that was gathered, the same price was paid, although this is a trifle high compared with spruce. White pine was one dollar and a quarter, tamarac and hemlock the same as cedar, that is, eight dollars per bushel. In each case, and particularly the cedar, the cones had to be practically free from browse and if this were not so, the estimated amount of foreign matter was deducted from the measurement.

Drying and Extracting.

One of the difficulties of handling large quantities of cones that are at all green, is to keep them from heating. In order to insure against this, the cones were spread on canvas in the sun, or on racks in the seed house, and turned once or twice a day. This preliminary drying caused them to open a little and to shed some of their seed. After this they were taken to the extracting room. Here they were placed in a drum thirty inches square and six feet long, covered with screening coarse enough to let the seed fall through, and fine enough to let the cones remain. The drum was then revolved by means of a windless on the floor below, and the seed dropped down through a hopper into a bag. After all cones had been treated once in this way, they were again spread on the drying racks and heated gradually from racks to drum from 60 degrees to 125 degrees F. The seed was then cleaned and stored for spring sowing.

In this way the tedious and expensive task of securing tree seed was accomplished, from boughs of redolent trees to the pickers' bag, from bag to drying rack, from rack to extracting drum, from drum to cleaning process, and from this to the nursery beds. Then more trees!

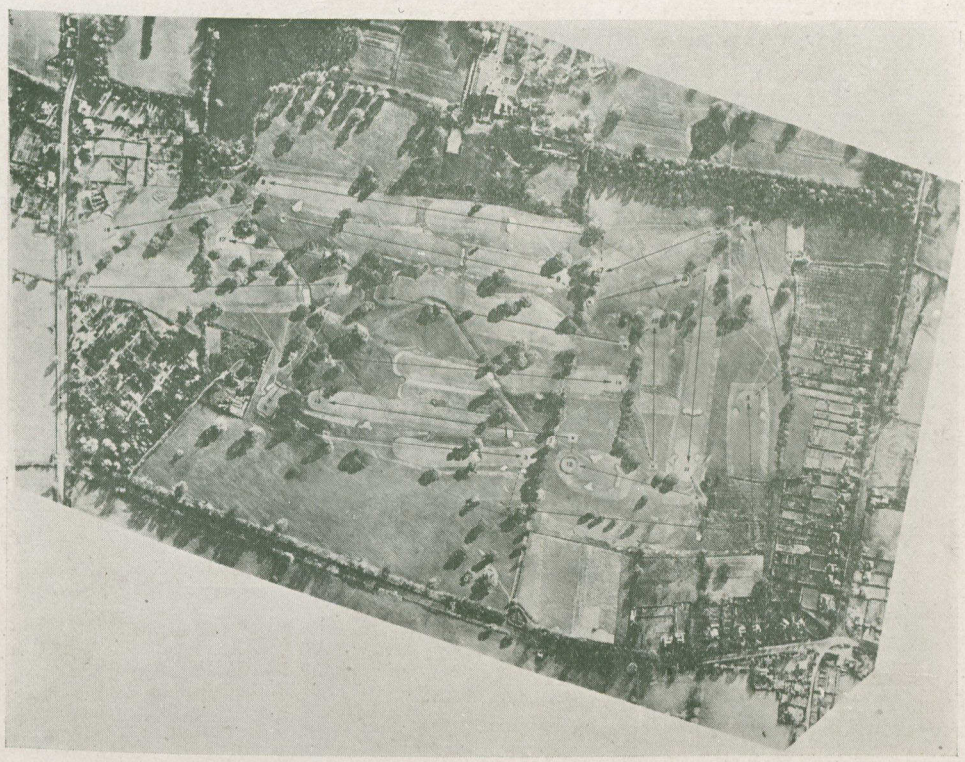
How Safe Is Flying?

by Col. Robert Leckie, D.S.O., of the Air Board, Ottawa

In 1920, 15,260 passengers were carried in Canada with only five fatalities

VERY considerable prominence has been given during the last few months to aeroplane accidents in Canada and elsewhere to such an extent that the unfortunate impression has been created in the minds of the general public, that flying is a highly hazardous occupation. During the war the casualties in active service and the fatal accidents in training in the R. A. F. were admittedly very high. This was due, however, to the system of intensive training made necessary by the rapid expansion of the R.A.F. to meet the ever increasing demands made upon it. The fall of an aeroplane to earth is always spectacular, and an ever ready press never fails to make the most of the event as a news item. As a matter of fact the ratio of fatalities to the number of hours flown is really very low.

In Canada during the last 11 months 15,260 passengers were carried in aeroplanes for hire. These aeroplanes flew a total of 6,811 hours, covering 429,177 miles. Dur-



The aeroplane camera and its value in surveys. An extraordinarily clear photograph of an English golf links taken by the Aircraft Manufacturing Company.

ing this time only five fatal accidents have been reported. There is no doubt, however, that each accident was heralded by the Press as another horrible fatality, and a prominence given to it entirely out of proportion to its importance. One reads of railway accidents from time to time, but the news item is usually contained in a very small paragraph.

As the present war type machines give place to those designed and built for civil operations, the margin of safety will increase. During the war the brains of the designer were concentrated upon speed and climb. These designers are now paying more attention to the factor of safety, and to the general security of the machines. The ideal commercial machine has not yet been evolved, but it is apparent that the war product is gradually giving place to a more ideal type. When the transition is finally accomplished, it is safe to say that the number of fatal accidents will be still further decreased.

Stunting to Blame.

