First report of the conservation commission of the state of Wisconsin. 1909

FIRST REPORT

OF THE

Conservation Commission

OF THE

STATE OF WISCONSIN

TO

The HON. JAMES O. DAVIDSON
Governor of Wisconsin

MADISON, FEBRUARY 9, 1909

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GOVERNOR'S LETTER OF TRANSMITTAL

THE STATE OF WISCONSIN,
Executive Department,
MADISON, WIS., February 18, 1909.

To the Honorable, The Legislature:

On July 24th, 1908, I appointed a State Conservation Commission, consisting of President C. R. Van Hise, Hon. H. P. Bird, Prof. E. A. Birge, State Forester E. M. Griffith, Hon. Wm. Irvine, Hon. J. H. Stout, and Mr. G. A. Whiting.

The Commission held several meetings at Madison, and, considering the short time which has elapsed since the creation of the Commission, it has collected information of so such value that I deem it desirable that you have the benefit of their study and research in the consideration of certain legislation now pending, and which will come before you for consideration.

As the Commission is a voluntary organization, no authority exists by which its report to me can be printed. It is, therefore, transmitted to you in typewritten form, with the recommendation that you cause it to be printed for the use of the members of your body.

The Commission make several recommendations for legislation, some of which have been considered under the title of "Forestry Department" in my message transmitted to you at the opening of the session.

I desire to direct your special attention to what is said by the Commission on the question of the conservation of the undeveloped water powers of the state. Since the organization of the state, the policy of granting franchises, under special acts, to individuals and corporations to dam our navigable streams has been pursued. Such privileges, until 1905, contained no provisions tending to protect the public, except the power to amend or repeal the acts. Since that time a provision has been incorporated in these acts providing for a forfeiture of the franchise rights for failure to exercise them within a limited

period after they are granted, for a forfeiture in case of violation of law, and providing for the protection of the public in the prices to be charged for the sale of the power generated. These provisions, while valuable, do not, in my opinion, fully meet the requirements which the importance of the situation now demands.

The undeveloped water powers of our state are the most valuable of its natural resources. Their value is rapidly increasing with the advanced methods of transmitting power to long distances with but little loss of energy. Capital is fast seeking their control, and it is time now that the state should seriously consider the matter of the disposition and regulation of water power rights; for, in a few years, they will all be utilized, and it will be much more difficult then to formulate a system of effective control and regulation on account of the interests that will be affected. Industrial development should not be retarded, and the state should not desire to adopt a policy with respect to them other than one which may aid, to the fullest extent, their development in the interests of all the people.

It has wisely been provided that our navigable streams and rivers shall be forever open to the free use of all the people of the state. No individual can acquire exclusive ownership of such waters. Our constitution prohibits the granting, by special or private laws, of corporate powers or privileges, except to cities. Some of our acts granting franchises to build dams come dangerously near, if they do not encroach upon, a violation of the spirit of the constitutional provision referred to. In view of these facts, it seems the time has come when some system should be adopted under which all franchises to build dams on our streams should be conferred by general law applicable to all like. Such provision would save much valuable time of the legislature, and a considerable item of expense to the state. I, therefore, recommend:

First: That a general act be passed providing that the granting of such franchises be placed in the hands of some state authority.

Second: That the powers of corporations receiving such franchises be carefully defined.

Third: That the conditions upon which franchises may be granted by the state for such purposes be provided.

Fourth: That a small privilege or franchise tax be imposed on each horse power to be utilized, payable annually, so long as the power generated is used.

Fifth: That all acts granting franchises to build or maintain dams on navigable streams heretofore granted be amended so as to provide for their expiration at a fixed date in the future, with a provision that all persons and corporations exercising or holding such rights may comply with the general law in respect thereto, and thus bring all such franchise privileges under one general system, taking care in such legislation not to affect injuriously vested rights.

We have undertaken at great expense the establishment of a Forestry Commission, with a view of preserving such of our forests as remain, especially at the source or near the head waters of our streams, and to acquire other lands, not suitable for agriculture, with a view of reforestation.

Preservation of our water powers go hand in hand with forest conservation. The one is dependent upon the other.

It is but just, therefore, that the recipient of water power privileges contribute a small sum yearly to the forest funds.

Payments thus made will then be applied to the preservation of the property of those who pay the tax.

Respectfully submitted,

J. O. DAVIDSON,
Governor.

RECOMMENDATIONS OF THE STATE CONSERVATION COMMISSION

WATER POWERS.

The state conservation commission represent to the Governor the great importance of the subject of the regulation of franchises for water powers. They call attention to Commissioner Birge's report, submitted herewith, and its suggestions. They approve the recommendations of the report and urge the following recommendations as especially important:

1. That franchises for water powers be granted under a general statute.

2. That the issuing of such franchises be placed in the hands of the rate commission, or similar board, under conditions to be provided by a general statute.

3. That such franchises be in the nature of leases for a long term of years. Such leases should be renewable on equitable terms. Rentals should be low and should be applied to the extension of the state forest reserve.

4. That a reasonable conservation charge be levied on all developed water powers on rivers, the head waters of which are protected by forest reserve lands, the income from such charge to be applied to the extension of the state forest reserve.

5. That the survey of the water powers of the state be completed in cooperation with the United States Geological Survey.

FORESTS.

1. The state conservation commission deem it of the utmost importance that the state forest reserve located about the head waters of the more important streams of the state be greatly extended. At the present time the opportunities to make such extensions are much more favorable than they will be in the future and therefore the commission recommend that immedi-

ate action be taken to secure such extensions. The commission suggest that funds for the extensions of the forest reserve may be secured by issuing certificates of indebtedness on the forest reserve lands owned by the state to the extent of an amount not to exceed $1,000,000. As an alternative suggestion, a one-tenth of a mill tax may be levied for a period of ten years for this purpose.

2. The state conservation commission recommend to the Governor that in view of the large increase in the area of the forest reserves since the last session of the legislature, and the probability that in the future such holdings will be materially added to, that the annual appropriation of the state board of forestry for administrative purposes should be largely increased.

3. The state conservation commission approve of the plan to request Congress to grant to the state of Wisconsin all unsurveyed and unattached islands in lakes north of town 33.

4. The state conservation commission recommend to the Governor that the timber land owned by the state in the Menomonie Indian Reservation be made a part of the state forest reserve. These lands include 16,378 acres, which were patented to the state many years ago, but the possessory rights and the timber of which were until recently claimed by the United States government. The state rights, both as to possession and as to timber, have been fully recognized by a decision made last summer, which decision was secured through the vigorous presentation of the case of the state to the secretary of the interior by the state board of forestry.

5. The state conservation commission regard it as of the utmost importance to the timber producing industries of the state that the proposed laboratories of the United States Forest Service, which are to carry on an elaborate series of investigations upon all kinds of timber with reference to adapting each kind of timber to its best use, and to utilizing timber now wasted, including stumps and refuse, be located in Wisconsin. They strongly recommend that a building be provided for this purpose at the university, and be furnished with power, light, and heat, it being understood that the United States Forest Service will furnish and install all the necessary machinery, worth not less than $14,000, and will pay for the men in charge of the laboratories, the expense of these being about $28,000 per annum.

6. The state conservation commission approve the principles adopted at the Lake State Forestry Conference held at Madison, December 10, 1908, as embodied in the resolutions given below, and they recommend the enactment of these principles into law. These resolutions are as follows:

Resolved, That all persons cutting and exploiting timber in any part of the lake states here represented should be obliged to dispose of the debris in such manner that it shall not be a menace to the forests; that failure to do this should be punished by a fine commensurate with the extent of the operations and consequent possibility of damage; that the timber cut or standing, as well as the land, should be held to secure the payment of such fines imposed, and that full authority be given to the proper authorities to carry out and interpret the law providing for this disposal of debris or "slashings."

Resolved, That forest fires, being one of the greatest enemies of the state, and thus akin to riot and invasion, the Executive Power of the state should be employed to the utmost limit in emergencies, in their suppression and control for the protection of the lives and property of the people.

Resolved, That we advocate the patrol system as the only satisfactory method of preventing forest fires, and the commanding factor in fighting them.

Resolved, That we recommend the retention of the fire warden system with the county, rather than the town, as the unit, as being essential in securing interest and responsibility among the people most affected.

Resolved, That in all districts covered by state fire patrol a reasonable portion of the expense for such patrol should be placed upon the unoccupied, unimproved, or wild lands, whether forest or cut-over land, preferably in the form of an acreage tax.

Resolved, That the expense of the local fire warden service, and the help called out for the suppression of fires, should be borne wholly or in part by the county or town, but the payment should first be made by the state to insure promptness.

Resolved, That all officials, including public prosecutors, charged with the enforcement of fire protective measures, should be subject to severe penalty or removal from office for non-performance of duty.

Resolved, That the successful prosecution and a commensurate punishment in case of conviction often cannot be secured in the

locality where the offense has been committed, and in order that the law shall be enforced, in the interest of justice, and under authority of the attorney general, a change of venue should be permitted.

Resolved, That it is the sense of this meeting that lands containing forests should be taxed in the usual manner so far as the land is concerned, said land to be assessed as if it contained no timber; but the forest products should be assessed and taxed only when they are cut and removed, and then in an appropriate manner; that the harvest timber tax should be based on a stumpage value determined by the value of the forest product at the place where it is assessed less the cost of placing it there.

SOILS.

1. The state conservation commission recommend to the Governor that a soil survey of the state be undertaken and carried on at such a rate as will give a general view of the soils of the state in about five years. The commission call especial attention to the immediate need of such a survey in the central and northern parts of the state, the soils of which are now coming rapidly into agricultural use; and also to its necessity on lands which may be included in a forest reserve and which should be devoted to forestry or agriculture, according to the nature of their soil.

REPORT ON WATER POWERS

By EDWARD A. BIRGE.

A careful investigation and summary of the water powers of the state, both those now utilized and those still undeveloped, was recently made for the United States Government by Professor L. S. Smith, who has also submitted a report on the same subject to the State Conservation Commission. From his estimate it appears that the developed powers of the state are capable of furnishing about 194,000 horse power. This estimate is based on the capacity of the installed turbines. The undeveloped powers, estimated on the basis of the minimum flow for the entire year, represent about 350,000 horse power, and estimated on the basis of the minimum flow for the highest six months, they are about 653,000 horse power. In most large power installations, provision is made for the use of steam power, helping out in times of low water; so that if all of these powers were utilized, the amount of horse power installed would be far in excess of 350,000. It appears, therefor, that the undeveloped water powers of the state far exceed in amounts those that are undeveloped. It appears, also, that no natural resource still in the immediate control of the state at all approaches in value the water power.

The policy which Wisconsin, in common with all other parts of the United States, has followed regarding water powers, has been that of granting them freely to any responsible applicant. No attempt has been made to secure revenue to the state from them, and, until very recently, nothing has been done to secure for the public any regulation of charges for power, or indeed to secure the public in any way. This neglect has been entirely natural, for it is only recently that the great value of water powers has become evident. It is now plain that their value is not only great but rapidly increasing, and that the coming decades will witness an enormous rise in the demand for water

powers, not only on the part of manufacturers, but also from municipalities and from quasi-public corporations, which will seek franchises in order to develop and retail power, which may be distributed to great distances.

The questions concerning the regulation of water powers and of water power franchises are, therefore, on the one hand, pressing for a rapid solution as the value of the powers is well understood and capital is seeking their control. On the other hand, the settlement of these questions is rendered extremely difficult by the almost total absence of experience with them, and the equal absence of any habit of mind or fixed opinion regarding them on the part of the public. Water powers have been treated as if they had no value to the public, and have been given away as the public lands were a generation ago. Now we suddenly awake to the fact that these water powers are the most valuable possession remaining to the state, and the problems of their control and utilization must be settled now if ever.

The question of the control of water powers is further complicated by their relation to the industrial development of the state and of its increase in wealth and population. The development and utilization of water powers tends to cause a great and permanent increase in all these important matters. The State, therefore, cannot adopt a policy which will check industrial development even though it should promise great returns in the future. In the same way the free land and cheap land of a generation ago aided greatly in promoting the rapid settlement and increase of population and of wealth. Yet this does not blind us, as we look back on the history of the past, to the fact that the public lands could have been so treated as to produce more good to the state and nation than they actually yielded; and in the same way the water powers can be and should be so handled by the State as to save for the public all the value possible, and provide for the largest possible returns to the Commonwealth, without checking individual enterprise or the development of manufactures.

