Third biennial report of the conservation commission of the state of Wisconsin. 1912

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W. E Scott
(Pgovernor)

THIRD BIENNIAL REPORT

OF THE

CONSERVATION COMMISSION

OF THE

STATE OF WISCONSIN

TO THE

HON. FRANCIS E. McGOVERN
Governor of Wisconsin

MADISON, WIS.
DEMOCRAT PRINTING COMPANY, STATE PRINTER
1912

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SIR:

Upon behalf of the Wisconsin State Conservation Commission, I transmit herewith their third biennial report, with the request that the same be printed as authorized by law.

Very respectfully,

CHARLES R. VAN HISE,

Chairman.

To His Excellency FRANCIS E. MCGOVERN.

Governor of Wisconsin.

Madison, Wisconsin, December 31, 1912.

REPORT OF THE CONSERVATION COMMISSION OF THE STATE OF WISCONSIN.

Commissioners	Terms expire July 1,
E. A. BIRGE	1917
T. H. GILL	1915
E. M. GRIFFITH	1917
H. H. HOARD	1913
V. P. RICHARDSON	1915
W. N. SMITH	1913
CHARLES R. VAN HISE	1917

CHARLES R. VAN HISE, *Chairman.*
E. M. GRIFFITH, *Secretary-treasurer.*

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REPORT OF THE COMMISSION

HISTORY OF STATE CONSERVATION MOVEMENT.

The conservation movement became a national policy in this country in consequence of the meeting of the governors of the states in conference at the White House May 13–15, 1908. This conference was called by the then president, Theodore Roosevelt. After this conference a national conservation commission was appointed by the president. This was done without any authority of congress; but the commission accomplished much, because of the authority which the president gave the commission to ask the various scientific branches of the government for information and investigation pertaining to subjects bearing upon conservation.

The example set by the president for the United States was followed by the governors of many states, and among these was Governor James O. Davidson, who on July 24, 1908, appointed a state conservation commission, consisting of H. P. Bird, E. A. Birge, E. M. Griffith, William Irvine, J. H. Stout, G. A. Whiting, and Charles R. Van Hise.. Charles R. Van Hise was elected chairman and E. M. Griffith, secretary. This commission, like the national commission, had no authority except that given by the governor; but through his request the various departments of the state and the University coöperated with the commission. The first report of the state commission was submitted to Governor Davidson, February, 1909, and was transmitted by him to the legislature with a letter endorsing their more important recommendations. The report was printed as a legislative document.

Aside from the report and recommendations of the commission, this document contained papers upon the water powers

by E. A. Birge, upon the forests by E. M. Griffith, upon the need of a soil survey by S. Weidman and A. R. Whitson, and upon the phosphorus in Wisconsin soil by A. R. Whitson. To a large extent the facts contained in these papers were used as the basis of the recommendations of the commission.

In regard to what became of these recommendations I quote from the second report of the state conservation commission:

"In reference to water powers it was recommended that hereafter special franchises be not granted for their development, that a general statute be framed upon the subject, and the granting of franchises be given by some commission under this statute. A number of recommendations were also made in reference to state forests. The legislature of 1909 followed these recommendations to the extent of granting no water franchises during the session. A special recess committee upon water powers, forestry and drainage was created by the legislature, to investigate these subjects and prepare a complete report, together with appropriate general bills to present to the legislature of 1911. The recommendations of the commission both with reference to water powers and forests went to the committee for consideration.

"The recommendation of the commission that a state soil survey be undertaken was adopted by the legislature and an appropriation of $10,000 per annum for two years was made for this purpose."

The second report of the state conservation commission was submitted to Governor Francis E. McGovern in January, 1911, and was by him transmitted to the legislature. That body ordered the report printed as a legislative document. This report contained papers upon mineral resources by W. O. Hotchkiss, upon the forest reserves by E. M. Griffith, upon the soil survey by A. R. Whitson, upon the weed situation by A. L. Stone, and upon agricultural economics, by Henry C. Taylor. As in the case of the first report, these papers to a considerable extent furnished data upon which the report of the commission and their recommendations were based.