One of the most fruitful causes of accidents is the irresponsible pilot. During the war aeroplane pilots were taught all kinds and conditions of aerial stunts, aerobatics being part of a pilot's course of instruction. In the minds of some of our very young pilots an aeroplane exists only to be looped, spun and Immelmaned, and the temptation to continue his war training in civil life is irresistible. There is no place in civil life for stunts of this nature, and steps have been taken by the Air Board to curb the unruly spirits, whose antics endanger their own lives and those of their passengers. It is now an offence against the law for a pilot to perform any of the above-mentioned stunts with a passenger aboard, and it is felt by the Air Board that this measure, however irksome it may be to the pilot, will go far to prevent some of the unfortunate accidents which we witnessed during the last year.

That flying can be carried out constantly and under varying conditions is evidenced by the following statistics collected at random from pilots at Air Board Headquarters:

Aeroplane, Seaplane and Flying Boats.

	Slight accidents.	Serious accidents.	Accidents entailing bodily injury.	No. of hours flown.	No. of years flying.
Pilot (a)	1	none	none	750	5
„ (b)	2	none	none	900	5
„ (c)	2	none	none	1,000	4
„ (d)	none	1	none	1,200	2½
Aeroplanes					
Pilot (e)	1	none	none	1,400	5
„ (f)	1	1	none	900	2½

800 Hours Flying—No Accident.

These figures, as I have already stated, collected at random from Air Board Headquarters, do not indicate that flying should be classified as a hazardous occupation. The Operation Branch of the Air Board has carried out operations under widely divergent conditions and although some slight injury has been done to machines, none have been "written off," and no one has been hurt. Still more remarkable probably is the record of the C.A.F. where one would nominally expect serious accidents to take place, where about 800 hours of flying have been carried out in training without injury to officers or men.

The above facts indicate that so long as flying is properly controlled and sane pilots are operating under sane orders, with the ever present desire to stunt curbed, that flying is really no longer a hazardous occupation.

Calgary's Good Word.

The Calgary Board of Trade has officially endorsed the work of the Canadian Forestry Association, and urged upon its entire membership the desirability of joining the Association and assisting its educational campaign.

How Sweden Handles Her Forests

by Helge Graeslund

National control of all timber areas with compulsory reforestation

THERE is one question which I have never failed to ask every one of my Canadian friends:

Has Canada got sufficient resources of forests to supply lumber consuming industries with raw material, without providing for regrowth of her forests?

The invariable answer has been: "No."

If that be true, it is quite evident that only good reforestation methods will enable the further development and maintenance through a considerable time of this splendid industry. Furthermore I have been told that many of your best situated forests may be exhausted in something like 40 years.

Eventually the reforestation problems must be looked upon from the point of view that Canada's forests are one of her richest and finest natural resources, upon which her national wealth is largely dependent, as well as the future of a proud industry in which hundreds of millions of dollars are invested.

Put briefly: reforestation seems to be one of the greatest economic questions at present in Canada, and it is a public affair as well as a private interest of very great importance.

In Sweden we had to face the same situation quite a long time ago. Our lumber industry is older than yours, and as much as 40 or 50 years ago we slowly began to realize what the bitter end would be if we did not tackle the reforestation problem somehow or other. But it is really during the last 25 years that modern methods to an important and remarkable extent have been developed. I would not tell you the truth if I said that everything in Sweden at present is ideal as regards forestry. But simply because we have been experimenting and working for some time our methods may be of some interest and use for you. Of course conditions are very different in the two countries, but the principles, the aim and the main lines are no doubt very much the same.

52 Per Cent. Under Forest.

Of the 41 million hectars (1 hectar equals 2.47 acres) constituting that total area of Sweden, if the innumerable inland waters be neglected, it is estimated that 21.6 or about 52 per cent. is covered by forests. This makes 392 hectars per 100 inhabitants, the average figure for Western Europe being only 37. Of the Swedish forests about 37.5 per cent. belong to the State, 1.9 per cent. to towns and parishes, and 60.6 per cent. to private individuals.

By far the greater part of the forest resources are to be found in the northern half of Sweden, where the climatic and other conditions are very similar to those in Canada. The transport of the logs from the forests to the mills is provided for in an excellent way through innumerable rivers going from west to east. Sweden's prominent position in the world's timber trade to a very large degree depends upon these 19,000 miles of excellent floating ways which at a very low cost carry the timber down to the mills. Most of the mills are concentrated at the mouths of the rivers, on or very close to the coast of the Baltic. These mills get their raw materials direct from the river and ship their products from quays a few yards from their doors.

The rivers are estimated to be able to supply water power amounting to 6½ to 10 million horse power available during six months of the year.

By this brief statistical information you may have got some idea of the general conditions and it may be time to turn to the subject.

Reforestation is a difficult problem. What you do to your forest today won't show its results until 50 or 100 years hence. Reforestation means one generation's work for coming generations. It does not appeal to our business sense at once and it takes quite a long time to realize that it is a first rate investment for the lumbering industry. Therefore it is necessary that the State herself takes the lead, dictates the outlines for the nation's forestry policy. Co-operation between the State and private interests to the benefit of both is the first necessary supposition.

At home the Government has found three ways to do her part of the work: i.e. Legislation, education and the management of her own forests.

LEGISLATION. — The legislation concerning private forests has, in the past, gone through highly remarkable phases of development. From complete freedom about three hundred years ago, they were by degrees made an object of increasingly severe legislation, and finally even lumber felling for household purposes was placed under the control of the State. Then followed a revision which at last once more led to nearly complete freedom. During the last five decades a reaction has set in, imposing several restrictions upon private forest owners with regard to the management of their forests.