The best policy, if it could be successfully carried out, would be that of leasing the right to develop water powers. This policy is commonly carried out in Europe. It appears that in practically all countries of Europe concessions for the use of water powers are granted either by the central or by the local govern-

ments, and on terms which vary widely according to locality. The concession is the expression of an agreement between the government and the industrial concern, and returns for the concession may be made in various forms, such as rental, a fixed payment, or an agreement to furnish power at certain rates for public purposes.

The Monthly Consular and Trade Reports for January, 1909, contains information from consuls regarding certain points of regulation of water powers in Europe. Switzerland is taking care of the enormous resources of power generated by the streams from the Alps. The Canton of Berne leases water powers to applicants for the term of fifty years, the lease being renewable for two additional terms of twenty-five years each. Companies seeking franchises pay a concession fee of 60 cents to $1.60 per horse power according to the size of the enterprise. They pay, also, a graded impost on each average horse power used during the year of 20 to 60 cents. They are taxed on the value of their property at the same rate as other property, and a horse power is rated at a taxable value of $180 to $300. If the concession is not renewed at the end of fifty years, the Canton must pay the value of land, buildings, machinery, etc. At the end of one hundred years the land only need be taken, but if the machinery is then taken by the Canton, it must be paid for.

The government of Norway has recently proposed to the legislature the granting of two concessions to a company which proposes to develop 60,000 to 70,000 horse power. Besides various agreements as to use of power for public purposes, etc., the company pays about 27 cents per horse power annually on all power created by its improvements. At the end of seventy-five years the concession expires, and the plants revert to the state.

These are the examples of recent European legislation on this subject. The essential points are, a lease by the state of the right to develop the water power for a long term of years with low rental, and the right of renewal and of revaluation at the close of the term. This policy preserves to the state in the future the right to receive an equitable share in the certain rise of value of such property, and the moderate charges made at present are so low that they do not place any check on the present development in the use of water powers.

Should the State decide to adopt this policy regarding the water powers of Wisconsin, it would be wise to devote all rentals coming from rivers rising in the state forest reserve to maintaining and improving that reserve. If the policy of taxing water powers of these rivers for this purpose should be adopted, the rental for new concessions could be made the same as the tax on franchises already granted.

Whether or not the State deems it wise to adopt the policy of leasing, it would be of great advantage to enact a general law on the subject of water powers which should embody the policy of the State in the matter. Such a law, indeed, is unnecessary if water powers are to be given away indiscriminately, as was the case in the not remote past. But if franchises are to be granted only on certain conditions, it would seem better to express these in general than to have each company bargaining afresh with the legislature.

Such a law might well contain the following provisions; most of which apply equally to the lease and the franchise systems:

1. All applications for the privilege of developing water powers should be submitted to the authorities of the State, or to one of the state boards, such as the Rate Commission, or, as proposed in the last session of the Legislature, the Geological and Natural History Survey. In New York there is a board for this purpose composed of four *ex-officio* members and one appointive member, who is to be a surveyor.

2. In case the application is for so small a power that the public has little or no interest in it, such commission should be empowered to grant permits without cost to the applicant and without survey. In case an application is more important, surveys, etc., should be made, as was provided two years ago in the case of The Wisconsin River Improvement Co. In considering these applications, the commission should have the right to grant such applications as will most wisely utilize the power of the streams in question, and to refuse permits in case the development of the stream at the point proposed would seriously affect its total value.

3. The capitalizing of companies should be limited to actual investment; accounts should be kept as directed by the Rate Commission or State Tax Commission.

4. In case power is sold or rented charges for its use should be limited to such amounts as will return such rate of interest

on investment as the State regards as equitable, having due regard for depreciation and expense of renewals.

5. Rentals or taxes on these franchises, if levied on streams coming from the state forest reserve, should be applied to the enlargement and improvement of that reserve.

6. Franchises should expire, if the improvements are not installed, within a limited period, and if the power lies idle for a term of years to be specified, the State should have the right to assign the franchise to a new applicant.

The Commission respectfully represent to the Governor the great importance of the subject of water powers. The care with which the legislature of 1907 framed the act to incorporate The Wisconsin River Improvement Company is evidence that the State is ready to give the matter careful and intelligent consideration. It would seem as though a general act might now be passed which should at once encourage industrial development and aid in securing to the public some share in the control and in the future worth of this valuable asset of the State. The matter will be determined in a very few years in one way or another. The State will either establish general principles as the result of framing a general law, or such a law will become unnecessary as the result of granting unlimited franchises for utilizing all of the important water powers.

The Wisconsin Geological and Natural History Survey, with the aid of the United States Geological Survey, has examined part of the rivers of the state with reference to their water powers. Nearly five hundred miles of the most important rivers of the state have been carefully surveyed. A report on these streams has been published by the Survey, and the United States Government has issued detailed maps showing the streams and the topography immediately adjacent to them. The report also contains much information regarding other streams, especially those in the southern part of the state. Since these streams flow through a well-settled region, and most of the water powers are already more or less utilized, much information could be collected concerning them without making the careful survey necessary on the other rivers. There still remain to be surveyed four hundred or more miles of important streams, chiefly in the northern part of the state, whose water powers are now for the most part undeveloped, but which will soon be utilized. It would be of great advantage to the State to com-

plete this survey, which can be done without great cost. An appropriation of five thousand dollars would pay the expenses of the field and office work involved in the examination of the more important of these streams, and would also permit the Survey to carry on the gauging of water flow at low water, especially in winter. This estimate is based on the expectation that the United States Geological Survey will coöperate as in the past, and will defray half of the expense.

REPORT ON FORESTS

BY E. M. GRIFFITH.

I have the honor to submit herewith a report upon the forestry problems in Wisconsin which are most pressing, and especially those which require legislation.

FOREST FIRES IN 1908.

As if in mockery of the efforts of the state and nation to conserve the remaining timber supply of the commonwealth, the fire fiend swept through northern Wisconsin during four months of 1908 and left a trail of desolation in its destruction of millions of feet of mature and young timber, of farmers' and settlers' homes and barns, of schoolhouses, of bridges, and thousands of men exhausted by their work in attempting to stay its progress.

As shown by the reports of the town fire wardens, 1,209,432 acres were burned over by the 1,435 individual fires that came to the attention of the wardens. It is estimated that 499,495,791 feet of merchantable timber was burned, and placing a low stumpage on that timber, it was worth $2,996,975, while the young growth of pine and hardwoods on the lands that were burned over, and which was valued at $6,047,000, makes the total loss of timber approximately $9,000,000. Nature's work of years in reforestation over hundreds of thousands of acres was quickly nullified, and where the fire burned the humus and left nothing but the baked sub-soil, it will be many years before nature can repair the damage. Farm houses, barns, livestock, school houses, bridges and other private and public improvements to the value of $149,454 were destroyed. Over 11,000 men fought fire under the supervision of the wardens and the expense as borne by the towns was $43,850, and the expense would have been many times as much except for the fact that

thousands of men volunteered without pay. An additional $55,820 was spent by lumber companies in fighting fires, though undoubtedly a far greater outlay was made than the figures of the fire wardens would indicate.

The largest losses incurred by timber owners were in Chippewa, Douglas, Florence, Iron, Langlade, Lincoln, Marathon, Marinette, Oconto, Oneida, Price, Rusk, Sawyer and Vilas counties. Practically 97% of the damage to commercial timber was caused by the fires in those 14 counties. Altogether, the area burned over in the counties named was 995,971 acres, on which 470,487,000 feet of timber with a stumpage value of $2,822,922, was damaged. In Oneida county one concern alone suffered damage to 50,000,000 feet of white pine it was holding. Much of the timber that was burned in the northern counties would not have been cut for a number of years and would surely have increased very largely in value. Besides the loss in timber, both mature and young, there is the enormous loss in soil fertility, which it is impossible to express in dollars and cents but is none the less real.

The warden's reports show that over 60% of the fires were started by settlers burning brush, and this is the same percentage which has been reported for the last four years. About 15% were due to sparks from locomotives and the remaining 25% is attributed to various causes such as carelessness of campers and hunters, logging crews, berry pickers, Indians, etc.

FOREST FIRE PATROLS.

As previously stated, the town fire wardens are doing a most valuable work both in preventing and putting out forest fires, and the railroads now appreciate that it is fully as much to their interest as to the state's to protect the timberlands along their lines, and they are working to put a stop to the fires for which they have been responsible.

Of course, it is a self evident fact that in localities where there is the most timber, the settlers are few. There are frequently five or six townships, or over 100,000 acres, in such sparcely settled towns, and when a fire occurs, the fire wardens have only a few settlers, living perhaps miles apart, to help them. The town fire warden system is an excellent one as far

as it goes, but it does not go half far enough, for the fundamental point should be not to let fires start in the first place, and town boards are averse to spending much money in the way of preventive measures.

A well organized and capable force of patrols or rangers is the proper way to handle the forest fire problems, for in no other thing is the old saying so true, that "an ounce of prevention is worth a pound of cure." This office proposed to some of the lumber companies, early in the summer of 1908, that patrol system should be formed to protect the timberlands in northern Wisconsin and if the work had been organized at that time, it is believed that a very considerable part of the heavy loss in September last could have been prevented.

The tremendous fire losses of 1908 have been more than sufficient to prove that if our remaining merchantable timber and the young growth, which must form the future forests, is to be saved, it is high time that the people of the state awoke to the situation and took energetic steps to stop this fearful loss which is largely so easily preventable.

In October the American Immigration Company of Chippewa Falls, which controls a very large amount of land, both timbered and cut-over, at the request of this office took active steps to arrange a meeting of timberland owners of northern Wisconsin, so that plans for more adequate fire protection could be discussed. The invitation met with a ready response from many lumbermen and owners of timberlands and the first meeting was held at the Eau Claire club November 17th.

The fire losses of 1908 were discussed, also the various ways in which the present fire warden law had proved itself weak, the need of patrolling timberlands in order to prevent fires from starting and the vital necessity of compelling by law the piling and burning of slash. After these and other similar matters had been talked over fully, it was voted that the chairman of the meeting, Mr. J. T. Barber of Eau Claire, appoint a committee of five, of which the chairman should be one, to carefully consider the questions of forest fire patrols and the piling and burning of slash, and to report their recommendations at a second meeting of timberland owners to be held not later than December 1st.

The chairman appointed the following gentlemen as members of the committee: W. H. Bundy, Rice Lake; G. D. Jones, Wau-

sau; George E. Foster, Mellen; and Guy Nash, Grand Rapids. The committee met immediately and organized by electing Mr. J. T. Barber chairman, and then adjourned subject to the call of the chairman.

On November 27th the committee again met and prepared their report, which was represented at a meeting of the timberland owners in the Eau Claire club on December 1st. The report was unanimously adopted and is here given in full, as it marks a splendid step forward on the part of our lumbermen in co-operating to conserve for wise use the forest resources of Wisconsin:

Your committee, to whom was submitted the very serious question of dealing with timber fires, with instructions to report recommendations at this meeting, beg leave to report:

The committe wishes to say that it has been greatly assisted by the State Forester, Mr. Griffith, and has confined its considerations largely to plans recommended by him, with such modifications as seem to it advisable.

We recommend that the fire warden law be entirely revised and enlarged to include a system of patrol for the forest section during the dry season. We think the law should provide for an annual tax of two (2) cents or two and one-half (2½) cents per acre upon all wild and unimproved lands, to be paid into the State treasury, and to constitute a forest fire fund.

Divide the timber portion of Wisconsin into not less than five districts to be in charge of an assistant inspector, and each district subdivided into patrol districts, each one containing not less than thirty-six (36) sections, and the whole organization to be in charge of one head inspector with headquarters at some convenient point.

The assistant inspectors and patrols should be employed from April first to November first, but it probably would be found advisable to retain the services of the head inspector throughout the year.

The assistant inspector at the head of each district should familiarize himself with the conditions in each subdivision, and should supervise all the work of the patrols, reporting to the head inspector as to the fire risk in each county, the amount of available help in case of necessity, and the protective measures which should be taken.

The patrols should be appointed fire wardens to give them all

the authority of law, and should post or cause to be posted all fire notices sent to them by the state fire warden, get in close touch with all settlers, campers, etc., in their section, and instruct them fully in regard to the provisions of the law and the danger from forest fires.