The recommendations made in the second report of the conservation commission covered minerals, waters, forests, and lands. The extent to which these recommendations were adopted by the legislature, will be considered in connection with the subjects named.

The general question of the waste of the natural resources of the state, using artesian water as an illustration, was discussed,

and the commission recommended "that the legislature pass an act making it unlawful unnecessarily or wilfully to waste a natural resource and providing proper penalties for violation of the same." This recommendation was enacted into law by the legislature (Chapter 143, Laws of Wisconsin, 1911). This law reads as follows:

"Section 1. There is added to the statutes a new section to read: Section 4570m. 1. It is hereby made unlawful for any person, firm, or corporation, unreasonably to waste or maliciously to injure, destroy, or impair any natural resource within this state.

"2. It is the purpose of this act to promote and secure the conservation of the natural resources within the state in the interests of the public welfare.

"3. Any person, firm, or corporation violating the provisions of this act shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by a fine of not more than fifty dollars, and for a second offense may be punished by a fine of not more than two hundred dollars.

"Section 2. This act shall take effect and be in force from and after its passage and publication."

This is believed to be the most comprehensive law for the protection of natural resources which has been enacted by any state. At the outset its effect may not be great, but it will have a steadily increasing power through the years to come. To illustrate: When it can be proved that it is unnecessary to waste the branches and tops of the trees or some part of them in lumbering operation, by showing that they can be utilized with economic advantage, this act may be invoked to prevent the waste. Where a farmer unnecessarily permits erosion to cut gulleys in his field and to destroy the soil, which should be a perpetual resource of the state, it is clear that this act may compel him to take reasonable measures to prevent the continuation of such destruction.

Apparently the work of the commission, appointed by Governor Davidson, met the approval of the state legislature; for the legislature of 1911 created a permanent state conservation commission, (Chapter 644 Laws of 1911), consisting of seven members, to be appointed by the governor, for periods for the first appointment of two, four, and six years, and as their successors are appointed for terms of six years. The act states that the

duties of the commission are: "To consider the natural resources of the state of Wisconsin with reference to their remaining unimpaired so far as this is practicable. The commission shall present a first report to the governor on or before January 1, 1913, and biennially thereafter, such report to contain the results of investigations with recommendations as to measures to be taken to conserve the natural resources of the state, and, if such recommendations embody legislation, drafts of bills to accomplish the same. The governor is authorized to have such reports printed by the state printer."

The commissioners receive no compensation for their services, but are to be reimbursed for their actual necessary expenses in the performance of the duties assigned to them by the governor. An appropriation of $1,000 was made to cover such expenses.

The governor acting under this law, on April 6, 1912, appointed the following as the state conservation commission:

For two years, H. H. Hoard; W. N. Smith.

For four years, Thomas H. Gill; V. P. Richardson.

For six years, E. A. Birge; E. M. Griffith; Charles R. Van Hise.

On May 24, 1912, the commission above appointed met and organized by electing Charles R. Van Hise chairman, and E. M. Griffith, secretary-treasurer.

The third report of the Wisconsin state commission is prepared upon the same plan as the first two reports. Special papers are presented on various subjects concerning which action is advisable. Some of these papers are by members of the commission and others by nonmembers. The special studies thus made have to a considerable extent furnished the basis upon which the report of the commission is built up. As heretofore, the commission has confined itself to those subjects upon which concrete suggestions or recommendations seem advisable at the present time.

MINERALS.

The important exhaustible minerals of the state are iron, zinc, and lead. Peat is the only underground mineral fuel occurring in the state.

IRON.

For nearly thirty years the Gogebic district has been a moderate producer of iron ores. The tonnage actually or nearly in sight on the Wisconsin end of this range has been estimated by Drs. C. K. Leith and W. O. Hotchkiss for the Wisconsin State Tax Commission as not exceeding 5,000,000 tons. As development and exploration proceed, additional tonnage will, of course, be shown. The amount of this cannot be definitely stated. It is a reasonable expectation from the geological conditions that at least as much additional ore of present commercial grade will ultimately be found on the Wisconsin end of the range as has been shipped during its past history, in other words about 11,000,000 tons. In addition there are vast quantities of leaner ores, measured by hundreds of millions of tons, but not now commercially valuable, which will be used in the future at least in part. Some of these ores are magnetic and have been considered in reference to magnetic separation.