Modern legislation has taken into consideration how different conditions exist in different parts of the country and tried to apply laws according to these conditions.

Control of Farm Bush Lots.

In Lappland, the northern districts of Sweden, it was ordained in 1873 that farm owners should not enjoy other rights to the woods on their farms than those of taking without previous official survey such timber as they might require for household needs and for fuel, and of appropriating, subsequent to

official surveying and marking for the purpose of selling such timber in addition as can be annually felled without danger to the future preservation of the forests.

In this way the farm forests which form a very considerable section of the forests of the north have been subject to regulations ensuring system to the lumbering there. The immense importance of this will be seen more clearly when it is remembered that these forests are situated in the immediate neighborhood of the Scandinavian Alps which renders their preservation invaluable as protection against over-severity of climate.

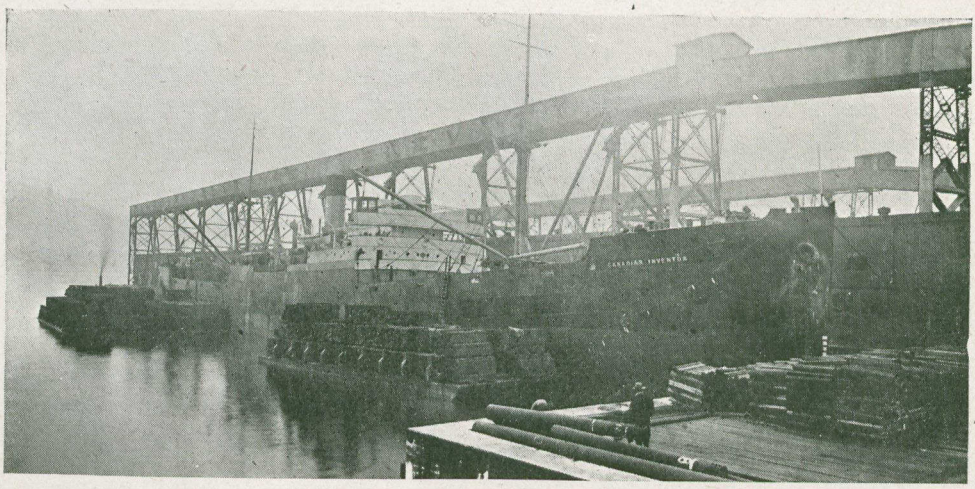
It may be pointed out in connection with this that exhaustion seriously affects the soil and the climate in a bad way. I won't go into any particulars whatever as I am sure you know this thing better than I do, but I will take the opportunity of pointing out which tremendous responsibility there is connected with the management of the forest of a nation. Millions of men and women are dying this year in the far East. Why? Because their forefathers did not possess the necessary feeling of citizenship and responsibility for their sons and their country to preserve their forests. And especially nations which have developed agriculture extensively must be careful with their forests as their exhaustion seriously affect the soil and the climate.

A purely dimension law has been enacted for the coast districts of Lappland. This enactment forbids the shipping and the sawing at export saw mills and the employment for the purpose of manufacturing wood-pulp, of pine and spruce timber which at a height of 4.75 meters from the base, does not measure at least 21 cm. in diameter, the bark not included. The penalty for the infringement of this regulation is the confiscation of the timber. Such a law directed as it is against a special form of mismanagement of forests, can easily become a hindrance for the proper care of the timber, which in many places requires the removal of second-rate wood in order that space may be secured for the growth of healthy young trees. The law does not overlook this fact, however, as it instructs the owner of timber in a way that requires the felling of second-rate wood, so as to promote the growth of the healthy timber, if he wishes to ship or saw such second-rate wood, to apply to the proper state-forester, who will then make such a survey of the forest as circumstances may require. This forester selects and stamps the second-rate timber that is allowed to be cut. The State pays the cost for this survey on condition that the owner has arranged the forest in sections for the purpose of being cut in proper rotation and in accordance with a plan approved by the Government Forest Service.

In 1903 a law was passed respecting the so-called "protective forests" the existence of which are a protection against drifting sand, or the lowering of the tree-limit on the high mountains. The law enjoins that timber felling for other than domestic purposes may take place only after a survey and marking of the trees to be cut by the Government Forest Service at the cost of the State.

Compulsory Reforestation.

The other private forests in Sweden are subject to the regulations of the law of 1903, respecting the care of private forests. According to this law, in forests belonging to private persons, lumbering must not be carried on in such a way, nor, subsequent to lumbering operations, may the ground be so treated, as to clearly endanger the regrowth of the timber. If there has been such mismanagement of the forest, the guilty person is obliged to take the steps necessary to secure the regrowth. If the lumbering rights have been made over by the owner of the forest to another person, the owner is responsible for the necessary restorative measures being taken. The burden of seeing that the law in question is properly carried out rests on the Forest Conservation Board, which must exist in every county council district. Besides being entrusted with this task the said Boards have also to promote the proper economy of the private forests by spreading a knowledge of forestry, by making grants in aid of the work of culture, by supplying seeds and plants, etc.



AN ALL-CANADIAN BUSINESS DEAL.

A photograph of the first shipment on a one million dollar order of creosoted railway ties to India—Canadian timber, creosoted in a Canadian plant with Canadian creosote, exported by the H. R. MacMillan Export Co., Ltd., a Canadian firm, insured in Canadian companies, and carried to its destination by the Canadian Merchant Marine.

EDUCATION.—Every part of modern economics requires thorough education. A modern mill requires well trained engineers, modern forestry needs highly educated forestry men. And as regards preservation and regrowth of the forests, the expenses for this purpose are identically the same as the money the mill manager has to pay for repairs and maintenance of machines and mills.

