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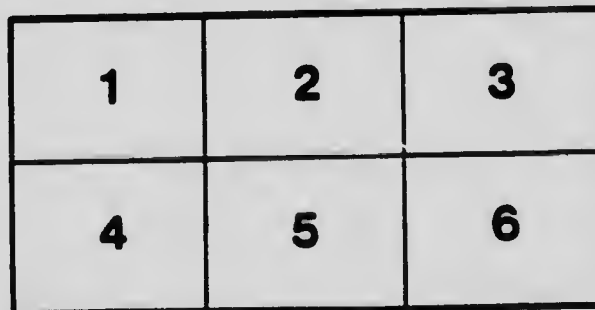
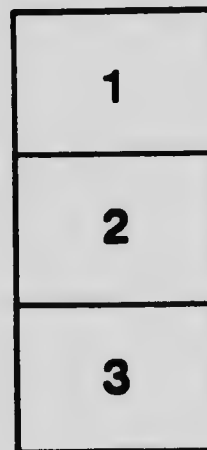
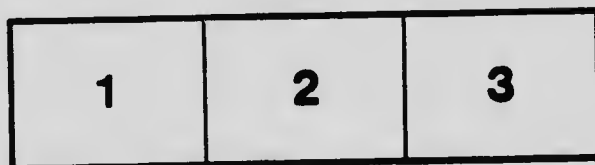
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DOMINION OF CANADA  
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EXPERIMENTAL FARMS

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DIVISION OF ENTOMOLOGY

Bulletin No. 4

THE CONTROL OF INSECT PESTS  
IN CANADA

BY

C. GORDON HEWITT, D.Sc.  
*Dominion Entomologist*

BULLETIN No. 9—SECOND SERIES

Bulletins of the Second Series of the Bulletins of the Experimental Farms treat of such subjects as are of interest to a limited class of readers and are mailed only to those to whom the information is likely to be useful.