Explorations of recent years have shown iron ores in large quantity in the Baraboo district. The immediately available part of this ore, roughly the portion running above 50 per cent in iron in the natural state, constitutes only a small fraction of the total tonnage of lower grade ores in this district which may be available for the future. In the present early stages of exploration and development, the tonnage of immediately available ore is not publicly known, but it probably does not exceed 5,000,000 or 10,000,000 tons.

In the Iron Ridge district of Dodge county the mining of iron ore has been conducted for many years on a grade of ore running 40% or below in metallic iron. It has been possible to use this low grade material, because of the fact that the gangue is mainly calcite, rather than silica, which constitutes the principal impurity in the Gogebic and Baraboo districts.

Recent drilling has largely extended the limits of the Iron Ridge field. Probably 30,000,000 to 40,000,000 tons of this ore are now known to be available.

In both the Baraboo and Iron Ridge districts the mining is yet on a small scale, but it is likely to be greatly increased in the future. The necessary development will require large expenditure, but the ownership is in strong hands so there is not likely to be delay because of this.

So far as mining methods are concerned, it may be expected that the iron ore reserves of Wisconsin will be intelligently handled. The ownership is almost entirely with the large iron and steel companies, whose policy it is to employ the best of expert help and eliminate waste so far as possible. There is a growing tendency in the Lake Superior region to take care not only of presently available ores, but ore of the next lower grades which may be available in years to come. The fee holder has been largely responsible for the insistence on the proper care of the lower grade ores, and his financial interest will continue to be a strong pressure in this direction in the future. Therefore there is little criticism to be made regarding losses of iron ore through undue carelessness in mining.

The immediate important present question relating to the iron ores is that of taxation. In order that this question may be intelligently handled, it is necessary that accurate estimates be made of the quantity and quality of iron ores which have been discovered by exploration. Also the survey of the northern part of the state should be continued to delimit the areas of mineral land. There are in this part of this state rather extensive areas which may possibly bear iron ore and considerable areas which are known to contain iron bearing formation. These lands are mainly held by private parties and at the present time no attempt is being made to explore them. By some lumber companies extensive tracts of lands have been sold to settlers with reservation of the mineral rights. In both cases, that in which the lands are held for future development by mineral companies, and that in which the mineral rights are separately owned, no taxes are paid on the minerals. It is clear that if the rights are valuable, they are subject to taxation; but before a proper method of taxation can be worked out, it is necessary that a delimitation of the mineral lands and their probable value be ascertained.

The presently available ores grade so imperceptibly into the leaner ores available only for the future, that consideration of present reserves for tax purposes involves necessarily a consideration of the widest range of possibilities in mineral lands. While it is possible to estimate closely the tonnage of developed ore, it is, of course, much more difficult to estimate the possibilities of future tonnage in undeveloped formations, or to ascertain what lands have possibilities for ore. Because of this difficulty, it has long been contended that none of iron bearing lands outside of those known to contain merchantable ore, should be considered for taxation; but it has been practicable in recent years through geological surveys and through the computations of average returns from mineral lands, to ascertain approximate ranges of values for commercial purposes.

All information of this type should be in the hands of the Tax Commission to enable them intelligently to frame methods of taxation of ores and mineral rights. Whether the method of taxation should be that of the general property tax, the taxation of annual output, or taxation of income, can only be wisely determined after the investigations above outlined have been made by the State Geological Survey.

In view of the foregoing facts, the commission make the following recommendations:

Recommendations.

1. That the state geological survey make for the Tax Commission careful estimates, and revise them year by year, of the discovered marketable iron ores by grades for the Gogebic, Baraboo, and Iron Ridge districts, also of the ores in these districts probably available for the future.

2. That the geological survey push forward, as rapidly as possible, the survey of the possible iron bearing areas in the northern part of the state with reference to the delimitation and classification of the lands containing iron bearing formation.