All schools and colleges in Sweden, with very few exceptions, are state institutions. The same with regard to instruction in Forestry. The higher forestry education is provided for at the College of Forestry in Stockholm. The number of students admitted to this college is limited to the probable number of opportunities for their employment so that there is a considerable competition for the opportunity of entering and a high standard of men and work is maintained. There are a higher and a lower course, the first supposed to educate State foresters, the second especially intended for the training of private forest officials. The instruction is both theoretical and practical, including the following subjects: Forest Management, Forest Mathematics, Forest Technology, Forest Botany, Forest Zoology, The Science of Soils, Forest Policy, General Legislation, Book-keeping, Technical Chemistry and Agricultural Economy. The practical work is done during summer time out in forests specially devoted to the purpose in different parts of the country. Journeys are made under the direction of the teachers to study the methods of different companies.

The lower State Schools of Forestry are directed mainly to giving the pupils practical skill in the more important branches of forestry, but also embrace theoretical studies in the fundamental principles of Forest Economy.

As mentioned in the beginning the State owns more than a third of our forests. These state forests are managed by the Government Forest Service and not leased to private companies. The end aimed at by the Government's forest policy is to render the economy of the State Forests as permanent as possible. The two factors, personal, technical knowledge and permanent economy have made the Swedish State forests valuable and well preserved resources. The Forest Service consists of 10 Chief Foresters each one in charge of a "district," 90 foresters managing the same number of "revirs" and 417 rangers who are superintendents of so-called "guarding sections."

As regards forestry of the private companies. The main principle nowadays may be said to be an attempt to arrange the cutting in such a way that in times of good prices in the market the forests are slightly over-cut, in times of low prices the contrary, and the average of timber taken out from the forests corresponding to the regrowth.

Most of the companies have their forests divided into districts managed by graduates from the College of Forestry. These districts are divided into guarding sections supervised by rangers trained in the above mentioned schools. These rangers live on their sections in comfortable houses built by the Company, and constantly surveys his forests. He carries out all orders from his chief forester and has the responsibility for the practical handling of everything respecting his section, marking the trees, organization of the cutting and transport, nurseries, etc.

Trees---and the Future of Our Prairies

by Archibald Mitchell

Western Lecturer of the Canadian Forestry Association

Soil Drifting, the West's Great Menace---How to Offset Wind Damage---a Practical Remedy

THE heavy losses that have been experienced in the last few years from soil drift, have drawn attention as never before to the necessity for systematic tree planting, and it is right our young farmers should know something about Forestry as applied to Prairie conditions, while we still have some soil to protect.

When we talk about planting trees on the Prairie it seems only reasonable to consider for a moment why the Prairie is not already entirely tree covered. For, if trees wont grow there naturally, it does not seem of much use our attempting anything of the kind.

The Trees Are Creeping Back.

It may be easier to do this by looking at what has been taking place the last 20 or 30 years and seeing how far the forest is actually coming back on to the Prairie. There are plenty of men living who remember when there were no trees west of Brandon unless in the river bottoms and the coulees. Now the eastern line of natural bush country reaches to about ten miles from Regina, 200 miles west. Gainsborough, Oxbow, and Estevan had no trees when first settled.

Now a good deal of that country is quite bluffy.

Down the Goose Lake line of the C.N.R. southwest of Saskatoon, some 12 or 14 years ago there were very few bluffs. Now there are plenty, stretching as far south as Harris. Twenty years ago we used to meet the first bluffs on the old Calgary and Edmonton trail about Didsbury, now they are at Crossfield. Settlers in the Three Hills district now find little bluffs of trees where there was nothing of the kind when they came in there first, and so it goes all the way round. The treeless prairie is really a great big bare arc which is continually getting smaller because it is bounded by an ever encroaching line of trees and which, to all appearance would cover, in time, the whole country if allowed to go on. What has prevented its taking complete possession, has been fire, and what is encouraging it to spread so rapidly since settlement began is the fact that the settlers have kept down the Prairie fires which formerly ran unchecked and de-

This Prairie tree planter, Mr. J. Caldwell, of Virden, Manitoba, has built up a real farm asset. Photograph shows a stand of pure Russian poplar, 28 years old, from cuttings. The stand would be the better for a little thinning out, coupled with under planting with spruce.

stroyed every vestige of forest growth that dares to show itself above the grass.

This forest advance has taken place most rapidly of course where the rainfall has been greatest but even in the very driest parts of the country we find the same thing taking place. One notable instance occurs about 10 or 12 miles west of Macleod on a spot where there is now nearly half an acre of native poplar where, 20 years ago there was nothing of the kind. It is most significant that that bluff has a broad road on one side and a steep cut bank on the other, which form a most efficient fire guard.

So much for nature's success in tree growing on the dry Prairie.

Knowing these things gives us plenty of confidence in our ability to grow all the trees we want if we adopt the right methods. Nature should be able to teach us these methods and so we go to our little native bluffs to find how she manages.

First, though, we have to remember that all growth on the Prairie be it wheat, grass or trees, is a matter of moisture. Given plenty of moisture, we can have plenty of growth. And the interesting thing is we have plenty of rain for our crops most years if we could only use all of it. That is our trouble, the storing of the moisture for the use of the crops. When we talk of storing, naturally we think of losses and how they occur; for if we know where the losses are, we may be able to do something to prevent them.

Where The Rainfall Goes.

There are five ways in which our rainfall is disposed of:

(1) Run off. The running of the rain and melting snow into coulees and being lost that way.

(2) Sinking down into lower reaches of the soil and so feeding springs elsewhere.