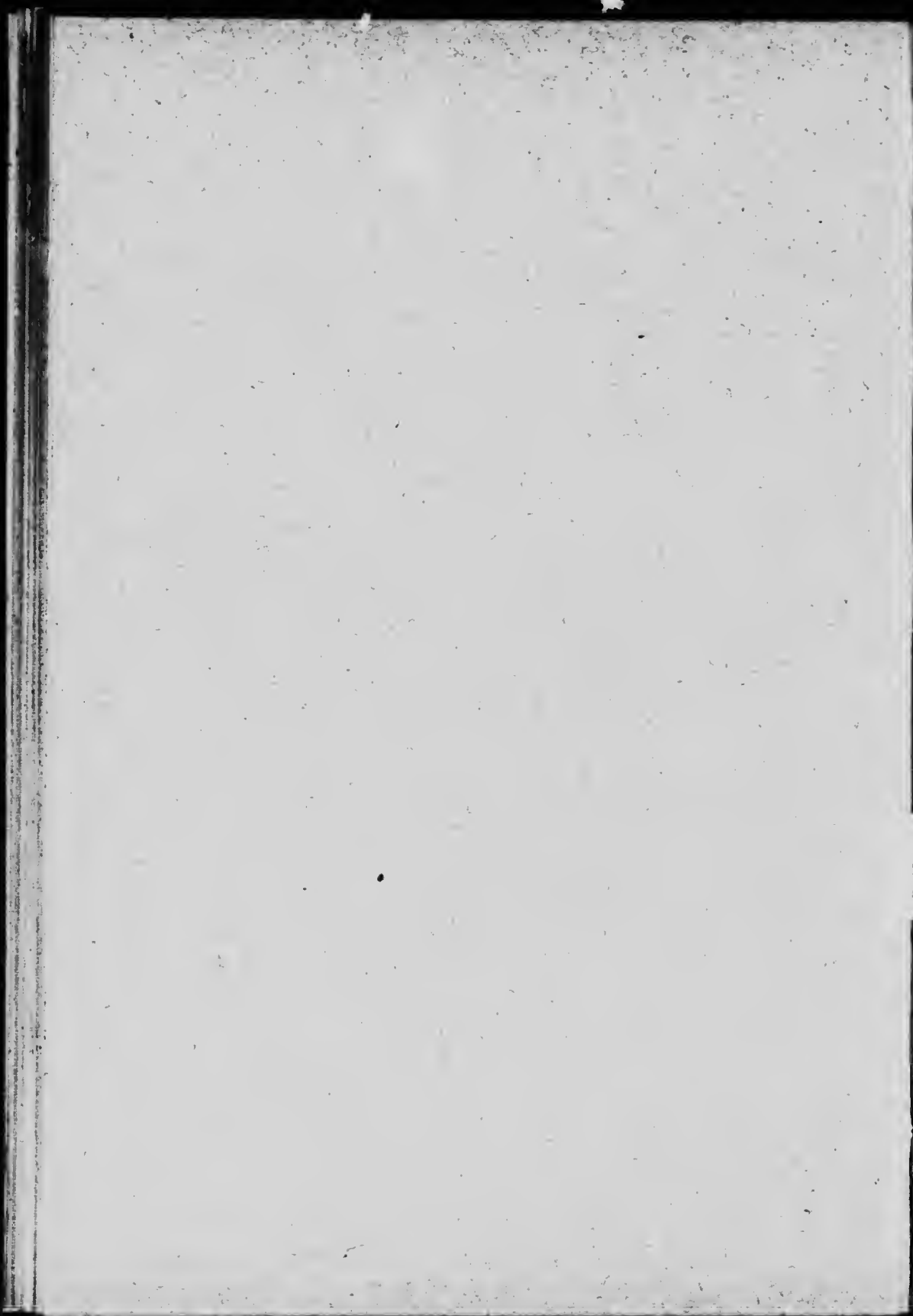
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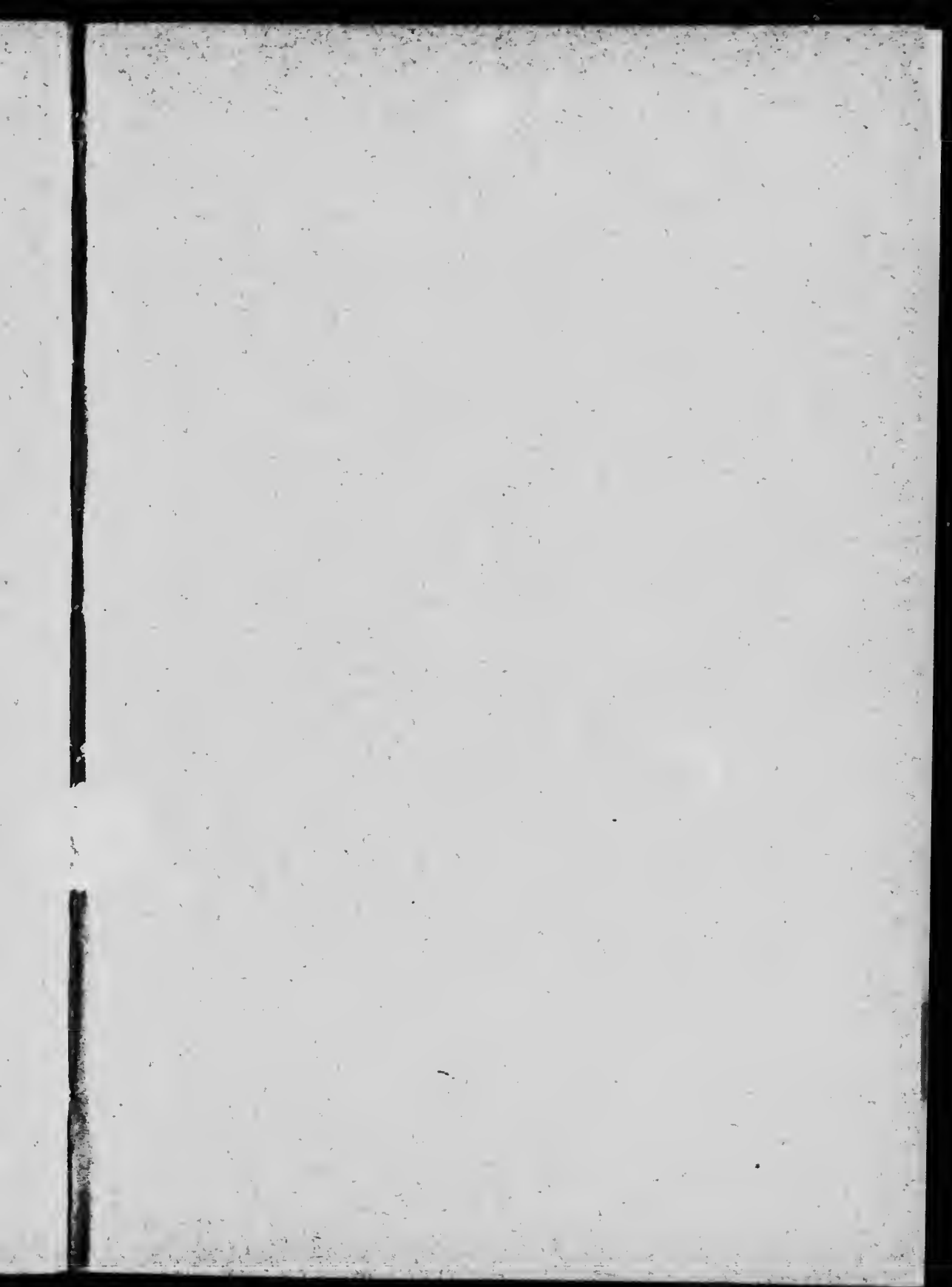
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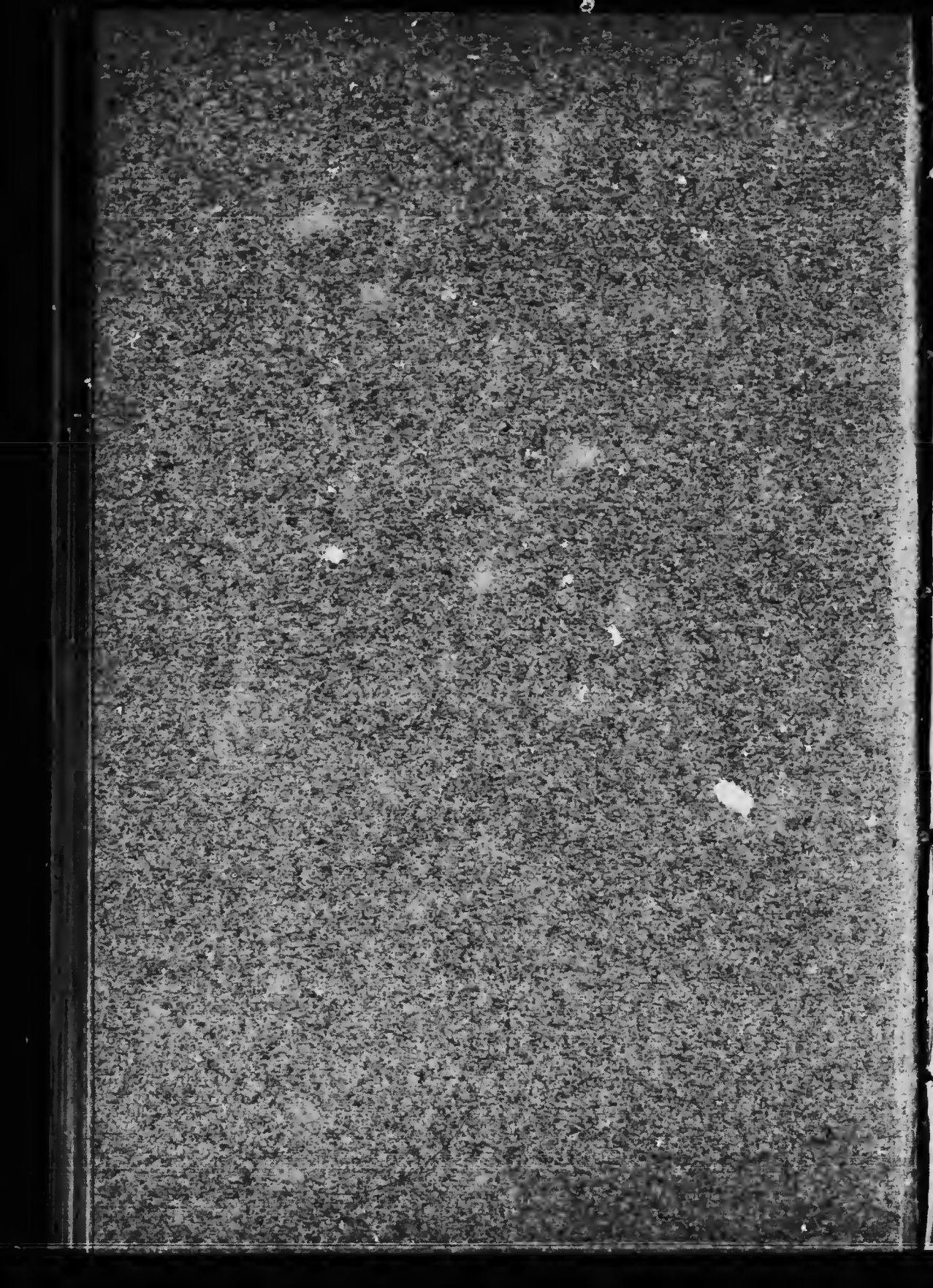
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1912