ZINC AND LEAD.

The situation for zinc, lead, and sulphur remains the same as two years ago; therefore the statement contained in the last report of the commission is repeated:

"The zinc, lead and sulphur ores occur together in the southwestern part of the state in the counties of Grant, Iowa and La Fayette; the zinc as sphalerite, also called "blend" or "jack"; the lead as galena;

and the sulphur as pyrite. In reference to these, the losses in exploitation and extraction are great,—unnecessarily great. There are serious wastes which may be prevented by intelligent mining; of these products the most important is zinc. Mr. Hotchkiss' report shows that under the present practice the total loss of zinc is, in some cases, as much as 48 per cent; in other words, the recovery as metal is only a little more than one-half of the total. These losses are due to poor mining, poor milling, poor separation, and smelting. The losses in mining, estimated at 13.4 per cent, in milling estimated at 16.4 per cent, and in magnetic separation estimated at 10.1 per cent, all may be reduced, and with an increase of profit.

"The loss in mining occurs largely in connection with the lease system of small parcels of land under which a flat percentage of the concentrate recovered is paid as royalty, commonly ten per cent. The lease holder is interested simply in securing the maximum profit in the shortest possible time. He therefore takes out of the ground only the richer ores. If the land were owned by the operator and the product was not subject to a lease charge, large quantities of ore could be profitably handled which are now left in the mine. Indeed, in the zinc districts closer mining is done in the case of companies who own the fees of their own properties than by those operating on the lease system. Especially is this likely to be the case if the company which mines also smelts its ore, for it is an advantage under such circumstances to take out all the material which can possibly be mined, even to the extent of a slight loss for the lower grade material, if such loss may be more than compensated by the gain in smelting.

"It is not supposed that it will be practicable to change at once from the method of mining by lease to that of mining by the fee holder, or even in the distant future; but the above facts clearly point out the necessity for remedies in operating under the lease system. The rate of royalty should decrease with the grade of the ore. The relation of the richness of the ore to the royalty to be paid is very carefully discussed by Mr. Hotchkiss in his report. He shows that a ten per cent royalty should be limited to ores which contain not less than 8.62 per cent of zinc; but it may be suggested as fair that a ten per cent royalty should only be paid on ores which contain as high as ten per cent zinc; and that for lower grades the rate of royalty should not be flat rate upon the quantity of zinc, but a percentage of the total profit.

"There are difficulties in putting such a plan into operation because the different grades of ore underground cannot easily be separated. But the same end might be met by changing the form of leases so that the rate of rolalty shall be on a sliding scale dependent upon the average richness of the ore, as in the case of many leases for iron ores. To such leases detailed provisions could be added as to the nature of the material which must be mined. By a change in the practice along the

lines suggested the total profits of the fee holders could be made somewhat more than they are now, the profit of the miner would be as large or larger than at present; and the amount of material left underground could be greatly decreased."

Another class of losses is in the smelting of zinc. Mr. Hotchkiss estimates that of the concentrates obtained fourteen per cent of the zinc is lost in smelting.

The above losses in mining and smelting are so great that improved methods should be introduced. Information has reached the commission that in Japan a wet electrolytic method has been worked out for the extraction of zinc from its sulphide. By this method the loss of zinc is reduced to a negligible quantity. It is claimed for the method that it is wholly practicable and that the expense of extraction by it is less than the value of the losses which now exist under smelting methods. If this process proves to be commercially successful, it will be of very great importance to the southwestern part of the state.

The situation is not sufficiently developed with regard to lead and zinc so that the commission is ready to recommend any legislation. It is necessary first to know more accurately the facts concerning mining and smelting. Also it is necessary to have better information in regard to the extent of the lead and zinc territory. Until a close study of mining costs and methods has been made, it will not be practicable to prepare definite recommendations concerning royalties.

Also investigations should be made to ascertain the available reserves of the lead and zinc mines. In order to do this it will be necessary not only to consider the ore deposits which are in sight, but the history of deposits which have been worked out. Further it is desirable to forecast the probable life of the district. This can only be done by careful investigations of the ore deposits which have been discovered in the known productive areas and further surveys concerning possible extensions of the productive fields.