(3) Transpiration through the leaves of plants in the function of living.

(4) The sun's heat, and

(5) Drying out by the action of the wind.

Running off we have in plenty on the Prairie as can easily be seen in wet weather or Spring. Floods in our creeks and rivers are the result. We can prevent a great deal of it by plowing deep and leaving the surface of our fields loose so that the rain as it falls may readily enter, to be used later by growing plants.

There is very little, if any, loss on the Prairie from water sinking into the lower soil to appear again as springs. We rarely have rain enough for that.

The only sort of tree planting that creates results as a prairie windbreak is that adopted by such men as Andrew Anderson, of Alsask, Saskatchewan. The plantation is dense and wide.

Then the transpiration of water through the leaves of plants must be carried on or nothing will grow. Indeed, all our efforts are directed towards encouraging the use of water this way. The more water used by the crops as a rule, the better they are.

The foregoing methods of water disposal may be of some benefit, but the last two, the drying out by the sun and the wind are channels of distinct loss and nothing else. On our farms we check this by summerfallowing. Indeed, this is so important that it is the chief business of the farmer on the Prairie, for his crops depend on it and the whole cycle of his farm operations centres round it. Successful cropping depends on conserved moisture, and it is the same with tree growing.

Learning From the Bluffs.

But it is obvious we cannot go on systematically summerfallowing our plantations as we do our wheat fields. That would constitute a steady drain on our resources, a constant expense that would in time become intolerable, and as tree growing has to be done as cheaply as possible, some other method must be found. And the best place to find it is to go back to the little bluffs that are so steadily taking possession of the Prairie and see how they manage, for, after all Nature is the great teacher.

There, we find the young trees growing so close together that the leaves and branches afford such a screen the sun's rays cannot find their way down to the soil to dry it out. In the same way the trees are so close together, and present such a dense solid mass to the passing winds, no matter how high they may be, that they are thrown right over and never get inside to dry out the moisture.

That is the whole secret of nature's success in tree growing.

The great controllable channels of moisture losses are the action of the sun and the wind; the sun shining down and the wind passing through. Nature has her own way of combatting these and in our farm forestry, all we do is to follow her in planting our trees close together and in masses enough that the sun and the wind may be shut out as soon as possible. The moisture that falls among the trees is thus preserved for their use and not lost by evaporation.

This is really the whole secret of successful Forestry on the Prairie.

Other considerations of course enter in, and of the most important is economy.

We may use too many trees and waste money in unnecessary purchase of plants, and in planting. Or we may use too few trees and waste time and money in unnecessary cultivation after the trees are planted. And so we use the golden mean, which we find by experiment is to plant the trees 4 x 4 or 4 x 6 feet apart.

Windbreaks One-Hundred Feet Wide.

After they are planted, we conserve the moisture for their use at first, by cultivating the soil as in a summerfallow. This goes on for three or four years till the branches and leaves get close and dense enough to protect the ground from sun and wind as in the natural bluffs, after which the plantation becomes self-sustaining and needs no further cultivation.

The width of the plantation should be about six rods, or 100 feet, to throw the wind over thoroughly and completely.

These are the principles on which a farm forest should be built, but there are other two very important matters to be considered also.

These are, 1st. Rapid results, and second, permanency.

A farmer's first object in planting, naturally is shelter and so we expect quick height growth in our plantation. We can get this by using a quick growing variety of Russian Poplar.

But quick growing trees are usually short lived and so we mix with them a certain proportion of Ash and Elm, and under certain conditions, Spruce or Pine. These are all long lived trees and will go far to give us the permanency we desire. Mixed in definite proportion with the Russian Poplar, we can at the same time secure the rapid height growth we want.

To assist in sheltering the ground quickly and so cutting down the cost as we have seen, we use with this mixture a great many Manitoba maple or Box Elder, and Caragana. These are branchy and have much denser foliage than the others and their function in the plantation is to shade the ground.

In some parts of the country the maple is not entirely hardy and will rarely grow into a tree, but none-the-less it should be used as part of the mixture in all such plantations. Its value lies in its ability to shade the ground and so preserve moisture for the use of better trees than itself.

Caragana is a very bushy shrub and its best services is rendered by two rows being planted on the outsides of the plantation to keep out the wind and withstand any grass that may work in.

Seedling plants are the best to use. More of them live and they are cheaper.

The accompanying diagram shows how the trees should be mixed.

Planting Diagram.

The outermost rows of Caragana should be six feet from the edges of the plantation.

The trees to be 4 x 4 feet apart.

C C C C C C C C C C
C C C C C C C C C C
M M M A M M M E M M
R R R R R R R R R R
M E M M M A M M M E
R R R R R R R R R R
M M M A M M M E M M
R R R R R R R R R R

And so on alternately. The two outer rows should again be Caragana.

C—Caragana.

M—Manitoba Maple or Box Elder.

R—Russian Poplar (Populus Petrowskiana).

E—Native Elm.

A—Native Ash.

You will see every other row is Russian Poplar. These are grown from Cuttings and planting them is done with a spade and is a speedy job. A man can easily do 2,000 a day.

The other rows are mostly Maple, three-fourths Maple and the balance Elm and Ash.

You will also see, every other tree is crossed off. This is to allow for thinning, which will take place 20 or 30 years after planting. This seems rather far fetched, but Foresters have to look far ahead in the management of their crops, and the thinning must be taken into consideration. The actual thinning will not work out exactly according to the Diagram, for some trees will be dominated by the others and will die, but in the main the Diagram will work out when the proper time comes to thin.

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General Manager.