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Published by direction of the Hon. MARTIN BURRELL, Minister of Agriculture,  
Ottawa.

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OTTAWA  
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1912

## DIVISION OF ENTOMOLOGY

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To the Honourable  
The Minister of Agriculture,  
Ottawa.

SIR,—I have the honour to submit for your approval Bulletin No. 9 of the Second Series and No. 4 of the Division of Entomology, entitled 'The Control of Insect Pests in Canada,' prepared by Dr. C. Gordon Hewitt, Dominion Entomologist.

This is an address delivered by the author in January, 1912, before the Literary and Philosophical Society of Manchester, England. It summarizes briefly the history and progress of the work in connection with the study and control of insect pests in Canada from 1863 to the present day. It will, therefore, be useful as a publication for reference and as a report on progress.

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

J. H. GRISDALE,  
*Director, Experimental Farms.*

OTTAWA, March 9, 1912.



# THE CONTROL OF INSECT PESTS IN CANADA

By C. GORDON HEWITT, D.Sc., F.E.S.,

*Dominion Entomologist.*

Canada is unsurpassed in the variety of problems which it offers the entomologist. Some he is permitted to solve, others baffle him by reason of their magnitude. With an area of more than three and three-quarter million square miles, of which one million and a quarter square miles are forest lands, and extending from a latitude of 42 degrees to the Arctic ocean, with her shores washed by three oceans and her mountains rising to an elevation of over nineteen thousand feet, the variations in climate may readily be understood. The vastness of her plains will be appreciated when it is remembered that the three western or prairie provinces—Manitoba, Saskatchewan, and Alberta—are larger than France, Germany, and Italy combined, and include the finest grain-producing land in the world. At the one extreme in southwestern Ontario, grapes and peaches ripen out of doors, and a shade temperature of over 95 degrees is a common occurrence in the summer; at the other extremes good wheat can be grown at Fort Simpson, on the Mackenzie river, 800 miles north of Winnipeg, and in latitude 61.52 degrees, where the thermometer may fall lower than 50 degrees below zero Fahrenheit in the winter. Thus, briefly, may the physical facts be summarized.