In the concentration of the lead and zinc ores a large quantity of finely ground limestone is produced. This by-product is in a mechanical condition favorable for use as a fertilizer and is adjacent to transportation. The question has therefore arisen regarding the value of this particular material as a fertilizer. In consequence of the suggestion of the commission,

this question has been taken up by the agricultural college and experiments are now being carried on to determine the value of this ground limestone as a fertilizer. If it is well adapted to this purpose, it is plain that the lead and zinc district will be able to furnish limestone fertilizer very cheaply to the southwestern part of the state.

The recommendations of the commission concerning lead and zinc are as follows:

Recommendations.

1. That a study of mining costs and methods of mining of lead and zinc already begun by Professor R. E. Davis of the Mining Trade School, be continued and completed with reference to working out a practicable graduated royalty plan for leasing mining lands.

2. That selected areas in the lead and zinc district be mapped in detail by the State Geological Survey in a manner similar to certain areas already mapped by that organization.

3. That the State Geological Survey continue the general survey of the southwestern part of the state with reference to possible extensions of the area in which lead and zinc may occur in economic amounts.

4. That the immediately available reserves in the mines be carefully measured and considered in connection with the past production of the mines; that the possibilities of extension of the mines' reserves be ascertained so far as possible; that the average life of mines that have been worked out be ascertained; in short, that all of the data be assembled which are used commercially in judging the probable value of the mines and mineral bearing lands; and that the work be done through coöperation of the mining department of the university and the state geological survey.

5. That the university and the mining trade school coöperate in a study of the problems of mining concentration and smelting.

6. That the experimental work by the department of soils of the university regarding the use of ground limestone produced in the land and zinc district as a fertilizer be continued.

WATER POWERS*

THE EXISTING SITUATION.

According to Professor L. S. Smith, in 1910, the water power developed in the state was 183,105 horse power, and the undeveloped power was 827,900, making altogether a possible maximum horse power in the state of 1,011,005. These figures for undeveloped horse power are too high for the minimum flow of the year, which, according to Dr. E. A. Birge, cannot be estimated at more than 350,000 horse power, and the amount which would be available through six months not more than about 650,000 horse power. It thus appears roughly that the minimum undeveloped horse power of the state is twice as great as that which was developed, in 1909.

The question regarding the right of the state of Wisconsin in the water power arose about four years ago. In a number of states the use of the energy of falling water in navigable streams has been declared to be a public right. This is illustrated by the states of North Dakota, Washington, Wyoming, Idaho, and California. Since the legislature of the state of Wisconsin had made no enactment in this matter, it was supposed by the conservation commission that the legislature might with binding force make a similar declaration regarding at least that portion of the water power of the state which was undeveloped.

The development of water power in the state has been under special acts of the legislature authorizing the construction of dams. An investigation of the facts by Mr. M. C. Riley shows that 665 such permits have been granted. Of these "244 permits were granted to improve navigation and to facilitate log driving, or both; 227 for hydraulic purposes; 52 to improve navigation *and* for hydraulic purposes; 79 to facilitate log driving

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1st Report of the Wisconsin state conservation commission, p. 10.

* The facts concerning the water power situation in this state are very fully summarized in the report of the committee on water powers, forestry, and drainage, of the Wisconsin Legislature, (Madison, 1911,) and in the report of Senators Paul O. Husting and Henry Krumrey, members of the special legislative committee upon water powers, forestry, and drainage, (Madison, 1910).

and for hydraulic purposes; and 63 for other purposes, viz.; to feed canals, for pisciculture, to create ponds, to flow cranberry marshes, for the 'public good,' for general municipal purposes.'' For 44 permits no purpose was specified. Of these permits, 326 grant the right of eminent domain and 325 contain a reserve clause permitting the legislature to alter, amend, or repeal; 31 were granted for a limited period. In regard to the rights of the state in the water powers developed under these various special acts, the conservation commission was uncertain at the time the first and second reports were made. However, for those in which there was a reserve right to alter, amend, or repeal, and in those cases in which the grants were for a limited period, it was believed by the commission that the state had surrendered no rights in the energy of the falling water which it initially had.