No thinning should be done before 20 or 30 years, for the opening up of the crown of branches will allow the sun and wind to get in and dry out the ground if it is done too soon.

At that age the leafy canopy will be 30 or 40 feet high and will still afford sufficient shade for the plantation to maintain itself.

Prunning will be attended to by nature herself. The lower branches will die and drop off for want of light, and the trees will grow smooth and clean without the owner ever having to touch them with a knife.

Preparation of the Land Before Planting

Before trees are planted on the Prairie, the land must be prepared the year before. Deep plowing in May or June when there is moisture still in the ground to preserve, followed by careful cultivation during the summer, makes an excellent preparation.

Sod should be broken and worked up two years before planting to trees. We have seen that the elimination of moisture waste is of the utmost importance in Prairie Forestry and as grass is a great moisture user, every small shoot of grass that is seen the first year or two in the plantation should be at once dug up and destroyed. This is very important, and especially so on sod land, for sometimes there are little spears of grass roots that are not rotted and they may soon spread and take possession of the plantation, when the trees of course will suffer, and may even in time, die.

If a plantation or any part of it does get over-run with grass, a good heavy mulching of straw or manure should be applied about the month of June. This will rot out the grass and help to conserve the moisture at the same time.

These, then, are the principles of Forestry as applied to Prairie planting. It is all a matter of moisture. We get sufficient to grow trees if we can only save it.

Nature says so by the success she is

making to re-clothe the Prairie with trees all along the edge of the tree line. All we have to do is to follow her methods.

The greatest causes of moisture loss are the shining of the sun and the blowing of the wind and we know that by planting broad belts of trees with the trees close together, we can counteract these.

The drifting of the soil in the last few years has shown us that trees on the farm are no longer merely an advantage; they are a necessity, and the day of systematic Farm Forestry is here.

Just think! It is only 20 years or less since the bare prairies of Saskatchewan and Alberta began to be settled, and in many districts already, the top soil is nearly all blown away.

The top 8 to 12 inches of soil is the fertility of the farms, the source of the wealth and well being of the people on the Prairies.

Providence in His wisdom took thousands, perhaps millions of years to lay down that twelve inches of top soil and here we are, in less than a generation, allowing it to blow away.

And what is one generation on the life of a nation? Another 20 years at the same rate and there will scarcely be enough good soil left to be worth while protecting. Surely now is the time for us to set our hand in earnest to this matter.

But even without this soil loss, the Prairie, bare for ever, and yet settled with people, is unthinkable. It will have to be planted some time anyway.

Let us plant it while we still have something to protect. Belts of trees across the farms will check the force of the winds, will protect the soil, the stock, growing crops in all stages from the seed to the harvest, and will prevent the loss of moisture by holding the snow on the ground in winter and checking evaporation in summer. Homes will be more comfortable, and the whole aspect of the country will be immensely improved.

Forests are said to be nature's balance wheel. They will prove no exception on the prairie.

ARCHIBALD MITCHELL.

The above article by Mr. Archibald Mitchell, Western Lecturer of the Canadian Forestry Association has been adopted by the Junior Branch of the United Farmers of Alberta for their educational programme.

Good Shingles Not a Fire Menace

by Frank L. Nash, Secretary Shingle Agency of B.C.

AT the recent meeting of the Ontario Fire Prevention League held the first week in October, J. B. Laidlaw, manager of the Norwich Union Fire Insurance Society, addressed the league on the subject "The Fire Menace of Wooden Shingles." At the conclusion of his remarks he offered the following resolution:

"That the Ontario Fire Prevention League request the Legislature of Ont-

ario to pass an act, to be of general application in every part of the Province, and with no exceptions, to prohibit the use of wooden shingles or other combustible material as a roof covering on any building hereafter erected nearer than fifty feet to an existing structure, and to prohibit the extensive repair of any existing roof covering composed of wooden shingles."

This is just another instance of the many attempts by certain interests to eliminate the wooden shingle as a roof covering. In spite of this fact the number of cities having anti-shingle ordinances throughout the United States and Canada remains about the same, (stated in Mr. Laidlaw's address as being 91, which is approximately correct), for as often as one city decides to experiment with an anti-shingle ordinance some other city will repeal one which had formerly been passed, but had not produced the desired results, that of reducing the fire losses.

There are many cities that have passed anti-shingle ordinances only to repeal them at a later date. There is another class of cities that have investigated the question, and have passed common sense building codes, in which they permit of the use of vertical grain, or quarter sawed shingles, in which the shingles must be 5-2" in thickness at the butts. These shingles will lay flat on the roof and will not curl up at the edges, allowing places where inflammable material may accumulate. The fact is that such shingles are the only shingles that should be used for roofing, as they give better satisfaction and last longer.

The public is often willing to take for granted reports made as to the origin of fires without giving careful thought as to whether or not the case had been carefully diagnosed and the real cause found. This condition has been known to exist, and in many cases the shingle has been blamed in reports of fire causes as "Sparks on Shingle Roof" when the cause should have been reported as "Defective Flue," or as "Sparks from Chim-

ney," which was due to the burning of soot in unclean chimneys.

Examination of the report of the State Fire Commissioner of Texas, dated February 14th, 1917, indicates that had the chimneys been properly constructed and cleaned, and buildings properly fire-stopped, the 1568 "Unpreventable Fires" attributed to "Sparks on Roofs" would have been reduced to a minimum.

The National Board of Fire Underwriters in their statement of fire losses in the United States for 1917 place the total at $231,628,040 and in 1918, $283,103,-101, or a total loss in two years of $514,-785,141, with a total of fires caused by sparks on roofs of only $13,682,423 for two years, or a percentage of 2.66 per cent. which could not at least all be attributed to wooden shingles.