So great an area, including as it does widely different climatic and other conditions, implies a very considerable variety of insect life. In addition to variety, it involves no little difference and possibility of difference in the behaviour of the same species in different parts of the country. But the fact which, to my mind, is of the greatest interest is that in Canada it is possible to witness a gradual disturbance of the natural conditions by the bringing under cultivation from a previously wild and virgin state thousands of acres every year. Insect life is quickly responsive to a disturbance of the natural balance which exists prior to the invasion of man into new territories. Insects previously existing on native wild plants when provided with large quantities of available food in the form of newly-planted crops multiply very rapidly, and assume an economic importance of a very serious nature. Further, owing to the rapid development of the country following its colonization, large quantities of vegetation, including fruit, ornamental and other trees, are imported in annually increasing quantities, with the possibility of the introduction of insect pests from other countries, which on being introduced may prove to be more serious in their ravages than in their native country.

Instances of these phenomena will be mentioned in the following account in which I have endeavoured to describe briefly the means which are being adopted in Canada to prevent the introduction of insect pests, and to control or eradicate those pests already existing within the Dominion.

It may be of interest first to refer briefly to the early work which was carried on against insect pests.

## History.

No work of an official nature had been carried on prior to the confederation of the provinces in 1867. The Canadian Entomological Society had encouraged the

study of injurious insects since its foundation in 1863, and in 1868 it published the first number of *The Canadian Entomologist*, which served to record the results of such studies. In the following year the society received a grant from the Council of the Agricultural and Arts Association for the formation of a collection and the publication of a work on 'Insects Useful or Prejudicial to Agriculture and Horticulture.' Accordingly, the 'First Annual Report of the Noxious Insects of the Province of Ontario' was prepared in 1870, and published by the Provincial Government of Ontario in 1871. It included accounts of the insects affecting apple, grape, and plum, and an edition of three thousand was soon exhausted. In 1871, the Government of the Province of Ontario passed a statute incorporating the Canadian Entomological Society as the Entomological Society of Ontario, which was instituted "for the investigation of the character and habits of insects, the improvement of entomological science and more especially its practical bearing on the agricultural and horticultural interests of the province." A grant was made to the society by the Provincial Government, and 'The First Annual Report of the Entomological Society of Ontario' was published. The annual publication of this report, which contains articles chiefly of an economic and practical nature, has been continued, and the Provincial Government at present makes an annual grant of one thousand dollars to the society. No steps in a similar direction were taken by the Dominion Government until 1884, when an inquiry was held as to the desirability of appointing a government entomologist, and the Select Committee recommended that such an officer be appointed. Accordingly, in 1885, the Minister of Agriculture appointed a Dominion entomologist, selecting for the position Mr. James Fletcher, who had been acting in an honorary capacity as entomologist to the Department of Agriculture since 1884, and had issued his first report on injurious insects. From this it will be seen that the Canadian Government recognized at a comparatively early date the necessity of taking steps towards the control of injurious insects.

When the Dominion Experimental Farms were established in 1886, this officer was attached to that branch of the Department of Agriculture in the joint capacity of entomologist and botanist. This position was occupied by Dr. Fletcher until his death in 1908.

Owing to the increase in entomological work, and the necessity for its further extension, the old joint Division of Entomology and Botany was divided, and separate Divisions of Entomology and Botany were established in 1909. In that year the writer was appointed as Dominion Entomologist, and entrusted with the work of organizing the new Division of Entomology.

### The Invasion of Insect Pests.

Brief reference has been made to the effect which the opening up and settlement of a new country has upon the insect life of that country. Not only is the native insect life affected, but the gates of a promised land are thrown open to the alien hordes without, and the history of economic entomology in Canada contains a lengthy record of successive invasions of injurious insects, or of the first discovery of their previously unnoticed entry. Most of our seriously injurious insects are species which have invaded Canada from without. The Hessian Fly (*Mayetiola destructor* Say) reached Canada about 1816. A few years later it was followed by another serious pest of Canada's staple crop, namely, the Wheat Midge (*Diplosis tritici* Kirby), which crossed the frontier in 1828, and from time to time has been responsible for enormous losses. In 1866, the Chinch Bug (*Blissus leucopterus* Say), which in sixty years has exacted a toll of not less than three hundred and fifty million dollars in the United States, was first found in Ontario. Four years later the Colorado Potato Beetle (*Leptinotarsa decemlineata* Say), in devastating millions, swept across the frontier, and is now the most commonly reported pest in eastern Canada, and in its spread westward has reached Alberta.