All payments on account of the expense of maintaining and operating this system, should be made by the state, through the state board of forestry, which board should have the power of appointment of the inspector, assistant inspectors, and patrols.

This law should include a provision for the burning of slashings, limbs, tops and refuse left by operators on any of the forest lands in the section mentioned, and should provide as follows: Any person or corporation who shall cut or cause to be cut any logs, bolts, pulp wood, ties, poles, posts, or other forest products, in any of the counties designated in this state, shall pile the tops and refuse as the cutting proceeds and shall within one year from such cutting and felling, but not during dangerously dry weather, burn all such piles of refuse and tops, and in such burning all reasonable care shall be taken not to damage standing timber or adjoining property; provided the state fire warden shall be given authority to suspend the operation of this section when, in his judgment, the operator causing such refuse, has been prevented by weather conditions, or other causes beyond his control, from burning such refuse without endangering other property; provided, further, that the term "burning" shall be construed to mean the destruction by fire of so much of such slashings as would become easily combustible material and dangerous in event they were not so destroyed.

Any person or corporation who violates any of the provisions in regard to the burning of slashings, refuse, etc., shall be guilty of a misdemeanor and shall, on conviction, therefore, be punished by a fine of not less than fifty (50) cents nor more than two dollars ($2.00) per thousand feet, log scale for all timber; not less than twenty-five (25) cents, nor more than one dollar ($1.00) per cord for all bolts, pulp wood, cord wood or bark; and not less than ten per cent (10%) nor more than fifty per cent (50%) of the full cash value of other forest products cut and removed from such land.

In case any person or corporation fails to properly pile and burn the tops and refuse, the state board of forestry may, in its

discretion, cause the same to be done, and the expense thereof shall be a lien on the timber or other forest product cut from the land on which the tops and refuse are situated or cut, and shall also be a lien upon the land itself. Proceedings for the enforcement of such lien shall be instituted by the district attorney of the county in which the cutting was done, at the request of the state board of forestry and in the name of the state of Wisconsin as claimant; and costs shall be recovered in the usual manner. The claim for any lien shall be filed by the state fire warden, or under his direction by any of his assistants, inspectors, assistant inspectors, patrols or fire wardens, in the district in which the expense occurred, in the office of the clerk of the district court, in the county in which the claim arose.

The present fire warden system should be maintained and all town fire wardens should be subordinate, in times of service, to the inspector, assistant inspectors, or patrols, in the section of country covered thereby.

No fires shall be set from April first to November first, except for warming the person or cooking food, without the permission of the fire warden, either in writing or by posted notice in the usual manner for posting fire notices.

The laws pertaining to the inspectors, assistant inspectors, patrols and fire wardens, and all laws with reference to forest fires, should be read by the town clerks at the annual town meetings, and should also be published in one or more newspapers in each county, twice a year, once in April and again in August.

The town fire wardens and those assisting them, should be paid not less than fifteen (15) cents, nor more than twenty-five (25) cents per hour, for the time actually employed in posting notices, removing special warning notices, fighting fires, warning settlers, calling out citizens, making arrests, and carrying out any measures for the prevention or extinguishing of forest fires.

The town board should have authority to pay for services under the provisions hereof, in sum not exceeding one hundred dollars ($100.00) for each thirty-six (36) sections, in any one year. In case the town board and fire warden cannot agree on the amount to be paid, or in event the amount agreed upon is in excess of one hundred dollars ($100.00), as herein provided, the facts should be submitted to the state fire warden, who should have authority to hold hearings and summon witnesses,

and his decision as to the amount to be paid by the town shall be final.

Section 4405a should be amended to read: "Every person violating any provision of this section shall be punished by a fine of not less than twenty-five dollars ($25.00), nor more than one hundred dollars ($100.00) or by imprisonment", etc.

Section 4406 should be amended to read: "Any person who shall build a fire on any lands in this state not his own or under his control, except as hereinafter provided, shall, before leaving the same, totally extinguish it, and upon failure to do so, shall be punished by a fine of not less than twenty-five dollars ($25.00) nor more than one hundred dollars ($100.00), or by imprisonment in the county jail not exceeding one month, or by both such fine and imprisonment, and shall be liable to the town for all expense incurred in checking or extinguishing such fire. Any person who shall negligently or wilfully set fire to, or assist another to set fire on any land, whereby such land is injured or endangered, or shall wilfully or negligently suffer any fire on his own land to escape beyond the limits thereof, to the injury of the land of another, shall be punished as hereinbefore provided, and be liable to the person injured for all damage that may be caused by such fires, and to the town for all expense incurred in checking or extinguishing such fires."

Respectfully submitted,

J. T. BARBER, *Chairman.*

The ultimate success of the patrol system will, of course, depend almost wholly on the character of the men appointed and the manner in which they are organized. They should be thorough woodsmen, young enough to be active and able to stand long hours of hard work, who can use a compass, run lines, and where possible, it would be well to select men who have had actual experience in fighting forest fires. The cost of two to two and one-half cents per acre per annum is a low insurance and there is no question that the patrol would save enough valuable timber and young growth in two or three years to cover the cost of the service for many years. The loss from forest fires in Wisconsin for 1908 alone is over $9,000,000 and this would pay all costs of such a patrol system for nearly fifty years.

This plan of protecting timberlands by means of a patrol

through all the dry season is not a new and untried experiment, for with certain modifications to meet our American conditions, it is the same plan which has done so much to build up the wonderful forests of Germany and France; it has been put into successful practice by the lumbermen of Maine and Washington; and since the United States Forest Service has taken charge of the national forests and the ranger system perfected, the losses from forest fires have been lessened to a wonderful extent.

The patrols in northern Wisconsin would be able, by being constantly on the ground, to enforce the law against settlers or others burning brush during a dangerously dry time, and this alone would be worth their employment, for, as shown by the reports of the town fire wardens, burning brush is the cause of over sixty per cent of the forest fires. Town fire wardens are human and it is difficult for them to enforce the law against their neighbors as rigidly as it should be. There is often, also, a great deal of local jealousy aroused in the election of a town board and a feeling of political expediency frequently has great weight when it comes to enforcing the law against some farmer who has considerable influence. For this and other reasons the patrols appointed should not be local men and by enforcing the law impartially, it is believed that they will receive the ready support of most of the settlers in the northern towns, for many of the settlers have lost heavily through the criminal carelessness of their neighbors. The patrols would also be able to look after all camping, fishing and hunting parties, and see that the law providing that all camp fires must be extinguished when they are left, is enforced.

A plan by which all guides should be licensed by the state and also sworn in as game and fire wardens, is outlined in another part of this report, and it is felt that if this is done, the patrols and guides working together can greatly lessen the number of fires for which campers and sportsmen have been responsible. The average man from the city who goes into the woods is ignorant about how to build a camp fire, and is inclined to use a fallen tree or butt as a back log, which, of course, is a very dangerous practice, as the fire works into the log and will often smoulder for days to burst out in case a heavy wind springs up.

A good portion of the time while the patrols are on duty,

there will be little, if any, danger from forest fires, and then they should be employed in clearing out old logging roads and making trails, as these will be of great value as fire lines, to prevent the spread of fire or as vantage points from which to backfire in case of necessity. A patrol, knowing his district thoroughly and with cleaned roads and trails from which to work, can do more with half a dozen men than an army of fire fighters who are rushed into a section of country that they do not know and where the roads are choked with inflammable material. Wherever the expense is justified, a telephone system should be installed by the owners of the land so that the patrols can easily keep in touch with each other and summon help in the shortest possible time.

The fact should not be lost sight of that it is more important to protect the young pine and other valuable timber which is now coming up on our northern cut-over lands, than the mature saw-log timber, for in case of a forest fire the latter can oftentimes be logged at once and so saved, while the least surface fire running through young growth, usually means a total loss. It at least seems peculiar that while many railroads, lumber companies, and other big timberland owners are planting, others allow young pine which has come up on their lands naturally and which is perhaps ten to twenty years old, and so worth a very considerable sum per acre, to be destroyed by fire without making an effort to save it. There is, of course, a great deal of land in northern Wisconsin which is fertile and will make good farms, and no forester of experience would advocate that such land should be kept under timber, but there are also enormous areas of poor, sandy and rocky soils, which are absolutely unsuited for agriculture and the only use to which they can profitably be put is growing timber. The trouble heretofore has been that these lands have been bought and sold as a speculative venture, with the idea that settlers might buy them or that they could be used for a cattle or sheep ranch. There is ample evidence to show that they are not suited to either purpose and they have been handed around from one land gambler to another, a prey to forest fires and thus losing soil fertility, until in some sections they are rapidly approaching the condition of a desert.

The action of the timberland owners in advocating a forest fire patrol, which will be largely paid for by themselves, and

the compulsory piling and burning of all slash, shows that they are keenly alive to the situation, and that in order to save our present and prospective forests and make northern Wisconsin attractive to settlers, strong protective measures must be taken and that all must work together. At the meeting in Eau Claire, December first, the committee was instructed to prepare articles of incorporation for a Timberland Owners' association, and it is the plan to have the association advise frequently and fully with the state board of forestry on all matters pertaining to the forests, protection to our rivers, etc. Such co-operation between the state and the men who own the great bulk of the timberlands of Wisconsin, is a tremendous step forward and will surely lead to much better understanding on both sides and a working out of the practical measures by which the natural resources of Wisconsin can be truly conserved.

PILING AND BURNING OF SLASH.

This has been covered in the report of their committee to the Timberland Owners' association but I wish to emphasize the fact that forestry will amount to little or nothing unless we can put a stop to the forest fires, and that destructive fires will continue until the slash of logging operations is taken care of.

PROPOSED AMENDMENTS TO THE FIRE WARDEN LAW.

Under the proposed plan of forest fire patrols the wardens will be retained and the service strengthened. The patrols will be the preventive force, but the tax of 2 to 2½ cents per acre will not be sufficient to pay the men that they or the wardens must call upon in case of fire and the cost of fighting fires must be borne by the towns or counties, and much preferably the latter, as will be explained. The proposed amendments are as follows:

1. One or more fire wardens to be appointed for each township in the northern counties (the counties to be named in the act) by the state forester. Each such county shall keep on deposit with the county treasurer a fire fund of $200 per township with power to raise additional funds in case of necessity.

This proposed change of having the wardens appointed for and paid by the counties instead of the towns seems necessary, as the town boards are often composed of men of such calibre that they do not appreciate the value or need of the fire wardens and will neither support them in their work or pay their just bills. It is very desirable that there should be a fire fund so that the fire fighters can be paid promptly.

2. No fires shall be set in the counties for which wardens or patrols are provided, from April 1st to November 1st, except for warming the person or cooking food, without the written permission of a fire warden. The present law allows fires to be set at any time provided the warden has not posted special warning notices forbidding the setting of fires. Practice has shown that the settlers pay small attention to these notices and therefore it seems necessary not to allow fires except with the permission of a warden.

3. The laws pertaining to fire wardens and forest fires should be read by the town clerks at the annual town meetings, and shall also be published in such county newspapers as the state forester may select, once in April and again in August, the bills therefor to be paid by the counties in the same manner as the fire warden bills.

4. The county fire wardens and those assisting them shall be paid not less than 15 cents, not more than 25 cents per hour, for the time actually employed in posting notices, fighting fires, warning settlers, calling out citizens, making arrests and carrying out any measures for the prevention of forest fires. The present law provides that the fire wardens and those assisting them shall receive such compensation as the town board *shall allow,* not exceeding 25 cents per hour. The result is that some town boards have refused to allow a cent and in such towns I cannot get any decent man to serve.

5. Sections 4405a and 4406 should be amended so that the minimum fine for setting fires in violation of the law should be $25 and the maximum $100, or imprisonment. This is important from the fact that the present law provides a maximum fine of $100, but no minimum and some of the judges have been making a farce of the law by fining persons who had plead guilty to setting fires, from $1 to $5 and costs.

It is believed that the fire warden law strengthened in the above manner will be a very valuable adjunct to the patrol

system and that if both branches are well organized, forest fires in Wisconsin can be prevented to a very marked degree.

LICENSED GUIDES.