The foregoing situation led the commission to hold that in the absence of any legislative enactment granting same to private parties that the undeveloped water power of the state, approximately two-thirds of the whole, belonged to the commonwealth, provided it desired to claim it, since to utilize power by a private party had always heretofore required a special enactment.

Therefore the conservation commission recommended to the legislatures of 1909 and 1911 that the state assert whatever rights it had in the water powers of the state; also they recommended that hereafter, instead of a special act of the legislature for each water power, a general policy be adopted.

Specifically the recommendations of two years ago were as follows:

"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 railway commission, or similar board, under conditions to be provided by a general statute.

"3. That such franchises be granted by one of two methods; (a) Leases for a reasonable period of years, such leases to be renewable, on equitable terms, or (b) indeterminate franchises carefully safeguarded and under the general principles of the public utilities act. In either case rentals or a tax should be charged, the income from same to go to the state. The rate of rentals or taxes should at first be low, and should be readjusted at definite and reasonable periods."

The legislature of 1911 took the point of view of the commission and enacted a general law which is in accordance with all of the recommendations made. This law specifically declared that "all energy developed or undeveloped in the navigable waters of the state is subject to the control of the state for the public good," and that "the beneficial use and natural energy of the navigable waters of this state for all public purposes are held by the state in trust for all the people."* The railroad commission was designated as the authority to grant the franchises under the act. Many provisions for the protection of the rights of the state, under the theory that the energy belonged to the commonwealth, were included.

The water power act was immediately brought before the supreme court by a test case. That court in an opinion rendered January 30, 1912, promulgated the diction that "The right of the riparian owner to use the water of the river on his own land within his boundary determined by ordinary high water mark, for the purpose of creating power or, as the act in question puts it, 'developing energy,' returning the water again to the stream, is unquestionably a private right appurtenant to the riparian land."

In regard to the relation of the right for water power and the right for navigation, the court made the following statement:

"It is conceded there is such a riparian right as the right to use the water for power, and also that this right is to be exercised in subordination to the public right of navigation and the necessary accessories of the latter. We say that if the exercise of this riparian right in the judgment of the legislature interferes with the public right of navigation it may be forbidden. But, as has been said by Judge Cooley * * * 'Each right should be enjoyed with due regard to the existence and protection of the other.' Or, as he says * * * 'Each right modifies the other and may perhaps render it less valuable, but this fact, if the enjoyment of the right is in itself reasonable and considerate, can furnish no ground for complaint." Where the ownership of the bank is essential to the construction of a dam or the creation or development of a water power, the state is as helpless to use, sell or lease such right without condemnation and compensation as the riparian owner is to intrude into the navigable stream without consent of the state. It requires the concurrence of the riparian owner, and the state in such case

*Wisconsin Session Laws, 1911, p. 906.

to make the water power efficient and this right of the riparian owner to refuse to concur and stand out for compensation in the case mentioned, is a private property right and often gives to such land its chief value. The state may refuse its permission to the riparian owner to build a dam and may attach conditions to its consent such as the height, strength, mode of construction, etc., of the dam, and perhaps other conditions, but it may not seize upon this right without compensation and use it or sell it or lease it to another. It cannot authorize the use and enjoyment of this right by a person not a riparian owner for a private purpose without condemnation and compensation to the riparian owner. The act in question attempts to deprive the owners of improved riparian land and of the resulting water power and owners of unimproved riparian land with its appurtenant water power privileges and advantages, of property without due process of law; it attempts to authorize the taking of private property for private purposes; and it attempts to take property without just compensation. The act in question, in the particulars mentioned, is inconsistent with the paramount commands of the state and of the federal constitution applicable to the same facts and conditions. Hence, we cannot recognize it as law."

PROGRAM FOR THE FUTURE.

Accepting the conclusion of the court regarding the existing status, the question which the commission has to consider is, what steps the legislature should now take to give the public the greatest possible advantage of the water powers. The general recommendations of two years ago are still mainly applicable, except with regard to leases and rentals.