All these insects confined their ravages to field and cereal crops. In 1882, however, it was discovered that the Larch Sawfly (*Lygaconematus erichsonii* Hartig), which had been first observed a few years previously in the New England States, had reached Canada. Its depredations were so serious that in a few years the mature larches or tamaracks, over practically the whole of eastern Canada, were almost completely destroyed. About 1887, the Dominion Entomologist received specimens of the Pear-leaf Blister Mite (*Eriophyes pyri* Nalepa) from Nova Scotia, and although this is not an insect in the strict sense, nevertheless for practical purposes it is regarded as such. It was undoubtedly introduced on nursery stock from Europe, and has now spread throughout the whole breadth of Canada, from the Atlantic to the Pacific, and is increasing in abundance, the extent of its injuries becoming more noticeable annually. The milling industry was the next to be seriously alarmed by the sudden appearance in Ontario, in 1889, of the dreaded Mediterranean Flour Moth (*Ephesia kuhniella* Zeller). This European pest received the immediate attention of the Provincial and Federal Departments of Agriculture. The Clover Root-borer (*Hylesinus trifolii* Müller), which is very destructive to clover, and is a European insect, was first recorded in Ontario in 1891.

Passing over the next three years, during which period several new insect pests were observed for the first time, we find that the next serious pest which reached Canada was the Horn Fly (*Haematobia serrata* Rob. Desv.). This insect was introduced into the United States from Europe, and was first observed in Canada in 1892, when its appearance in Ontario caused considerable alarm among farmers. Cattle which are attacked by this insect rapidly lose flesh, and the milk yield is also seriously affected. Two new pests appeared in 1896. In British Columbia the caterpillar of a small moth (*Argyresthia conjugella* Z.) was found inflicting serious injuries to apples, on which account it is named the Apple Fruit-miner. A new apple pest also appeared in Ontario owing to the fact that one of the fruit-flies, whose larva is now known as the Apple Maggot or Railroad Worm (*Rhagoletis pomonella* Walsh), ceased to confine its attention to wild fruit and haws and attacked cultivated apples, of which it is a most serious pest at the present time in certain parts of eastern Canada.

The insect which has been responsible for the greatest injury to fruit trees in certain of the regions where it became established was the San José Scale or Pernicious Scale (*Aspidiotus perniciosus* Comst.). Originally introduced into California from Asia, it spread to Canada, where it was discovered in the Okanagan Valley in British Columbia in 1894, and two years later in Ontario, where it became firmly established and destroyed acres of orchards. In 1898, the San José Scale Act was passed, which prohibited the importation of trees, plants, and other nursery stock from countries in which the scale was present. Later, in 1901, this enactment was modified, and the aforementioned vegetation was allowed to enter Canada at certain periods of the year, and through certain ports, at which were erected fumigating houses for the fumigation of the plants with hydrocyanic acid gas. In 1899, other enemies of field and garden crops invaded our territories from the United States. The Pea Aphis (*Macrosiphum pisi* Kalt.) appeared in enormous numbers in Ontario and the maritime provinces, causing considerable damage. The two Asparagus beetles (*Crioceris asparagi* L., and *C. 12-punctata* L.) crossed over from the State of New York into the Niagara peninsula. The invasion or first appearance of other injurious insects might be mentioned, but this summary of the history of insect invasions of Canada has already reached a considerable length, and the last insect to migrate into our territories from the United States will also be considered. This insect is the Brown-tail Moth (*Euproctis chrysorrhæa* L.), which appears to have been introduced into the State of Massachusetts on nursery stock from Europe about 1890, and together with the Gypsy Moth (*Porthetria dispar* L.), which was also introduced from Europe into Massachusetts, has spread over a large area in the New England States, and has entailed enormous losses and the expenditure of millions of dollars in control and eradication work. At the present time, in the State of Massachusetts



alone, over a million dollars are being spent annually in endeavouring to control and prevent the spread of these two species of introduced insects. The Brown-tail Moth gradually spread in a northeasterly direction, and in 1902 specimens of the moth were taken in New Brunswick, but it was not until 1907 that evidences of the actual establishment of the insect were found in Canada. In that year thousands of the winter webs in which the young caterpillars pass the winter were found in Nova Scotia, and the further discovery of the insect in 1910 in New Brunswick indicated that it had firmly established itself in Canada.

### Federal Legislation in Canada against Insect Pests.

A brief reference has already been made to the San José Scale Act, which was passed by the Federal Government in 1898, prohibiting the importation of trees and other nursery stock from countries in which the San José Scale occurred. In 1901, fumigation stations were established at six of the customs ports, through which nursery stock was allowed to enter during certain periods of the year after fumigation with hydrocyanic acid gas. Beyond this power to fumigate imports, the Federal Government had no authority to take further action, should it be necessary, to prevent the introduction of other insect pests into Canada or the spreading of insect pests already existing in Canada. In 1909, winter webs of the Brown-tail Moth were found on shipments of nursery stock imported from France into Ontario, Quebec, and British Columbia; the same insect was also firmly established in Nova Scotia. It was necessary, therefore, that we should have the requisite powers to prevent the introduction of this pest into these parts of Canada not already infested and its spreading in regions where it had become established. Accordingly, The Destructive Insect and Pest Act was passed in 1910, under which regulations were made providing for the prohibition of entry, fumigation on entry, or inspection subsequent to entry, of nursery stock, or defining other conditions under which nursery stock and other vegetation might be introduced into Canada. The regulations, which include all the provisions of the San José Scale Act, also provided for the treatment of vegetation or premises to prevent the spreading of insect pests, the destruction of any crop, tree, and other vegetation infested, or suspected to be infested, the granting of compensation, and such other steps as might be considered necessary to carry out the objects of the Act.