Many of the forest fires which are started by campers, fishermen or hunters, come from their camp fires and are due more to their ignorance of how to properly build a camp fire and tend to it than to carelessness or malice. Where such parties are accompanied by a guide, he should, of course, caution them of the great care that should always be used when starting any sort of fire on the ground in the woods. Many of the guides are such only in name and oftentimes are simply hangers on in the small northern towns, or lumber jacks out of a job, who find this a pleasant way to earn some fairly easy money, and such men are oftentimes the worst members of the parties for starting fires, killing fish and game illegally, etc.

In Maine no man is allowed to act as a guide until he has applied for and received a license from the commissioners of inland fisheries and game, and all applicants not known to the commission are required to furnish the recommendation of some official who can testify as to their qualifications. The fee for a license to guide is $1 for a resident and $20 for a non-resident, and the commission keeps in touch with all the guides by means of reports showing the number of parties guided and the number of deer, moose, etc., which have been killed. Failure to make out reports when called for, or violation of the fish or game laws, renders the guide liable to a fine and forfeiture of his license. The result is that there is a fine class of guides in Maine who make a good living in this way and their valuable assistance in preventing many forest fires and in helping to enforce the fish and game laws has made their forests increasingly popular with sportsmen from all parts of the country.

As President Roosevelt has said: "A deer wild in the woods is worth to the people of the neighborhood many times the value of its carcass, because of the way it attracts sportsmen who give employment and leave money behind them," and the truth of this is proved by the enormous amount of money which is spent by sportsmen in Maine each year.

In Wisconsin it would seem advisable not only to license all guides, but to have them sworn in as game and fire wardens

and also obliged to report all cases of timber trespass upon state lands that might come to their attention. As the forest reserve is increased and the lands saved from desolation by logging and fire, many more summer tourists and sportsmen will come to northern Wisconsin and the money that they will spend will benefit the guides to such an extent that they should be only too willing to co-operate in every way to save the forests, fish and game, as it will mean the building up of their own business.

STATE LANDS IN THE MENOMINEE INDIAN RESERVATION.

The state now holds under patent from the United States some 16,378 acres of timberland within the Menominee reservation. These lands for the most part are heavily timbered and on many descriptions the timber is the finest that is to be found in any part of Wisconsin. As the reservation lies south of town 33, these state lands are not a part of the state forest reserves but upon request of the state land commissioners, I have taken up the question of their final management with the U. S. Forest Service, which now has charge of the logging operations on this reservation and has built a large sawmill on the reservation to manufacture the mature timber, which is owned by the tribe. In order that these valuable state lands should be managed under forestry methods, in co-operation with the U. S. Forest Service, it is important that an act should be passed making them a part of the state forest reserves.

TAXATION OF TIMBERLANDS.

While the nation and state are working to devise methods and means of conserving our fast waning forest resources, we are at the same time taxing our timber to death. Forests are a crop just as much as wheat or corn and when the private owner is obliged to pay an annual, and often increasing, tax on his growing timber, it is no wonder that he cuts, and usually cuts all, to escape practical confiscation through taxation.

Our legislature in 1907 passed an act exempting from taxation for a period of thirty years, forty acres of land owned by an individual or corporation when planted to forest trees. If it is a good thing for the state to thus encourage the planting

of trees, it is certainly wise to encourage the forest owner to cut his timber conservatively under simple methods of forest management.

The two great deterrent factors that are keeping many timberland owners from adopting forestry methods are fire and taxes. It is believed that the first can and must be overcome through a well organized patrol and fire warden system as previously outlined and it is felt that our state should give timberland owners a chance to manage their forests on a permanent basis by the enactment of the following proposed law or one which will give an equal opportunity:

Section 1. In consideration of the public benefit to be derived from forestry management upon a considerable area of the timberlands within the state, the owner of any timberland may apply to the state board of forestry for an examination of his lands and timber. Such application shall be accompanied by a plat and description of such timberland and a guarantee to pay the reasonable expense of such examination and report.

Section 2. In case the state board of forestry finds upon examination that the management of such timberland under forestry regulations would be a public benefit, they shall submit a report for the management of such lands to the owner thereof, clearly stating the regulations in regard to the cutting of the timber, and in case the owner shall accept the same, a contract shall be entered into between the owner and the state.

Section 3. Upon the execution of the above contract the state board of forestry shall file a plat and description of the lands with the local board of assessors, and after such plat and description have been filed with them, the assessors, when making the annual assessment, shall assess only the value of the land and no tax shall be paid upon the timber until it is cut. In no case shall the land be assessed at a higher rate than cutover, wild, or non-agricultural land in the same town.

Section 4. When the owner of such timberlands cuts therefrom any timber, cordwood, poles, posts, or any other forest products for any purpose whatsoever, he shall make or cause to be made an accurate measurement of all such products and file a sworn copy of such measurement with the board of assessors, and such sworn statement shall be the basis of the tax valuation.

Section 5. Before any such products are sold or removed, the owner of the timberland from which they have been cut, shall pay in lieu of the usual annual tax upon timber, 5 per cent of the appraised value of such products as determined by the board of assessors.

Section 6. The owner of any timberland who shall have entered into a contract with the state to manage the forests under such regulations as the state may prescribe and who shall then fail to file a sworn statement as to the measurement of such products as he may cut, or who shall remove such products without notifying the local board of assessors, or who shall swear falsely as to the measurement of such products, shall pay 10% of the value of such products as determined by the board of assessors, and in addition thereto shall be liable to a fine of not less than $5 nor more than $10 for each tree so cut and removed.

The Timberland Owners' association at the meeting in Eau Claire, December 1st, considered this matter of great importance and the following motion was unanimously carried: It is the sense of this meeting that the forestry department be requested to prepare a bill to be presented to the next legislature providing for a contract which may be made by the timber owners and the state, that shall exempt the timber on such lands from taxation under certain proper conditions during the term of such contract.

UNSURVEYED ISLANDS IN NORTHERN LAKES.

The following letter was sent to Honorable James R. Garfield, secretary of the interior, by Governor Davidson on June 15th, 1908:

Honorable JAMES R. GARFIELD,
Secretary of the Interior,
Washington, D. C.

Dear Sir: The State of Wisconsin has now created a forest reserve of 300,000 acres in the northern part of the state, and we intend to increase this area very materially by purchase and otherwise. Two counties, Oneida and Vilas, have over 1,200 lakes, and in these lakes there are many beautiful islands which are as yet unsurveyed.

I am informed that last year a Mr. Shepard of Chicago, through the general land office, had a survey made of the islands in Presque Isle and Crab lakes, Vilas county, and that he has filed script upon them. It is our intention at the next session of congress, to secure the introduction of a bill providing that all unsurveyed islands in lakes north of town 33 shall be granted to the state as an addition to the forest reserves.

I do not suppose it is possible to prevent Mr. Shepard from acquiring the islands in Presque Isle and Crab lakes, though it seems a pity, as I am informed that he is securing the same for purely speculative purposes, but I would earnestly request that, if possible, no other islands not now surveyed and in lakes north of town 33, be allotted before the state has had an opportunity to secure the passage of such a bill as outlined above.

One of the main objects of the forest reserve is to provide beautiful and healthy camping sites for not only the citizens of Wisconsin, but non-residents as well, and it does not seem right that the fairest spots of all, the islands, should fall into the hands of speculators.

Yours truly,
J. O. DAVIDSON.

I am of the opinion that there is a very good chance of our being able to secure the passage of the above measure and I would suggest that the state conservation commission request our delegates in congress to make every effort to secure its passage at this session.

PURCHASE OF FOREST RESERVE LANDS.

The policy of the state to sell the forest reserve lands that are scattering and agricultural, the proceeds going into a forest reserve fund which is used for the purchase of other lands more valuable for forestry purposes than for agriculture, and so located that they will form important additions to the permanent reserves, is a most important one and is based on the sound common sense idea that every acre of land should be used for the purpose to which it is best adapted. The creation by the legislature of a forest reserve fund in this way was a very wise and practical plan and it has so far placed the work of building up a forest reserve upon a self supporting basis

and, in substance, is very similar to the plan which has made possible the great work of the federal government in reclaiming, by irrigation, the arid lands of the west.

Some 34,000 acres of land have been purchased as additions to the forest reserves in Iron, Oneida and Vilas counties, and the state board of forestry has entered into a land contract to purchase 14,000 acres more in Vilas county. The Nebagamon Lumber company also gave the state some 4,300 acres on the Brule river in Douglas county. The lands purchased ranged in price from $2 to $3.50 per acre and for the most part are cut-over, though on a considerable area the young growth that is coming up is fairly satisfactory. Many of the largest owners of lands in these counties are also part owners or interested in water powers or plants using the powers, and such men are naturally glad to see the state acquire adequate forest reserves which will protect the headwaters of the rivers and so safeguard the water powers for all time. This is very fortunate for the state, as it is thereby enabled to purchase large, compact holdings at a reasonable price without being compelled to resort to condemnation proceedings.

This office has prepared a map showing the ownership of the greater part of the lands which the state should eventually own in order to consolidate its holdings and at the same time have adequate reserves which will really protect the headwaters of the rivers and yield in time a large amount of timber and a steadily increasing income to the state.

The amount of money which will accrue to the forest reserve fund through the sale of scattering and agricultural lands within the reserves will not be sufficient to purchase the lands that the state must own, though very considerable purchases have been and will be made with this fund. It is, of course, well understood that a forest reserve nearly adequate to the needs of the state cannot be built up in a day, and that a state cannot always do all that is best at once, but at the same time any policy that would mean delay in acquiring these lands for the forest reserve would, in the end, entail a very heavy loss upon the whole state. These lands in the hands of owners whose only interest in them is speculative, are rapidly and constantly deteriorating through the all-destroying influence of the forest fires, which are allowed to burn over them uncontrolled, every few years. The state must own these lands, and by em-

ploying rangers, building fire lines, etc., protect them from forest fires, for until this is done they will continue to deteriorate. Such being the case, it would be the worst form of economy to delay the purchase of these lands any longer than is absolutely necessary, and as the forest reserve fund is not sufficient to make such large purchases, other means must be found. As the value of the forest reserves will increase as the years go on, the ideal plan would be for the state to issue, say, $10,000,000 in fifty year bonds bearing a low rate of interest, as by that time the income from reserves of, say, 2,500,000 acres would be so great that there would be little trouble in paying off the principal, while the interest could be met in various ways by special taxes. But such a bond issue is impossible under the Constitution of Wisconsin, as the state is prohibited from having any bonded indebtedness in excess of $100,000. After having carefully considered ways and means, the following plan is recommended:

1. That the legislature by act shall authorize the state board of forestry to issue certificates of indebtedness in a sum not to exceed $2,000,000, on the lands owned by the state and within the forest reserves, such certificates to run for a period not exceeding twenty years and to bear interest at a rate not to exceed five per cent.

2. That the legislature provide for a reasonable tax upon the owners of all waterpowers on streams whose headwaters are protected by the forest reserves, and that the proceeds of such tax shall be used only for paying off the principal and interest of the above loan. The Supreme Court has held that such certificates of indebtedness are not a bond issue or a public debt, and in 1851 the legislature of this state passed an act authorizing the issuing of script, or certificates of indebtedness, in aid of the Fox and Wisconsin river improvement. These certificates were secured in part by lands which had been granted to the state of Wisconsin by the United States for the furtherance of the improvement of these rivers. Mr. Frank L. Gilbert, Attorney General, to whom the above plan was submitted, says, "I am, therefore, of the opinion that the plan suggested by you, of issuing certificates based upon the land held by the state as forest reserves and not constituting a liability upon the property of the people of the state, would not violate

our Constitution and would be legal." If the legislature will authorize the state board of forestry to issue such certificates, it is believed that a loan of at least $1,000,000 can be secured, to run twenty years, if not paid off before that time, and at a rate not to exceed five per cent.

In case the above plan of taxing water powers that are benefited by the forest reserves cannot be enacted into law at the coming session of the legislature, it is recommended that a bill be introduced providing for an annual state tax of one tenth of a mill to be used in paying off the principal and interest on the amount secured from the certificates of indebtedness, or if such a loan should fail to be secured, then the proceeds of the tax to be used in purchasing forest reserve lands and for the improvement and protection of the same. Mr. F. B. Moody, Assistant State Forester, with three cruisers, is examining two large tracts of land in Vilas county, which it is very important the state should acquire for the forest reserves, and it is expected that he will be able to present reports covering these two tracts at the meeting of the Commission on December 11th.

LABORATORIES OF THE U. S. FOREST SERVICE FOR WISCONSIN.