In the future the power furnished by the water of the state is sure to be far short of that required for public and private use. It therefore appears clear to the commission that the law enacted should give the public preference over private interests. This can be accomplished through condemnation and compensation to the riparian. The commission have therefore reached the conclusion that the proposed water power law should give municipalities authority to condemn water powers to develop energy for public purpose; and also that the state should have this right if the constitution is so amended as to permit the state in the future to engage in the development and transmission of energy.

Where municipalities require more energy than can be furnished by the water powers within a convenient distance, such

power should be equitably distributed between the different municipalities.

It is clear also that the law relating to the development of water power should place with the controlling body the authority to require the maximum development whenever the power is needed for public use and likewise for private use if markets exist therefor. It is further clear to the commission that since the water power, even when fully developed, will be insufficient to meet future demands; the people of the state should have preference over those outside of the state.

The unparalleled floods of the year 1912, with the breaking of dams and great damage to property at various parts of the state, coming after the flood upon the Black River in 1911, which resulted in the destruction of a large part of the city of Black River Falls, emphasizes the fact that dams should be so constructed as not only to handle the waters of the ordinary year, but of the flood years. Only if this be done will impounded water cease to be a menace to life and property.

During the year 1912, the fact, well known to geologists, has been emphasized: That the great floods may not occur more than once in fifty or a hundred years. It will probably be to the ultimate benefit of the state, now that the time is at hand for a general statute in regard to the waters, that a great flood occurred, since the damage done was far less than probably would otherwise have occurred in the future from the inadequate strength of the dams, when great floods came after the population and wealth of the state had largely increased. It is clear therefore that a general water power law should give adequate authority to the commission, which has control of the construction of dams in the state, not only to require them to be so constructed as completely to protect the people below them, but to require reconstruction of existing dams to that end.

In order to protect the public and gain the best use of the water power of the state, it will be necessary that the facts regarding them be thoroughly known and this can only be accomplished by careful surveys. Also this will require gauging of the more important streams through a number of years. Work of this class naturally falls to the geological survey rather than to an administrative commission.

In view of the foregoing facts and considerations, the com-

mission make the following recommendations concerning the water power of the state:

Recommendations.

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

2. That the issuing of such franchises be placed with the railway commission or similar board, under conditions to be provided by the general statute.

3. That such franchises be indeterminate and carefully safeguarded under the general principles of the public utilities act.

4. That the prior rights of the state and municipalities for water power for public purposes be recognized and protected.

5. That where the water power is not adequate to meet all the demands for energy for public purposes, the commission having the matter in charge shall have authority equitably to distribute such power between the state, the various municipalities, and the public utilities.

6. That the commission have authority, when the public needs require it, to compel maximum development of water powers for which franchises are granted.

7. So far as is lawful, that no corporation be authorized to create power in the state except for the preferential distribution and use in the state.

8. That all dams constructed under franchises be made under such regulations as to insure public safety; also that the commission be authorized to require changes in existing dams to this end.

9. That navigation and all public uses in the navigable streams be fully protected.

10. That a survey of the water powers and reservoirs of the state be completed by the state geological survey in coöperation with the United States Geological Survey.

11. That the guaging of the streams which will be necessary in connection with the above act shall be undertaken by the state geological survey in coöperation with the commission having water powers in charge.

FORESTS.

The general situation concerning the forests of the state has not changed greatly since the last report of the Conservation Commision. During the legislative session of 1911 the senate favored an appropriation of $200,000 a year for ten years to enable the forestry board to purchase the lands which the state must own in order to block up the forest reserve lands already held. However, the assembly cut down the appropriation to $50,000 a year for five years. This entire appropriation has now been spent or contracted for and the forestry board has only been able to secure some of the larger and most desirable tracts. During the two years about 94,000 acres have been purchased, and at the present time the total area of the state forest reserve is over 400,000 acres; but the area of land within the boundaries of the forest reserve area, and on the headwaters of the Wisconsin and Chippewa rivers, which is better adapted to forestry than to agriculture is between 1,200,000 and 1,500,000 acres. These lands are increasing in value; also the large holdings are being cut up into smaller ones and thus are becoming more difficult to acquire. Further, these privately owned lands which are scattered through the state holdings are a constant menace to the forest reserve, since, from them the destructive forest fires usually start.