All vegetation and nursery stock, except certain classes of florists' stock, such as greenhouse grown plants, herbaceous perennials, bedding plants, &c., is allowed to enter Canada through certain ports only, at six of which, namely, St. John, N.B.; St. John's, P.Q.; Niagara Falls, Ont.; Windsor, Ont.; Winnipeg, Man.; and Vancouver, B.C., fumigation stations are established, where stock requiring fumigation is fumigated before being released by the Customs, and a certificate of fumigation is given. For stock requiring inspection, a different procedure is necessary. All vegetation and nursery stock, except the classes already mentioned, coming from Europe, Japan, or the States of Vermont, Maine, Massachusetts, New Hampshire, Connecticut, and Rhode Island, is inspected, and the general method of procedure is as follows:—

Any person importing nursery stock is required to send to the Dominion Entomologist, within five days of ordering this stock, a notice of his order, which must give the name of the consignee, place of origin, the quantity and nature of the stock. When the shipment arrives at the port of entry, a notice of its arrival is sent by the Customs officers to the Dominion Entomologist and the importer and Custom House brokers are also required by the regulations to send a notice of its arrival. Two methods may then be followed: Nursery stock entering through certain ports, such as Vancouver or Winnipeg, is inspected at the port of entry, and after it bears a certificate of inspection it is allowed to proceed to its destination. Nursery stock entering Ontario or Nova Scotia through certain ports, however, is allowed to proceed to its destination, and on notices of its arrival being received from the Customs officers

and the importer, respectively, an inspector is immediately instructed to visit the consignee for the purpose of inspecting the stock. Under the regulations, the consignee may not unpack the stock, except in the presence of an inspector, who, after inspecting the same, issues a certificate of inspection.

The species of insects which are scheduled at present under the Destructive Insect and Pest Act are: the San José Scale (*Aspidiotus perniciosus*); the Brown-tail Moth (*Euproctis chrysorrhæa*); the Woolly Aphis (*Schizoneura lanigera*); the West Indian Peach Scale (*Aulacaspis pentagona*); the Gipsy Moth (*Porthetria dispar*). Other insects may be scheduled should it be deemed necessary at any time. Over two and one-half million plants were examined in eastern Canada during the importation season 1909-1910, and over three hundred of the winter webs of the Brown-tail Moth were discovered on nursery stock from France. These winter webs or nests of the Brown-tail Moth may contain several hundreds of the young hibernating caterpillars of this insect. During the last importation season over four million trees and plants were inspected. Recently, pupæ of the Gipsy Moth, fortunately dead, were found on Azaleas imported from Belgium. These facts indicate the importance of inspection of imported trees and plants collectively classed as nursery stock. In the work of inspection the Provincial Departments of Agriculture concerned co-operate with the Federal Department. In Ontario assistance is rendered in the inspection of shipments of nursery stock. British Columbia, as will be mentioned later, has regulations governing the inspection of imported nursery stock and also fruit, and as the Federal and Provincial inspection and fumigation work is carried on at Vancouver the two departments co-operate to avoid unnecessary duplication of the work.

#### Provincial Legislation against Insect Pests.

In addition to the legislation of the Dominion Government against insect pests, several of the Provincial Governments have enacted legislative measures relating to the prevention, control, and eradication of insect pests in their respective provinces.

In 1892, the Province of British Columbia passed a Horticultural Board Act, creating a Board with power to pass regulations for the purpose of preventing the introduction or spread of injurious insects. This Act was consolidated with other acts under the Agricultural Associations Act of 1911, under which Act regulations have been passed by the Provincial Horticultural Board, and these regulations give the board the greatest latitude in eradicating and preventing the introduction of injurious insects. A careful inspection is made of all nursery stock and fruit entering the province, and until such inspection has taken place the importations are in quarantine. Shipments may also be fumigated when it is considered necessary. The regulations are administered by the Provincial Inspector of Fruit Pests, who is assisted by a staff of inspectors. These inspectors conduct the inspection and fumigation at Vancouver and eradication measures in the nurseries and orchards throughout the province. The large amount of nursery stock and fruit which is condemned annually, and either sent back or destroyed, testifies to the assiduity and zeal with which the work of preventing the introduction of insect pests into the province is carried on, and the freedom of the province from certain insect pests is undoubtedly due to the vigorous inspection which is carried on under the Inspector of Fruit Pests at Vancouver.

The Province of Ontario has a Fruit Pests Act, which is administered by the Fruit Branch of the Department of Agriculture. The insects which are scheduled under this Act are: San José Scale, Codling Moth, and Pear Psylla. The work is carried on chiefly in conjunction with the municipalities, which appoint inspectors in addition to those appointed by the Provincial Department of Agriculture. These inspectors have power to order the treatment or destruction of infested trees and plants. Owners of nurseries are compelled to fumigate stock before it leaves the nurseries, and the Department's inspectors visit the nurseries for the purpose of destroying infested trees, and seeing that the fumigation regulations are carried out.