Some of the worst conflagrations and heaviest losses have been in the fireproof districts, as the National Fire Protective Association says in one of its publications "It is the frequent conflagration in a business district where the commercial values are greater which make the fire tax in the United States so enormous," and in these congested districts wooden shingles are seldom found, and never recommended for such use. Take the much talked Atlanta, Ga., conflagration. This fire started in the business district, burned out to the residence district, and was stopped in a shingle roofed frame constructed house.

When an overwhelming majority of all large cities in the United States and Canada permit the use of wooden shingles within their corporate limits, outside of the congested districts, it is proof that the advantages of the wooden shingle roof in residence districts are still recognized. It is also proof that the general public desire an opportunity to make their own choice of the roofing material they shall use, for there are many who advertised forms of roofing, claimed to be "fire-proof or "fire-resistant." To the public the words are generally synonymous—that is combustible.

A few years ago an anti-shingle bill was introduced in the legislature of Texas, prohibiting the use of wooden shingles within the State. This Bill was killed in committee simply in response to prompt public remonstrance. At the public hearing of the committee, the effort to defend the bill was very feeble, and no minority report was made, which would seem to indicate lack of proof that wooden shingles are really objectionable.

It is obvious from the above facts, and statistics show, notwithstanding statements to the contrary, that wooden shingles have contributed but a very small amount toward the spread of fire over large areas, or that a roof of good shingles is a fire menace.

The Pulp and Paper Magazine publishes the following as a "Creed" suggested by Dr. C. D. Howe, of the Toronto Forest School.

We believe in a wholly softwood forest.

We believe in fir, pine and spruce, and that the greatest of these is spruce.

We believe our country has the largest and most prolific pulpwood producing forests in the world.

We believe the forest is not dead, inert material like a mine, but is a living growing thing that can be continuously utilized and at the same time concontinuously restored to productiveness.

We believe the lack of consciencious effort in forest culture and forest protection will in the end be quite as disastrous to our country as the lack of similar effort in field culture.

On the other hand, with the application of intelligent methods of conservation and recuperation, we believe our forests could supply the wood-pulp and paper requirements of the world.

We believe in the development of home industries and therefore that it is unwise, illegal and uneconomical to allow the exportation of raw materials in large quantities from our country.

We believe in the power of falling water, and we believe its power should be greatly extended throughout our land that we may be less dependent upon the indirect source of power imported from without our borders.

We believe that the power of falling water and the power of forest growth are the Twin Genii of our industry, and that the one waxes or wanes with the other.

We believe in up-lifting in all our endeavours, not in tearing down, and hence that it profiteth neither men nor nations to tear down what they cannot replace with better.

We believe in Canada.

We believe in ourselves.

We believe in the quality of our products.

W believe the blessings of our fellow citizens, the blessings of our children and of our children's children for all time will rest upon those who accept this Creed—and act upon it.

Is There a Substitute for the Spruce Log

THE comparative scarcity of pulp for paper-making and the consequent high prices for newsprint are reflected in the stimulus given to research all over the world in an endeavour to widen the field of raw material for paper manufacture. A brief review of some of the possible competitors with Canadian spruce and balsam may be interesting.

Esparto is a grass-like plant found in Spain, Algeria, and Tripoli. It was used for paper-making in Great Britain as early as 1857. During the war, the scarcity of other sources of pulp gave it greater prominence. The fibres are short and weak, and the pulp is best used for filling and is employed largely in mixtures with longer and stronger fibres. In papers in which considerable strength is needed, not more than 20 per cent. of esparto can be used.

Zacatan is a plant belonging to an American genius of the same family as esparto. It is principally found in Mexico, where it grows profusely in certain regions. Experiments with this material,conducted by the Bureau of Plant Industry of the U.S. Department of Agriculture, showed that a satisfactory paper could be made from it by means of the soda process. Indeed, the report of the investigation was published on paper made from zacation. The experiments were not, however, conducted on a scale sufficient to make any estimate of the cost of manufacture. At present, zacaton is a waste product and flourishes in a region remote from paper-manufacturing sections.

Hemp hurds have also been investigated by the Bureau o fPlant Industry. After several trials, under conditions of treatment and manufacture regarded as favourable in comparison with those used for pulp-wood, paper was produced which received very favourable comment both from investigators and from the

trade, and which, according to official tests, would be classed as No. 1 machine-finish printing paper. The quantity available is not great, however.

Flax straw and tow may replace imported flax-waste in the manufacture of wrapping and writing paper. If this can be done, a market would be furnished to Canadian farmers for disposing of what is now a waste product.

Bamboo is coming to the fore in India and Burmah. Mr. William Raitt, consulting cellulose expert to the Indian Government, states that there remain no practical difficulties in transforming bamboo into pulp. Bamboo has the great advantage that it renews itself annually, whereas pulpwood takes half a century to grow.

Tropical reeds and grasses found in the Nile "sudd" of the Bahral-Ghazal province of the Sudan have been experimented with for paper-making, and, while complete success has not been attained, it is quite possible that the difficulties will be eventually overcome. The supply is unlimited.

Anhingo, a plant growing along the banks o fthe sluggish rivers of the state of Para, Brazil, is stated to be an excellent paper-making material, but the great profits to be obtained in the rubber industry have hitherto hindered its exploitation. Mills are now, however, being put in operation for the utilization of this fibre.