The U. S. Forest Service for some years has been operating laboratories for timber tests, seasoning and treating timber and railroad ties, making paper pulp from woods hitherto unused, and for making charcoal, turpentine, wood alcohol, etc., from the tops and other waste of logging operations. These laboratories have been located at different points in the country and on account of securing greater efficiency, the Forest Service now wishes to concentrate them at some first class engineering college and have taken up the matter with several universities, including Michigan, Illinois, Purdue and Wisconsin. The Forest Service will furnish and install all the machinery, which is worth some $14,000 and will pay all the salaries of the men in charge of the laboratories, which will amount to $28,000 per annum, and they only ask the university to provide floor space, power, heat and light. I feel that we have special need of such laboratories in the state and that we can offer peculiar advantages. Our supply of paper pulp timbers is being rapidly exhausted and the question of perfecting methods by which other woods may be used is an extremely important one.

The same thing, though not to the same extent, applies to the use of new woods in railroad work, especially ties. This year the enormous damage from forest fires was caused largely from the slash of logging operations, and if some commercially profitable method can be discovered of making charcoal, turpentine, wood alcohol, etc., from the tops, stumps and limbs, it will mean a tremendous increase in timberland values and will also largely solve the problem of preventing our most destructive forest fires and the more rapid settlement of lands suitable for agriculture.

I have excellent reasons to believe that if the regents of the university will appropriate $25,000 to $30,000 for a building, Wisconsin can secure these laboratories. This matter will come before the regents at their next meeting December 15th, and I would suggest that the State Conservation Commission pass a strong resolution requesting the regents to appropriate not to exceed $30,000 for such building.

INCREASED APPROPRIATION FOR THE STATE BOARD OF FORESTRY.

The work of the state board of forestry has grown so rapidly and the annual appropriation of $9,800 is so small in comparison with the needs of the department that it has been impossible to take up several important lines of work.

The forest reserves now comprise some 300,000 acres in 17 counties, being worth at least from $2,500,000 to $3,000,000, and the work of examining and appraising the scattered and agricultural lands, protecting all the state's holdings from tresspass and examining lands that are to be purchased as additions to the reserves, alone, demands the employment of a number of trained foresters and cruisers.

We now have over 400 town fire wardens and a very considerable part of the time of both the field and office force has been devoted to directing their work and in order to get the best results at least two well trained men should devote their entire time to it. The work has been so heavy for the small force that could be employed with the present appropriation that we have been seriously handicapped and if forestry is to advance in Wisconsin as it should, we must have a much larger department.

We must soon commence the construction of fire lines on the reserves, establish nursuries to grow our own seedlings, to re-

forest burned and barren areas, build rangers' cabins, clean out old roads and trails and, in a word, institute many measures for the protection and improvement of the reserves. It is expected that the cost of such work will be paid from the forest reserve fund. As timberland owners are requesting advice and help in the management of their forests, and farmers in the creation or care of woodlots, it is necessary that this department should be able to respond. There is also an important work to be done in educating the people of our state along forestry lines.

Under the present law provision is made for a forester, assistant forester and clerk. In addition I have employed a head fire warden, five timber cruisers and a stenographer. The department should be allowed a state forester, first assistant state forester, second assistant state forester, chief clerk, statistician, three stenographers, head fire warden, head cruiser, inspector of railroads, five cruisers and five rangers, and such a force would require for salaries and traveling expenses an annual appropriation of $30,000, but in order to meet unforeseen contingencies, I would recommend that an appropriation of $35,000 be requested.

The state has been carrying on forestry work for nearly five years and now that the department is firmly established and its needs clearly known, an appropriation should be made at least sufficient to enable it to do its work thoroughly and well.

Respectfully submitted,

E. M. GRIFFITH,
State Forester.

Madison, Wisconsin,
December 5, 1908.

REPORT ON WISCONSIN SOIL RESOURCES AND NEED OF A SOIL SURVEY

BY S. WEIDMAN AND A. R. WHITSON.

The State of Wisconsin has a total area of 56,040 square miles, of which 1,590 square miles is generally stated as water surface, and 54,450 square miles as land surface. Its territory is considerably larger than that of either of the great states of Ohio, Pennsylvania, or New York.

According to the United States Census the number of acres in farms, that is lands settled and worked by farmers in Wisconsin, was nearly 3 million in 1850, over 7-1/2 million acres in 1860, over 11-1/2 millions in 1870, over 15 millions in 1880, over 16-1/2 millions in 1890, and over 19-1/2 millions in 1900. Of the total acreage in these farms in 1850, 35.1 per cent was improved; in 1860, 47.5 per cent; in 1870, 50.4 per cent; 1880, 59.7 per cent; in 1890, 58.3 per cent; and 1900, 56.6 per cent. Thus according to the United States Census it would appear that while there has been a steady increase in total acreage of the farms there has been a decrease in the percentage of improved acreage on these farms since the census of 1880. These figures are from the U. S. Census reports, Table 52, vol. V., Part I, a condensed statement of a portion of which is presented in the accompanying table (Table I). In this table is shown the total acres in farms, improved acres in farms, and per cent of farm land improved in Wisconsin and in the adjoining states of Minnesota, Iowa, Indiana, and Michigan, as well as the older states of Ohio, Pennsylvania, New York, Massachusetts, and Georgia. The eastern states are included for the purpose of comparison.

In this table of the U. S. Census, as previously noted, although Wisconsin shows an increase of total farm land and total improved land yet the percentage of farm land improved shows a

decrease since 1880, whereas her neighboring states all show a healthy increase in percentage. In respect to percentage of farm land improved it appears from this table that Wisconsin since 1880, is more like the older states of Pennsylvania, and New York, rather than her adjoining states. The census records appear to show that the history of utilization of our soil resources is unlike that of the adjoining states no matter whether the adjoining state be a prairie state or a forested one like our own.

Such a decrease in percentage of improved land in farms could be due to two main causes: 1st, To the actual abandonment of considerable areas of cultivated fields in the older settled southern parts of the state; 2d, To the unusually rapid opening of new farms with only a small improved acreage in each farm, in the new northern part of the state. However to one at all familiar with the agricultural development of Wisconsin these factors do not appear to be important. A more rational explanation of the table would appear to be that the statistics compiled by the U. S. Census are in error.

TABLE I.—*Statistics of Wisconsin farm lands compared with certain other states.*

	TOTAL ACRES IN FARMS (in million acres).						ACRES OF IMPROVED LAND (in million acres).						PER CENT. OF FARM LAND IMPROVED.					
	1900	1890	1880	1870	1860	1850	1900	1890	1880	1870	1860	1850	1900	1890	1880	1870	1860	1850
Wisconsin	19.8	16.7	15.3	11.7	7.8	2.9	11.2	9.7	9.1	5.8	3.7	1.0	56.6	58.3	59 7	50.4	47.5	35.1
Michigan	17.5	14.7	13.8	10.0	7.0	4.3	11.7	9.8	8.2	5.0	3.4	1.9	67.2	66.7	60.1	50.9	49.4	44.0
Minnesota	26.2	18.6	13.4	6.4	2.7	.....	18.4	11.1	7.2	2.3	0.5	.....	70.3	59.6	54.1	35.8	20.5	17.4
Iowa	34.5	30.4	24.7	15.5	10.0	2.7	29.8	25.4	19.8	9.3	3.7	0.8	86.5	83.4	80.3	60.5	37.7	30.1
Illinois	32.7	30.4	31.6	25.8	20.9	12.0	27.6	25 6	26.1	19.3	13.0	5.0	84.5	84.2	82.5	74.7	62.6	41.9
Indiana	21.6	20.3	20.4	18.1	16.3	12.7	16.6	15.1	13.9	10.1	8.2	5.0	77.2	74.2	68.2	55 8	50.3	39.4
Ohio	24.5	23.3	24.5	21.7	20.4	17.9	19.2	18.3	18.0	14.4	12.6	9.8	78.5	78 5	73.7	66.6	61.7	54.7
Pennsylvania	19.3	18.3	19.7	17.9	17.0	14.9	13.2	13.2	13.4	11 5	10.4	8.6	68.2	71.9	67.8	64.0	61.5	57.8
New York	22.6	21.9	23.7	22.1	20.9	19.1	15.5	16.3	17.7	15.6	14.3	12.4	68.9	74.6	74.5	70.4	68.5	64.9
Massachusetts	3.1	2.9	3.3	2.7	3.3	3.3	1.2	1.6	2.1	1.7	2.1	2.1	41.1	55.3	63.4	63.6	64.6	63.6
Georgia	26.3	25.2	26.0	23.6	26.6	22.8	10.6	9.5	8.2	6.8	8.0	6.3	40.2	38.0	31.5	28.9	30.3	27.9

A comparison of the State Census reports has been made for the years 1885, 1895, and 1905 and our State Census reports show clearly a healthy and reasonable increase in percentage of improved farm land since 1880. The statistics computed by the State Census for this period is as follows:

TABLE II.—*Statistics of Wisconsin farm lands (state census).*

	1885.	1895.	1905.
Number of farms	133,108	150,801	166,421
Number of acres in farms	16,359,246	18,365 844	19,426,225
Number of improved acres	8,115,333	9,446,410	10,918,504
Number of unimproved acres	8,243,913	8,919,434	8,477,721
Per cent of improved land	49.6	51.4	56 2

It is not to be assumed, of course, that the State Census is absolutely correct in regard to these particular statistics. There seems to be little question, however, but what the U. S. Census, in this regard, is unreliable. The condition shown by the State Census is about what would be expected in the agricultural development of the state. In the following reference to statistics of this nature, therefore, the State Census reports are used. It is important, however, to call your attention to the table compiled by the U. S. Census for it is likely to be the one referred to by the future historian or economist in any discussion of the history of Wisconsin's agricultural development.

IMPROVED LAND IN WISCONSIN COMPARED WITH OTHER STATES.

In the tables referred to the percentages refer to the proportion of improved lands in settled farms in the various states. This table shows the percentage of farm land improved in Wisconsin in 1900 to be 56.6 per cent (State Census 1905, shows 56.2 per cent). Since the State Census for 1905 and U. S. Census for 1900 closely agree, this percentage may be considered nearly correct and a direct comparison can be made with the percentages in the various adjoining states.

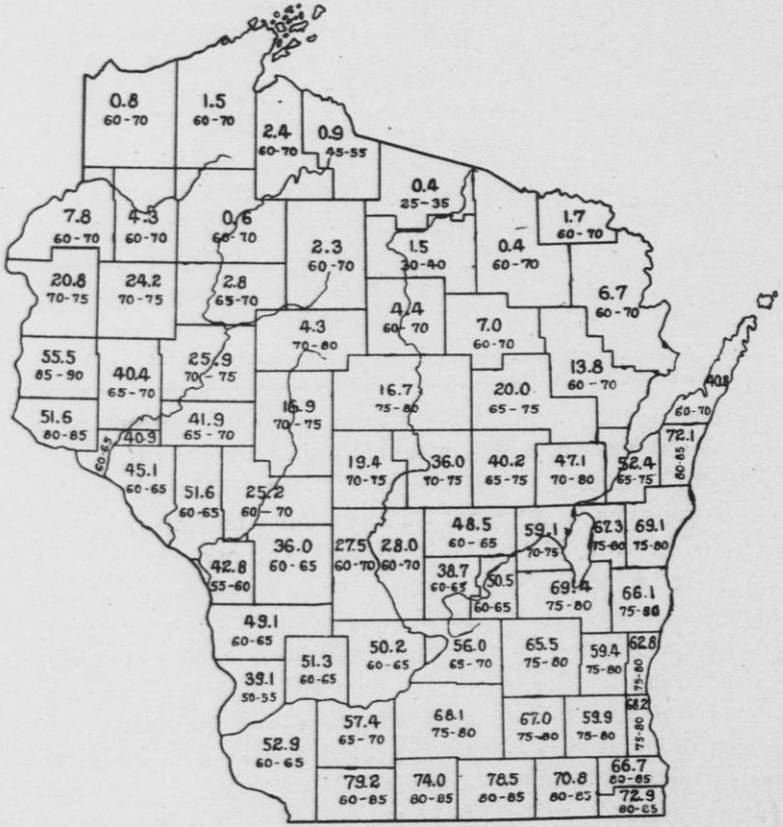
TABLE III.—*Percentage of total land improved in Wisconsin and in other states.*

States.	Total acres of land surface (in acres).	Improved land 1900 (in acres).	Per cent of total land improved.
Wisconsin	34,848,000	11,240,972	32.3
Minnesota	50,791,200	18,442,585	36.3
Iowa	35,489,000	29,897,552	84.2
Illinois	35,840,000	27,699,219	77.3
Indiana	22,982,400	16,680,358	72.6
Michigan	36,755,200	11,799,250	32.1
Ohio	26,086,400	19,244,472	73.8
Pennsylvania	28,790,400	13,209,183	45.8
New York	30,276,800	15,599,986	51.2
Massachusetts	5,145,600	1,292,132	25.1
Georgia	37,747,200	10,615,644	28.1

In the accompanying table (Table III) the percentage of total land improved in Wisconsin calculated from the U. S. Census, is 32.3 per cent (State Census 31.2 per cent) and approximately the same in Michigan 32.1 per cent; in Minnesota, 36.3 per cent; in Iowa, 84.2 per cent; Illinois, 77.3 per cent; Indiana, 72.6 per cent; Ohio, 73.8 per cent; while in such mountainous states as Pennsylvania, it is 45.8 per cent, New York, 51.2 per cent, Massachusetts, 25.1 per cent and Georgia, 28.1 per cent. In the group of North Central Agricultural States, the three northern states of Michigan, Wisconsin and Minnesota, with only 31 to 36 per cent of area improved, stand out in sharp contrast with the four states adjoining on the south, Iowa, Illinois, Indiana and Ohio, with 72 to 84 per cent of their area improved.