The Province of Nova Scotia has recently (1911) passed an Injurious Insect Pest and Plant Disease Act, which enables the provincial authorities to appoint inspectors and to take steps to eradicate insect pests and to prevent their spread. It is intended to introduce a measure shortly providing for the compulsory spraying of orchards in those districts where a certain number of fruit growers may desire it. This measure will be most valuable, if carried out and enforced, in compelling indifferent persons to adopt necessary measures of control.

### The Brown-tail Moth.

The invasion of the Brown-tail Moth has already been mentioned, and an active campaign is now being carried on with a view to controlling the Brown-tail Moth in those counties of Nova Scotia and New Brunswick in which it has established itself. This work at present chiefly consists in scouting the countryside for the winter webs of the caterpillars, and the destruction of these where found. Some of these webs contain enormous numbers of caterpillars; for example, a single web or nest collected in Nova Scotia was found to contain over 1,800 caterpillars, which indicates the importance of destroying even single webs. The insects occur mostly upon the fruit trees, but also on the wild varieties of apple, rose, and thorn, and on hardwoods such as oak, elm, maple, &c. In places where winter webs are found in considerable abundance, the trees are thoroughly sprayed after the appearance of the foliage. When the pest first arrived in Canada it was believed by many that the winters would be too severe for the young hibernating caterpillars. Experience has shown that this is not so, and experiments have proved that winter webs containing living larvæ are able to withstand being frozen in a solid block of ice for nearly two months, after which about thirty per cent. of the larvæ are still alive. The parasitic enemies of the insect are being studied, and the Division of Entomology will attempt to use these means in endeavouring to obtain a natural control of the pest. In the work of scouting for and destroying the winter webs, the Federal Government is assisted by the Provincial Departments of Agriculture.

### Other Work of the Division of Entomology.

In addition to the work of inspecting and fumigating trees and plants imported into Canada carried on under the Destructive Insect and Pest Act, and the Brown-tail Moth control work, which activities have already been described briefly, the Division of Entomology also carries on many other lines of work. The problems of insect control are intimately related to agriculture, horticulture which includes fruit-growing, forestry, public health and other activities of man; in proportion as these activities increase in importance the knowledge of the means of insect control likewise increases. On farm crops in Canada insects levy an annual toll at the present time of at least fifty million dollars, and a very conservative estimate would indicate that the fruit-growers of Canada experience an annual loss of over four million dollars owing to insect pests. These figures may appear rather large to the uninitiated, but it should be remembered that a loss of thirty per cent in fruit-growing, and a loss of ten to twenty-five per cent in the raising of farm crops, is generally assigned to injurious insects. Further, it is safe to say that even with our present knowledge of the methods of insect control, a saving of at least thirty per cent could be effected, and with increased knowledge this percentage will undoubtedly increase. One of the chief objects of the work of the Division of Entomology is to assist farmers and fruit-growers in the prevention of these losses. All should realize that it is a poor policy to advocate methods for the purpose of increasing the productivity of the soil and of the crops if, at the same time, steps are not taken to lessen the means responsible for reducing, in so large a measure, the crops so produced.

Inquiries and reports concerning insect injuries are received from all parts of Canada. All correspondence to and from the Division is carried 'Free,' no postage being required, thereby enabling all who desire to have information to obtain it free of cost.

By co-operation with other branches of the Department of Agriculture the Division is able to increase its usefulness. The Census and Statistics Branch has a body of correspondents of over three thousand, who report to that Branch each month on the conditions of the crops in the different provinces. A question is also asked with reference to insect pests, and the important replies are referred to the Division. In this way it is possible to communicate immediately with such correspondents as may need assistance, or if the pest is of a serious nature, to issue a statement to the local press of that district. Such an arrangement is also valuable as a means of receiving information of the incipient stage of an outbreak of an injurious insect. The Fruit Branch has similar correspondents reporting the conditions in regard to the fruit crops, and they also are asked to report concerning insect injuries. By these means the Division is in communication with practically every section of the Dominion, and is kept well informed as to the occurrence of injurious insects affecting farm and fruit crops.

With so vast an area it is necessary to study the insects and the methods of control in the regions where they occur; the life history of an insect in Quebec will probably differ from its life history in British Columbia, and the methods of control must be adopted according to such differences. Field stations or laboratories are being established in Nova Scotia, New Brunswick, Quebec, Ontario and British Columbia for the study of fruit insects and, in the case of the first two provinces, of the parasites of the Brown-tail Moth. It is hoped to establish one in the western provinces for the study of insects injurious to cereals.

One of Canada's most valuable reserves are the forests. The forest area is estimated at about one and a quarter million square miles, of which about four hundred thousand square miles are said to be covered with merchantable timber. In 1910 over three and a half million dollars' worth of pulpwood were produced. As injurious insects form one of the chief forest-destroying agencies, the important relationship which forest entomology bears to the question of the conservation of the forests needs no emphasis. This study of forest insects has not received in the past the attention its importance warrants, but Mr. J. M. Swaine, who is a recognized authority on the bark beetles, the most destructive of forest insects, has been appointed as an assistant entomologist, with the intention of developing this branch of entomological work. The officers and forest rangers of the Forestry Branch of the Department of the Interior are co-operating in this work by making field observations and reports on forest insects.