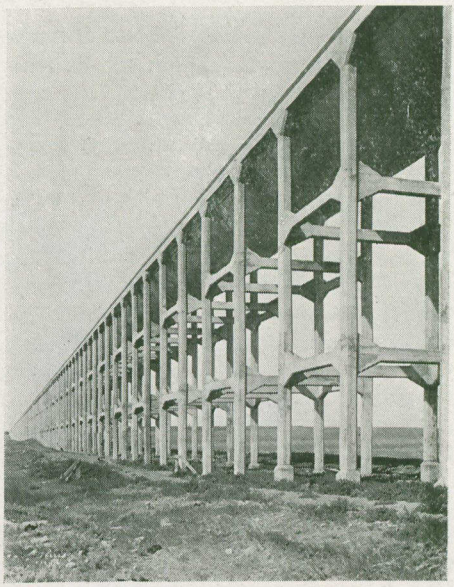
Ajimo is a seaweed found in Japon. It reproduces itself in less than six months. It is said that paper can be produced from it at much less cost than from wood, and a Japanese company has been formed for the purpose of turning out ajimo paper.

Jack-pine is a promising material in the paper-making field. As jack-pine is very common in Canada's northern hinterland, the commercial exploitation of this species would prove very valuable to supplement our dwindling stocks of spruce and balsam.

In the manufacture of newsprint wood-pulp still dominates the field, but one dare not predict that this will always, or even will long, be so. In the temperate zones, however—and proximity to the world's industrial centres is an important factor—there appear at present no serious rivals to our great pulpwood forest species.

The Brooks Aqueduct of Alberta

PART of the water which reaches Lake Newell reservoir after its 30 mile course from Bassano through east branch canal, feeds the Bantry canal, which irrigates 135,000 acres of land. About 2 1-2 miles beyond the lake it is necessary to carry the water across a long flat valley on the summit of the watershed between the Bow and the Red Deer rivers. This is accomplished by a reinforced concrete flume known as the Brooks Aqueduct, completed August 31st 1914. Its construction marked an interesting departure in the matter of water transportation. It is the first aqueduct in which the hydrostatic catenary, or elastic curve, has been adopted for the shape of the water section. This form was chosen as the most suitable, as it gives a maximum hydraulic radius for the given area, and a consequent low friction head. Structurally it is very economical since, when full, the shell is in simple tension, free from sheer and bending moments. Mr. H. B. Muckleston, assistant Chief Engineer, Department of Natural Resources of the Canadian Pacific Railway, is responsible for the adoption of this unique design.



An interesting feature arose from the necessity of crossing the main line of the Canadian Pacific Railway, there being insufficient clearance for an overhead structure. The water is carried underneath the track by means of an inverted syphon, which gradually tapers with its decreasing elevation to a reduced section which increases the velocity of the water from 7.14 feet per second to 12.25 feet per second on the principle of

the venturi tube. This design required less excavation under the tracks and assured better drainage. The gradual expansion of the section as it rises at the outlet is similar to the descent, the water entering the flume again at the same velocity with which it enters. The prevention of eddies and consequent loss of head in the syphon in addition to provision for hydrostatic pressure, and the usual stress and moments, led to some interesting details of design, arising out of an extensive preliminary investigation. When the water was turned on last September the syphon remained perfectly watertight under its full pressure.

In the construction of the Brooks Aqueduct some 25,000 cubic yards of concrete and about 4,000,000 pounds of reinforcing steel were used.

The Bassano Dam admits water to the eastern section o fthe Irrigation Block from the Bow River at Bassano. The sills of the canal head gates are about 34 1-2 feet above the previously existing level of low water in the river at this point. The dam raises the water an additional 11 feet above these sills, enabling the system to command a much larger area of land than it otherwise would, and reducing the quantity of material that had to be removed from the main canal cut, by a considerable amount.

The dam is a complete structure consisting of a long and high earthen embankment on the south bank of the river and a reinforced concrete spillway in the existing river channel, connected at its northerly end with the canal head gates.

The earthern embankment has a maximum height of about 45 feet, a total length of over 7,000 feet, and a width of base of 350 feet at its highest point. It contains about 1,000,000 cubic yards of material. The wetted slope is 4:1 and the dry slope 3:1. It has a top width of 32 feet with a free-board of 9 feet above normal water level. Its upper slope is paved with concrete slobs. There is an extension underdrainage system.

Planting Trees for Fuel

With the exception of setting out trees for shelter and ornament practically nothing has been done in the way of tree-planting on the prairies of Canada for producing wood material. The question of economic tree culture has not yet received sufficient attention to furnish enough absolutely reliable data upon which to base reliable conclusions. There seems to be little doubt, however, that tree-planting would pay in many cases. There are on almost any farm certain portions of land which are not utilized for grain-growing, and which, if pastured, do not really give the returns they should do. Low spots difficult to drain, rough, stony places, steep banks of coulees, and odd corners cut off from the large fields by water holes or creeks, are left idle, as they are too small to make it profitable to

cultivate them. These are instances of conditions where tree planting might be the means of converting land, at present worthless and idle, into valuable and revenue producing property. As farm lands in the West become more thickly settled, a farmer to be successful must make every acre of his property produce the greatest possible revenue without deteriorating the soil. In the case of spots unfit for grain cropping, there is no doubt that the only way to obtain a revenue from them is to plant them with trees. There may be an odd case where, owing to the presence of alkali in the soil or from some other cause, trees would not live, but such instances are very exceptional. It is true that for a few years after planting no revenue can be obtained from a plantation, but the initial expense is not so very great, and as an investment such planting would pay good interest in the future; the only alternative is to allow the ground to remain unproductive for all time.—**Norman M. Ross.**

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