LOCATION OF IMPROVED LANDS IN WISCONSIN.

The line dividing the well settled portions of the area included in these states, however, is not exactly co-incident with the state boundaries. The southern row of counties in Wisconsin, for instance, show a condition of agricultural development similar to that prevailing in Iowa, Illinois, and Indiana. Immediately north of these southern counties, however, the percentage area of improved land rapidly decreases. The southern counties show about 75 per cent of total land area improved, the



Upper figures (as 51.3) indicate percentage of total land improved in each county.

Lower figures (as 65-70) indicate estimated percentage of land which will finally be improved in each county.

south central part about 50 per cent, the north central about 25 per cent, and the northern part only from 1 to 10 per cent.

On the accompanying outline map of Wisconsin, (the upper figures in each county) the percentage of total land improved in each county is given. These percentages are calculated from State Census reports for 1905. The county showing the highest percentage of improved land, 79.2 per cent, is Lafayette, on the southern border. The counties showing the lowest percentages of improved land are along the northern border, several of which show less than 1 per cent of land area improved.

In the southern half of the state six counties have over 70 per cent of their area improved, 13 have over 60 per cent improved, 8 over 50 per cent and the remainder 30 per cent or more improved.

In the northern half of the state only 2 counties, Pierce and St. Croix, have over 50 per cent improved, 5 over 40 per cent, 6 from 20 to 40 per cent, 4 from 10 to 20 per cent, 6 from 3 to 10 per cent, and 12 less than 3 per cent of which five have less than 1 per cent improved.

Does the present condition of the development of our soil resources indicate in any manner the real value of the soil resources of the different parts of the state? In the southeastern third of the state, now the most thickly settled, richer in soil resources than other equally large portions of the state? It seems quite likely that this question must be answered in the affirmative and yet the difference in the soil resources and the proportion of the land area that can be successfully cultivated in different parts of the state, is not very great. If an area of 2,000 to 3,000 square miles in the lake region of northern Wisconsin in Vilas, northern Oneida and vicinty be excluded the percentage area of tillable land in the northern half of the state will very probably closely approximate that of the southern half.

In order to express a general idea of the relative extent or area of the lands that can and probably will come under cultivation in different parts of the state, a general estimate has been prepared (see map, the lower figures in each county) showing the percentage area of each county that will probably be brought under cultivation.

These estimates are based on comparative agricultural statistics, some preliminary soil surveys, and a general knowledge of the state. The percentages refer only to area, and not to

values. The value of the cultivated lands at the present time varies from 25 to 125 dollars per acre. There will always be a wide difference in the agricultural value of the 60–65 per cent of the improved lands of Grant, Richland, and Sauk, as compared with the 60–70 per cent of improved lands of large parts of such counties as Juneau, Adams and Jackson. At the same time large areas or belts of northern Wisconsin as in Pierce, St. Croix, Barron, Chippewa, Clark, Taylor, and Marathon counties have land values fully equal to that of the best counties in the southern part.

These estimates indicate in a general way how much land in Wisconsin will finally be brought under cultivation. With the exception of the lake counties of Vilas and Oneida and vicinity, the percentage of land that will be brought under cultivation in northern Wisconsin will probably amount to 60–70 per cent, a condition which will probably hold for a large portion of the central and southern part of the state. Some of the north central and north western counties will probably reach 70–80 and even 80–90 per cent cleared and improved land, about the same proportion as most of the counties in the southeastern third of the state which will probably cultivate 75 to 85 per cent of their area.

These estimates will make an average for the entire state of 70–75 per cent of ultimately cultivated land which is not high when compared with the percentage of improved area, at the present time, of Iowa of 84.2 per cent, Illinois 77.3 per cent Indiana 72.6 per cent and Ohio 73.8 per cent.

A word of explanation concerning these percentages may be necessary for a distinction must be kept in mind between what is tillable or improvable land, and what is estimated as the percentage of ultimately cultivated or improved land. A farm of wholly tillable soil is never wholly improved or wholly cultivated for a certain amount of each farm is usually reserved for wood lots, for buildings, private woods and lanes. In larger areas of towns and counties, a certain amount of land is used for wagon-roads, railroads, sites for school houses, cemeteries, churches, and mines and quarries, and also the sites for villages and cities. A township or county of wholly tillable land would probably never cultivate much more than 90 per cent of its area for crop purposes. The state of Iowa has already improved 84.2 per cent of its total land area. Iowa will probably

not improve much more than 90 per cent of its area for a certain amount of area is used for farm buildings and sites for villages, cities, railroads, quarries, mines, etc.

The difference in the percentage of land improved and the estimated percentage of land which will finally be brought under cultivation indicates the relative amounts of land yet to be utilized. In the northern half of the state but a small portion of the 60–70 per cent of land area is improved. In the southern half from 50–80 per cent is improved. Considered as a whole, less than 40 per cent of the soil area of the state which will finally be brought under cultivation is now utilized, as compared with the 85–95 per cent of the utilized soils of Iowa, Illinois, Indiana and Ohio; or in other words, 60 per cent of the available soils of Wisconsin are not at present utilized as compared with the remaining five per cent unutilized porton of Iowa, 10 per cent of Illinois, and 15 per cent of Indiana and Ohio.

Wisconsin, therefore, has a vast amount of soil resources not yet utilized. In any discussion of the conservation of our soil resources, the problem relating to the improvement of our undeveloped agricultural lands is especially important. For this reason, therefore, your attention has been called to the amount and location of the improved and unimproved lands of the state. Forty per cent, about 11 million acres, of our available soil resources are now utilized, 60 per cent about 25 to 30 million acres are not utilized. In the narrow sense, to only 40 per cent of our soils is the problem of conservation the dominant one, to 60 per cent, the problem relating to utilization is the dominant one.

The problem relating to first utilization and to conservation of the soils, however, cannot be separated. As soon as a soil is brought under cultivation, its conservation should be maintained. Indeed, it should be emphasized that it is in the early stages of the settlements of our lands that the preservation of the soils should be especially guarded.

The problems concerning the conservation and utilization of the soil resources of Wisconsin seem naturally to fall into two divisions, one relating to the settled southern half of the state, the other to the thinly settled northern half. From the viewpoint of the state as a whole and the general welfare of the people, the vast undeveloped soil resources of the northern half of the state should be utilized as rapidly as possible, and

the already improved acreage in the southern half should be brought to a higher state of cultivation with increased crop returns. Both of these problems of course concern all parts of the state, but the main problem in the settled regions is the preservation and increased fertility of the old cultivated lands, while in the unsettled portion the main problem is the actual bringing of the agricultural lands under cultivation.

NEED OF A SOIL SURVEY.

It is now universally recognized that it is the duty of the state to aid in the conservation and development of her resources by systematic investigation of her problems, and by the instruction of her people in the results of such study. To this end she has established the University and the Experimental Station. To this end she has supported a geological survey and a forestry and fish commission. While all of these are important, it is, of course, recognized that the resources of the soil are by all means the most important, and that the resources of agriculture should be given at least as much aid as other natural resources. Every dollar already spent in aiding agriculture or in other departments has been returned many fold.

When the work of the Agricultural College and Experiment Station is studied it will be found that the benefits therefrom are in a very large measure determined by the knowledge of the soil possessed by its workers. Before the work of the Agriculture Experiment Station can be of the greatest possible benefit in aiding grain raising, dairying, horticulture, special crop industries, etc., a full knowledge of the soil conditions of the fifteen hundred townships of the state must be at hand. In other words, a thorough soil survey is the beginning and foundation of any systematic plan to aid in the development of agriculture.

Such a survey must tell us the total amount of material necessary to plant growth in the various soils, and the conditions essential to the maintenance of this fertility, it must tell us of the physical conditions of topography, texture, and drainage which determine the crops and the systems of farming to which the various sections are adapted; and it must point out ways in which our fertility is being wasted.

A soil survey of Wisconsin is especially desirable on account

of the unusually wide variation in the character of the soils of the state. The soil conditions of any region are largely controlled by the geological formations and general topographic features. The great variation in Wisconsin soils as compared with those of adjoining states is due to certain geological and topographic conditions, among which may be mentioned:

1. The Driftless Area.
2. The unusual extent of glacial terminal moraines (Kettle moraines).
3. The wide extent of the Potsdam sandstone, and variation of its formation.
4. The area of crystalline rocks.

The peculiar geological development of the state has produced variations in the soil conditions quite unlike those prevailing in the surrounding states. The soil conditions of Iowa, Illinois, Indiana, and Ohio show no such wide variation as those of Wisconsin, Minnesota, and Michigan, while more like Wisconsin do not show nearly the wide range in geologic and soil features.

One of the results of the unusual soil conditions of Wisconsin combined with climatic conditions is expressed in the development of many special crops, such as tobacco, peas, sugar beets, cabbage, cucumbers for pickling, rye, and potatoes. Wisconsin is rapidly becoming one of the most important canning states in the union, and the canning industry is developing enormously.

The Agricultural College receives large numbers of inquiries every year for information regarding soils suitable for such special crops, and for advice in the treatment of the various soils used for these special crops. This information it is manifestly impossible to give until we have a soil survey to gather it. Whatever arguments, therefore, that can be urged for a soil survey in any region or state apply with special force to Wisconsin.

The survey of the thinly settled northern part of the state should be made from the principal point of view of assisting in the development and settling of that portion of the state. Accurate surveys should be made of the main types of sandy, clay, and loam soils, and the extent of each shown on maps of appropriate scale. The area of marsh and swamp lands should be outlined and the possibility of drainage determined. The

maps should be accompanied by reports describing the soil types with respect to topography and drainage, relation to ground water, native forest growth, and adaptability to staple and special crops. The climate and weather conditions should be described and also the general conditions of agricultural development. There is a large and constantly increasing demand by prospective home seekers for information regarding the agricultural conditions of that section of the state, including definite statements regarding the character of the soil, the crops to which adapted, and other general information. This is being supplied by the commissioner of immigration so far as it is at hand but the actual facts with reference to large areas are not known, and such are absolutely necessary to secure the essential information for the prospective home seeker.

In carrying on the soil survey of the northern part of the state, also the agricultural lands in the state forest reserve can be determined and the settlement of farmers within and about these reserves encouraged. In this general survey work, also areas of non-agricultural land suitable for forestry purposes should be located and mapped, with the view of aiding further in the proper development of the forest reserves.