A large number of inquiries are received concerning apiculture, and an apiary is kept for experimental purposes. Increasing attention is being devoted to bee-keeping throughout Canada, and with the development of the fruit-growing industry, there should most certainly be a concomitant development in apiculture. The most serious impediment to its development is the spread of the diseases known as European and American Foul Brood. Both these diseases have been introduced into Canada, and the Provinces of Ontario, Quebec, and British Columbia have enacted statutes with a view to preventing their spread.

Insects and ticks affecting live stock are a serious problem in many parts of Canada. The well-known Warble Fly (*Hypoderma lineata* Villers) is so prevalent in certain regions, that as much as two dollars per head is frequently deducted from the price paid for young stock on account of the injuries of these insects. Through the co-operation of the Veterinary Director General of the Department of Agriculture, reports and specimens are received from the veterinary inspectors throughout the Dominion, and a knowledge is being gained of the prevalence and distribution of these insect enemies of live stock.

In British Columbia, a few years ago, many complaints were made by fruit-growers concerning the condition of the orchards on the Indian Reservations, which in many sections adjoin or are situated in fruit-growing sections. The Indians, partly through ignorance and largely through indifference, paid little attention to the orchards in their reservations, with the result that insect pests of all kinds, being unmolested, flourished in abundance. The result was that the Indian orchards served as breeding-grounds and sources of supply for insect pests. Through strong representations being made to the Department of Indian Affairs, an annual appropriation is made by that Department 'for the cleansing of Indian orchards,' and this work is administered by the Dominion Entomologist. An officer is employed who devotes his whole time to this work. The Indian Reservations are visited, and the Indians are supplied with spraying machines and instructed in the methods of spraying, pruning, and generally cultivating their orchards. The work has already had very beneficial results, and many of the Indians are possessors of good orchards and produce excellent fruit, and the orchards in the reservations are becoming less menacing to the orchards of the neighbouring fruit-growers.

A vigorous educational campaign is carried on in reference to the relation of insects to man. By lectures illustrated by lantern slides and cinematograph, by circulars freely distributed, and by articles in the press, the public is being impressed with the necessity of eradicating the house fly as a means to sanitary reform and the reduction of the death rate, due to intestinal disease, especially among infants, such as typhoid fever, in the carriage of which flies play so large a part in Canada.

So far, mention has been made chiefly of the strictly practical aspects of the work of the Division of Entomology. Considerable time is occupied, however, in educational work. Agricultural and fruit-growers' associations, and meetings in the different provinces, are addressed on injurious insects and means of control. An increasingly large and representative collection of Canadian insects, which it is intended shall form the basis of a national collection, is maintained, and is largely used in determining collections of insects sent in by individuals, schools and colleges for identification. Although such work involves much time and labour, its educational value is undoubtedly great apart from benefits which accrue to the Division.

This account of the work of the Division of Entomology is necessarily brief, but it may indicate the great variety of problems with which we have to deal, and the many interests which are affected by injurious insects to which interests our work is accordingly related. As the development and growth of Canada is wholly dependent upon agriculture, the basic principle of the country's prosperity, the importance of the work thus briefly described, and its necessary increase, will be readily understood.

#### **Other Work in the Control of Insect Pests.**

In addition to the work carried on by the Federal Government, much valuable work is effected by several of the Provincial Departments of Agriculture. Reference has already been made to the work carried on by the Provinces of British Columbia and Ontario under their respective statutes.

The Province of Ontario has always been very active in regard to taking steps for the control of insect pests. This is due, to no small extent, to the fact that there exists in the Ontario Agricultural College at Guelph, which is maintained by the Provincial Government, an excellent entomological department under Dr. C. J. S. Bethune, in which men are trained in this work, and are available for employment either by the Provincial or by the Dominion Departments of Agriculture. The Entomological Department of the College also serves as a bureau of information in the control of insect pests for the province, and the members of the staff carry on an active educational campaign. The Province of Nova Scotia carries on similar work, though to a less degree, in that province.

The Macdonald Agricultural College in Quebec, through a branch of McGill University, and supported by the endowment of its founder, carries on entomological

work in the Province of Quebec; it is not supported, however, by the Provincial Government. The Provincial Government in Quebec, however, gives an annual grant to the Quebec Society for the Protection of Plants from Insect Pests and Fungous Diseases, which enables it to carry on valuable educational work under Prof. W. Lochhead, of Macdonald College, P.Q.

From this account of the problem of the control of insect pests in Canada, and the methods by which it is being attacked, some idea will be gained of its magnitude and the many interests with which it is concerned. The dependence of agriculture and forestry, to name Canada's greatest national assets, on scientific investigation, is becoming increasingly an acknowledged fact, and the people of Canada are recognizing the fact, pointed out by the Right Hon. Earl Grey in opening the first meeting of the Conservation Commission of Canada, 'that the future prosperity of Canada depends upon scientific research and upon the efficient application of the results of that research to the industrial and physical lives of the people.'