In the southern and older sections of the state a soil survey will greatly aid in the more complete development of the agricultural resources. This section contains about three-fourths of a million acres of marsh soil practically all of which is probably capable of drainage and cultivation. During the present year more interest in drainage has been shown in this section than ever before. The agricultural college has assisted in organizing thirteen districts in this section recently and undoubtedly many more will be formed in the near future. It is especially desirable that the drainage of these marshes be studied in a broad way before a large number of small districts unrelated to each other be formed. While the statute law with reference to the formation of drainage districts provides a way by which farmers can co-operate, it does not help them in determining what land can be profitably drained and what not, nor does it assure to the state a systematic plan in the development of this drainage work. The reclamation of these marsh lands will undoubtedly add many million dollars' value to the agricultural lands of the state, and their successful development depends very largely on plans made at the beginning in

laying out these drainage districts and constructing the first ditches. The necessity for a study of drainage applies not only to the marsh land proper but with reference to clay not sufficiently drained in connection with marshes. There are in the state large numbers of relatively small areas of clay land which will be very greatly benefited by drainage, and concerning which the farmers and the agricultural college should have information. Under present conditions it is only when an individual here and there takes up the matter privately and asks the aid of the experiment station in developing drainage plans, that any knowledge of such areas is secured. The improvement to be effected by drainage on other than marsh lands is in all probability as great or greater than that on marsh lands and it is of the highest importance to know the location of such lands needing drainage.

Hand in hand with this field study should go a careful chemical examination of the soils of the state. It is just as important that a chemical analysis of soils be made in studying their agricultural value and uses as it is that assays be made of ores under exploitation. It is of the highest importance to know the total amount of nitrogen, phosphorus, and potash and the conditions under which they become available. This can be told only by chemical analysis.

The more or less commonly held view that all soils contain sufficient phosphates for a practically indefinite period of cropping is entirely unfounded. The average content of phosphoric acid in the virgin soils surrounding fields that have been subjected to forty-five to fifty years of cropping is .185 per cent, while the average of the soils from these fields is .12 per cent, showing that over a third of the total phosphate has been removed in a single generation. Moreover all of these soils have become acid by this cropping—that is, the carbonates of the surface soil have been removed. While it is true that the remarkable development of dairying in Wisconsin has to a very great extent prevented the tendency toward soil exhaustion, which had been begun by the grain raising of earlier days and which has become so serious in other states, especially in the east, it is, nevertheless, true that there are large numbers of farms in Wisconsin which have been seriously reduced in fertility by a continuance of wrong methods of farming. It is im-

portant to have such regions known in order to facilitate the work of the experiment station in aiding them in the improvement of their soils. There are few states in the Union in which so little has been done in the analysis of their soils as in Wisconsin.

The loss of nitrogen has been as much or more than the loss of phosphates, so that in many of the soils the limiting factor in crop production is nitrogen. In the survey of the soil the distribution of nodule forming organisms should be studied. As an illustration of the need of this study the fact might be cited that in some sections alfalfa is thoroughly successful since sweet clover growing native has inoculated the soil with organisms also capable of developing on alfalfa, while in other sections the absence of sweet clover renders the artificial inoculation for alfalfa necessary.

Public attention has been rapidly directed recently to the great loss of fertility by erosion. While Wisconsin suffers less in this respect than do the southern states, she still undoubtedly has a large loss in this way in regions of rough topography, and every assistance should be given to farmers of these regions in adapting their farming to such conditions in such a way as to prevent as far as possible this loss. This assistance can only be given after the areas concerned are definitely known. A soil survey should include a study of the losses by surface erosion and a mapping of those regions where this loss is serious.

That the importance of a careful study of the soil problems of the country is clearly recognized by the most careful and farsighted statesmen and others in a position to realize the agricultural tendencies of the country is shown by such statements as that of Hon. Knute Nelson in his report to the national conservation commission, in which he says:

"The soils are not, however, producing a half of what they will be required to produce if we would avoid buying our foods elsewhere in the future. The acreage of cultivated land is increasing much more slowly than the population and can never be more than twice as great as at the present, while by the end of the present century we shall probably have three times as many people to feed as now. The amount of our farm crops is also increasing much more slowly than our population. An increase in yield per acre is therefore imperative. In that

matter we are far behind western Europe, and as our soils are at least equally rich, it becomes a matter of care in the selection of seed, of fertilizing, and of cultivation."

Hon. James Wilson, secretary of agriculture, says: "The important source of our prosperity is the soil of the American farm, and it is a national duty to see that the soil is conserved and the farm improved for the immediate benefit of the farmer and the ultimate welfare of the country."

James J. Hill, president of the Great Northern Railroad, in his address before the Farmers' National Congress in Madison, Sept. 24, 1908, among other things said: "What we are here for is to consider how to increase the farmer's successes, lessen his failures and place his work upon the most certain foundation. His occupation is the first to exist in a civilized state. It is the basis of all other industry. And only recently are we coming to realize that it is an exact science. The man no longer deserves the name of farmer who conceives of his industry as a scratching of the earth, a hit or miss scattering of seed and a harvesting of such yield as soil and weather may permit. That is not farming, but a game of chance."

"It is as well assured as any future event can be that the population of the United States will be 200,000,000 by about the middle of the present century, or in less than 50 years. Where and how are we to obtain loaves enough to feed these coming millions?"

"The average wheat yield in the Netherlands is 34.18 bu. per acre, as against our 14; she produces an average of 53.1 bu. of oats per acre, when we are satisfied with 23.7 bushels in 1907, and an average of less than thirty bushels for the past ten years; her farmers gather 232 bushels of potatoes for every acre so planted while in this country, with soils capable of fabulous yields, we took in 95.4 bu. last year and averaged a little less than 96 bu. the last six years."

"To such a height (like that of the Netherlands) we can bring the productivity of many of our own fields. Every respectable authority on agriculture in this country will endorse this statement. But at present we are doing little out on the lands, among the farmers to accomplish the change, the revolution in ideas and methods that is involved."

"I have been urging the essentials of better farming upon our whole people at every opportunity for more than twenty-

five years. In all agricultural colleges it is taught. Farmers' institutes have done much to make it known. And still bad methods, soil exhaustion, skimming the cream of the land by single cropping are the rule instead of the exception. Something must be done to reverse the process. That it must be done is the most important fact confronting us as a nation today."

The maintenance of a survey of the soils of the state for the purpose of aiding in the conservation and utilization of our vast soil resources, as already stated, is thoroughly in harmony with the general policy of state aid in matters of the public welfare. The national government and many states have organized soil surveys. The problems relating to the utilization and conservation of our mineral and forestry resources, receive the attention of state aid, and the value of state aid for these purposes is unquestionably many times the actual expense.

The annual value of the output of the soil, that is the annual value of farm products, sold or consumed in 1904, was about $200,000,000. The value of forest products in 1905 was about $56,000,000. The value of the mineral products in 1907 was $13,832,395. The value of the soil products in 1907 was probably between 225 and 250 million dollars. The soil resources are by far the most important natural resources of the state and yet practically nothing has been done by the state in the study of the soils for the purpose of aiding in the development and conservation of the soil resources.

The bill passed by the legislature of 1897 authorized the geological and natural history survey among other things to prepare a soil map. With the many calls for information on the mineral resources, clays, building stone, water powers, areal and physical geology, etc., it has been found impossible to give the soils anything like adequate attention since it would not have been wise to start a soil survey without a sufficient fund. It will therefore be necessary for the state to make an additional appropriation to the survey especially for this purpose. The plans of the geological survey include the completion of the areal survey of the northern part of the state, of which about 20,000 square miles yet remain. On this area therefore the work of the soil survey should be carried on in co-operation with that of the areal geological survey. This

co-operation will materially reduce the expense of both geological and soil work. The geological survey has already covered 14,000 square miles in Northern Wisconsin, making a preliminary soil map which would aid in the final work of the soil survey. The remaining 20,000 square miles chiefly in the southern and older sections of the state have been mapped with reference to their geological formations, but no soil survey has ever been made of them.

Since this soil survey, as already pointed out, is the fundation of much of the other work of the experiment station, and since the information it will gather is so much needed in the development of especially the newer parts of the state, it is important that it be completed at as early a date as possible, at least in eight to ten years.

The cost of this work as carried on by the U. S. department of agriculture and by the various states has been studied and is found to vary with detail work from $1 to $5 per square mile. The state of Illinois has appropriated a sum of $25,000 annually for the investigation of her soils, especially their mapping. This appropriation has already extended over a period of six or eight years and will undoubtedly be continued for a number of years in the future. A part of this work, however, is similar to that being carried on by our agricultural college and experiment station. We believe an average expense of $2 per square mile will provide a sufficiently thorough soil survey of Wisconsin. It will therefore require a sum of $10,000 annually for 10 years to make the soil survey of the state (54,000 square miles).

Since this work is largely to be used as the foundation of much of the work of the agricultural experiment station, it is important that the work be done through the co-operation of the geological and soil survey with the agricultural college. The soil survey should be carried on simultaneously in the northern and southern parts of the state.

A PRELIMINARY REPORT ON THE PHOSPHATES OF WISCONSIN SOILS

BY A. R. WHITSON.

All agriculture depends on the fertility of the soil, that is, on the availability of essential elements for plant growth. Among these phosphorus holds a particularly important position. While most of the other essential elements occur in considerable amounts in the soil and are seldom found lacking in sufficient quantity for plant growth, phosphorus is usually present in very small amounts. Moreover, all systems of farming involve the loss of greater or less amounts of this element in the products sold from the farm. While potash goes largely to the straw or stalks of plants, and is therefore left largely on the farm when either the seed or animal products are sold; phosphorus going to the seed and the bones and meat of animals is carried away in products used for human consumption.

Unlike nitrogen this element cannot be recovered when once lost. Continued fertility, therefore, involves: first, a reduction of this loss to as small a point as possible, and second, the replacement, in the form of commercial fertilizers made from bones and phosphate minerals of all that taken away.

Realizing the importance of a full knowledge of the content of phosphorus in Wisconsin soils and of its loss in various systems of farming, we have recently begun a study of this whole matter. So far the work has covered: first, the determination of phosphoric acid in a few typical soils of the state; second, a preliminary study of the influence of two different systems of farming on the loss of phosphorus from the farm.

Phosphoric Acid in Wisconsin Soils.—A preliminary study has been made of the phosphoric acid contained in a few of the important soil types occurring in the state. These determinations been made on virgin soils surrounding fields that have

been under cultivation, and so show the original supply with which the cultivated fields started. The amount of phosphorus now found in lands that have been under cultivation will be discussed later. Since a very large part of the food of plants is taken from the surface soil, determinations have been made of the surface eight inches. This depth is as great as any but excessively deep plowing reaches, and probably includes three-fourths or more of the supply available to farm crops when good growth is taking place.

The marsh soils of the southeastern portion of the state which are of a mucky nature, as distinguished from those of a peaty nature, show 800 pounds of phosphoric acid per acre in a depth of eight inches, as an average of seven determinations. The peaty soils occurring in the central and northern parts of the state show 860 pounds of phosphoric acid per acre-eight inches as the result of four determinations on samples from Marinette, Horicon, Mather, and Phillips. The sand soils of the central and northern part of the state contain, as shown by an average of six determinations on soil from Sparta, Black River Falls, two from Iron River, Lac du Flambeau, and Peet, 2,870 pounds. Heavy red clays of Ashland and Superior contain as an average of two analyses, one from each of these places, an average of 2,400 pounds per acre-eight inches. The clay loam soils of the southwestern part of the state, as shown by determinations from Onalaska, South Wayne, Viroqua, and Lancaster, contain 4,000 pounds per acre-eight inches; while the clay loams of the southwestern part of the state, as shown by an average of twenty-one samples, contain 3,340 pounds per acre-eight inches; and those of the north central clay loams, as shown by determinations on samples from Crandon, Radisson, Ladysmith, and Tony, contains 3,650 pounds per acre-eight inches.

While the averages, for some of these types of soils, are relatively large, as compared with soils in some other states, still the total amount is never so much that it can be considered an inexhaustible supply from which crops may draw. Moreover, there is a great variation in the amount of phosphoric acid contained in different areas of the same general physical type of soil. Soils which appear to be greatly similar may show surprising difference in the content of this valuable element. In case of the peat soils some determinations indicate less than 500 pounds of this element per acre-eight inches. In the sands some

run as low as 250 pounds per acre-eight inches. In the case of the clay loams the total amount has never run as low as in the the sands and peats but does run as low as 1,500 pounds per acre. When it is recalled that the staple farm crops require from twenty to thirty pounds of phosphoric acid per acre annually, it will readily be seen that the total amount available in some of these soils will be seriously depleted by one or two generations, provided these crops are entirely removed from the farm. When, however, the crop is fed to stock maintained on the farm and only dairy products or beef are sold a very much smaller amount is lost. Indeed, the feed ordinarily purchased under such conditions may contain sufficient phosphoric acid to entirely replace that lost. Such a system of farming, however, cannot be universally followed. When certain sections are largely devoted to dairying or to meat production, these sections are exhausting the phosphorus of surrounding regions in the purchase of their feed stuffs. This exhaustion of phosphorus of those regions supplying feed to stock raising sections must necessarily be followed by rise in price of such feeds until it is practically prohibitive. Moreover, the farmers of these exhausted sections must sooner or later discover their enormous mistake and modify their system of farming, so as to include the raising of stock and the feeding of all grains as far as possible on the farm. In other words, a much more general system of farming will unquestionably develop and is the only one which can hope to maintain the fertility of the soil in a permanent condition. Wisconsin, therefore, cannot hope indefinitely to maintain this phosphorus by the feeding of grain products from adjoining states, and we must prepare to protect ourselves as far as possible from the loss of this element, which must result as this modification in systems of farming develops. Moreover, it must not be assumed that because the fertility of the farm on which dairying is practiced is maintained, or even increased, during the first twenty-five or fifty years of such practice that this will continue indenitely. The experience of some sections of the East, especially New York, is at variance with this assumption.

In order, therefore, to gather as much information as possible regarding the influence of different systems of farming on the phosphorus of the soil, we have begun a series of studies on the phosphoric acid of soils which have received different

treatment during a considerable period of years. So far only two general systems have been studied: First, that where grain crops have been grown continuously with little stock maintained; and second, that in which a special crop, particularly tobacco, is grown, and most of the manure produced on the farm applied to the field growing that crop.

Influence of Continuous Grain Growing on Phosphorus Content of Soil.—For this study we have selected fields on farms which have been under the same management for a considerable number of years. Samples have then been collected on the field under study and on a virgin soil adjacent in as nearly comparable condition as possible. Estimates have been made of the amount of phosphoric acid taken by crops produced and of that returned to the soil in fertilizers. From this data loss by cropping and in other ways has been estimated. This study shows that where clay loam soils are cultivated continuously to grains, that relatively little phosphoric acid is lost from the soil except that removed by the crop but that the amount removed by the crops of one or two generations is a very important fraction of the total amount originally contained in the soils. As an average of nine cases of clay loam fields cropped in this way for an average of about forty-five years just about one-third of the total phosphoric acid originally contained has been removed. Nor must it be even supposed that the remaining two-thirds are so readily available that good crops could be grown for an additional ninety years, for the fact is that the remaining two-thirds of the original amount contained in the soil is so slightly available that in most of these cases the yield of crops has fallen off to less than one-half of this original amount.

Although it is true that Wisconsin is among the most progressive states in the union, it is also true that even in Wisconsin a considerable fraction of the land of the older sections of the state is in a seriously depleted condition. In other words, we have here a part of the poor condition of soil exhaustion which is so much talked about in other states. On this land the depletion of phosphorus is the most serious phase of the exhaustion. The nitrogen can be recovered from the atmosphere by growing legumes; the clay soils contain almost inexhaustible amount of potash; but the phosphorus once lost can be restored only at great expense. The enormous expense for fertilizers of eastern and southern states should be a dis-

tinct warning to farmers of Wisconsin to make sure that the permanent system of agriculture which they adopt protects, as far as possible, their native stock of phosphorus.

Influence of Special Crop Farming on Phosphorus of the Soil.—In this case tobacco fields were selected for this study, since many of these can be found which have been heavily manured continuously for a considerable number of years. Those selected were in the vicinity of Janesville, Edgerton, and Evanville. On these fields about twenty loads of manure per acre was applied annually. This manure contains on the average 10 pounds of nitrogen, 7 pounds of phosphoric acid, and 10 pounds of potash per load. The tobacco, however, takes large amounts of nitrogen and potash, but relatively small amounts of phosphoric acid. It might be supposed, therefore, that the phosphoric acid not needed by the crop would accumulate in the soil and that after tobacco had been grown for a number of years such a field could be cropped to grain for a considerable period and so recover the phosphate applied in the manure. While it is well known that a few good crops of corn and other cereals can be grown after such a period of tobacco raising, there is no data on which to base a conclusion as to whether any considerable amount of the phosphorus applied in the manure could be recovered by the grain crops or not. Indeed, the analyses of soils from these tobacco fields on which heavy applications of manure have been made for a number of years, but from which the tobacco has taken relatively small amounts of phosphoric acid indicate that the phosphoric acid has not accumulated at least in the surface eight inches, but that, on the other hand, a very serious loss by leaching has occurred. As the average of sixteen such fields there appears to have been a loss of 2,966 pounds of phosphoric acid per acre-eight inches by leaching, while the crops of tobacco have removed but 970 pounds. While it is possible that a part of this phosphoric acid has been retained by lower layers of the soil and may in part at least become available to cereals and other crops is a matter which only further study can determine, but it is, nevertheless, highly probable that a serious and permanent loss of phosphoric acid is taking place in any soil treated in this manner. The damage from the growing of tobacco is, therefore, of two kinds: First, that it uses a large part of the fertility of the farm for the production of

a luxury; and second, in the production of this luxury there seems to be a serious loss of phosphoric acid. The general result of tobacco farming is, therefore, the depletion of soil fertility, not only on the remainder of the farm, which does not receive the fertilizer which it should receive, but on the field actually growing this crop. On many of these tobacco farms the remaining fields are now producing not more than half what they should produce under a more rational system of farming. We do not mean by this that the production of tobacco should necessarily be abandoned, but that it should not be grown at the expense of the fertility of the remainder of the farm. Fertilizers should be purchased sufficient to replace that loss from the tobacco field on account of the very high stage of fertility in which it is maintained.

What applies to tobacco farming doubtless also applies to many other special crops in which the land is heavily manured. The growing of these special crops is rapidly developing, and it is highly important that their effects on the loss of phosphoric acid and possibly of other elements should be very carefully studied. This study should include not only the actual loss of the elements themselves, but of the changes in conditions by which the remainder is rendered unavailable.

It has been found in this department that soils under cropping conditions without manure for a considerable number of years tend to become acid, and that acid soils indicate a deficiency in available phosphates. This points to the importance of the maintenance of neutrality by the use of manure and lime carbonate where practicable. A number of fields have been found in the small amount of field work the department has been able to do which show a very serious exhaustion of available phosphates. In some cases on soils which thirty years ago were extremely productive the yields are not more than one-third of a good crop, and can readily be trebeled by the use of a phosphate fertilizer.

Loss of Phosphorus from Manure and Hillside Erosion.—In addition to the considerable loss of phosphorus which apparently takes place in soils that have been heavily manured and cropped to plants not requiring large amounts of phosphorus there are two sources of phosphorus lost on the farm. The first is that taking place from manures in their storage and the second is that caused by side-hill erosion.

Since by far the greatest portion of the phosphorus occurs in the solid excrements there is much less loss of this element in manure than in the case of nitrogen and potash. The best data available indicates that where manure is returned to the field during the winter, as is very commonly practiced in this state, the loss in the stable is very slight, perhaps not above five per cent. On the other hand, when manure is kept in the yard and subjected to the leaching of rains the loss even of phosphorus, may be considerable. An experiment conducted at the Ohio Experiment Station in which manure was placed in a pile out-of-doors for three months, from January until April, showed that 13.84 per cent of the phosphorus was lost, 57.01 of potash, and 26.46 per cent of nitrogen. A similar experiment on horse manure made by the New York Experiment Station in which piles of manure were exposed from April 25 to September 22 showed that 47 per cent of the phosphorus, 60 per cent of the nitrogen, and 76 per cent of potash were lost. It should be noted, however, that the rainfall during this season was extremely large, amounting to 27 inches. During the same period cow manure treated with gypsum lost 19 per cent of phosphorus, 41 per cent of nitrogen, and 8 per cent of potash. It is evident, therefore, that while the loss of fertility as a whole from manure thus exposed is very large, amounting to half the ordinary value, the loss of phosphorus is not so great. Nevertheless, the loss of phosphorus is serious and every effort possible should be made to encourage better use of manure. We may congratulate ourselves that in Wisconsin the practice of hauling manure to the fields during the winter has become very general on the farm, and that under our climatic conditions a relatively small loss of phosphorus occurs from manures.

It is doubtful whether this loss can be prevented, as can that of potash and nitrogen, by the use of water-tight tanks and cisterns. An experiment by the Ohio Station in which equal quantities of manure were placed under cover on a cement floor and on an earth floor showed that there was no more phosphorus lost on the earth floor than on the cement floor. In the case of nitrogen and potash, however, about ten per cent of the total content of each of these elements was lost on the earth floor.

The loss of phosphorus by side-hill wash is a matter of the

greatest difficulty to estimate. The damage of this process, however, is not simply on account of the amount of total phosphorus removed, but on account of the fact that the vegetable matter and humus, which contains phosphorus that may more readily become available than do the inorganic forms, are most rapidly washed away from the surface. So far no through study has been made of the loss by this process. Our attention is very frequently called to the development of gullies and ravines, and the washing away of banks of streams carrying with them trees and considerable quantities of earth, but erosion confined to such situations is not the most serious phase of the matter. A very much greater injury occurs on the side hills, which are under cultivation and from which the most valuable part of the soil, namely the vegetable matter, is so readily washed away. No full study of the actual damage in this way has been made.

Need of Further Information of Composition of Soil and Effects of Farming.—The facts above stated make it evident that it is impossible to estimate the loss of phosphorus from the composition of the crop sold alone, and that a very exhaustive study must be made of the actual effects which the various systems of farming have had on the phosphorus content of the soil. This study will involve a very large number of analytical determinations, but is the only way in which actual information can be gained.

There is probably no state in the Union having a greater variety of soil types than has Wisconsin. This is due to the complex conditions under which they originated and this great diversity of soils in all probability causes a considerable variation in the amount of phosphoric acid which they contain. Up to the beginning of this study, which took place two years ago, practically no analyses of Wisconsin soils had been made. This work is, therefore, essentially new and should be pushed until we have a fairly complete knowledge of the composition of our typical soils, especially in respect to their content of phosphorus.

The use of sandy and marsh soils will involve undoubtedly the application of considerable amounts of phosphate fertilizers on account of the relatively small amount of phosphorus these soils naturally contain. On the sandy soils the production of a humus containing a good supply of phosphorus is absolutely necessary to render them fertile. In the case of marsh soils the

abundance of organic matter, and, over large areas, the existence of acidity renders possible the use of untreated rock phosphate, which is by far the cheapest source of phosphorus available.

While phosphorus is probably the element over which we should be most seriously alarmed, it is not the only one the loss of which may give us future trouble. In certain soils potash is seriously deficient. This applies to the marsh and sandy soils of the state. Practically all marsh soils require either a heavy application of manure or of potash fertilizers. The manure necessary is more than can be produced on a farm where the entire farm consists of marsh soils, and more than can be applied to the marsh lands on farms where the marsh constitutes only a portion of the land, since in such cases the upland soils must receive a considerable part of the manure if their fertility is to be maintained. The improvement of marsh lands in Europe during recent years is largely on account of the development of the potash mines of Stassfurt, Germany. The development of our marshes will to a considerable extent depend on the care taken to protect such farms from the loss of this element.

In the case of the sandy soils the amount of the potash is naturally very low as compared with that of clay loam soils, and often what they do contain is relatively unavailable on account of the fact that the minerals containing it exist in rather coarse grains, while in the clays they are very finely divided. It will be necessary, therefore, to give considerable attention to the potash of both marsh and sandy soils if they are to be profitably and permanently farmed.

With regard to nitrogen the condition is somewhat different, since the proper use of legumes in any system of farming can supply this element in large amounts. Nevertheless, the extent to which legumes must be grown in order to maintain or to increase the nitrogen of the soil in any system of farming is not known, and as a matter of fact the nitrogen content of probably three-fourths of the soils under cultivation in the state today is actually decreasing. It is obvious, therefore, that much more study must be given even to the nitrogen of the soil than has already been given.

Since a permanent system of agriculture forms the basis of the prosperity of the state and since this agriculture depends on the maintenance of the supply of these essential elements, nothing can be of greater importance than a full knowledge of

their amount in the different soils of the state, and of the influence of different systems of farming on their loss. A thorough survey of the soils of the state, including both of these lines of study is the basis on which the superstructure of a definite science of agriculture must rest.