Therefore the legislature should act promptly by providing at the coming session for sufficient funds to complete the forest reserve of the state. To accomplish this, as nearly as can be estimated, will require the proceeds of a tenth of a mill tax during twenty years. Should the legislature make such appropriation it will be legal for the forestry board to make land contracts in advance of ready money. Through the policy outlined it will be possible for the forestry board, making purchases carefully to take advantage of opportunities to block up the forest reserve, if not as fast as they appear, at least with a reasonable degree of speed.

The provision outlined for an adequate state forest reserve does not fully solve the wood problem of the state. If we are to retain our wood-using industries, we cannot in the future de-

pend altogether upon the state forest reserve for the necessary supply of timber. Private owners must be encouraged in the growing of forests, as they are in Europe. It is clear that this can only be done under a new method for the taxation of timberlands. It is not possible for private parties to pay an annual tax upon the full value of growing forests. A careful study by the federal government of the taxation of timberlands in Wisconsin and other states has shown that timber upon land more suitable for growing forests than for agriculture, should be taxed only when it is cut, in other words, there should be a harvest tax.

In Vilas county is a solid block of forest reserve lands in T. 41, R. 7 E. It is proposed by the forestry board that 8,000 to 10,000 acres of this land be fenced as a game preserve. Here would be included moose, elk, deer, beaver, mink, otter, grouse, partridge, pheasant, and all kinds of fur bearing animals. The preserve would also be used as a wild fowl refuge. To carry out this plan will require about $20,000. Since the sportsmen contribute the funds derived from hunting and fishing licenses, it seems but fair that these funds should in large measure be devoted to the propagation and protection of fish and game; and, consequently, the above amount should be paid out of the hunting and fishing license fund.

In view of the foregoing statements, the commission make the following recommendations:

Recommendations.

1. That an annual state tax of one-tenth of a mill be levied for a period of twenty years for acquiring lands to block up and consolidate the state forest reserve, and for the improvement and protection of the same.

2. That measures be enacted so as to permit of a more rational method of taxing timberland in order that it may be practicable for private owners to hold growing timber on land more valuable for this purpose than for agriculture.

3. That $20,000 from the hunting and fishing license fund be appropriated to establish a game preserve on forest reserve lands in Vilas county.

LANDS.

The recommendations regarding land made by the conservation commission two years ago were five in number. Two of these were enacted into laws by the legislature. Concerning the other three no action was taken, and these are again included among the recommendations given below. The two recommendations adopted were that extending state support for agricultural education in order that the teachers in the rural schools shall be trained to teach agriculture, and that the soil survey be continued. The recommendations not acted upon by the legislature were those concerning the publication of a weed manual, the revision of the laws relating to noxious weeds and the creation of the office of a state weed commissioner, and provision for a topographic survey of the state.

The more pressing of the problems regarding the land of the state are those relating to erosion, weeds, and drainage.

EROSION.

The paper of Professor A. R. Whitson in the report of the conservation commission for 1911 shows how extensive are the areas in Wisconsin which are subject to severe erosion and indicates the methods through which erosion may be decreased. Professor Whitson estimates that the land in the state subject to such severe erosion as not to be available for agriculture without special treatment amounts to about one and one-half million acres, and that an additional area subject to serious erosion is about two and one-half million acres in extent. While erosion on those lands which have unusually steep slopes is the most rapid, the more moderate erosion continually taking place on the vastly larger area of land with less accentuated topography results in a loss of soil many times the amount of that on the smaller areas of steep slopes and is therefore of much greater importance to the state.

As has already been stated, the legislature of 1911 enacted a general law making it a misdemeanor unnecessarily to destroy a natural resource. This law is certainly sufficiently comprehensive to include erosion. Probably it is not advisable at the present time to invoke the law for ordinary soil erosion; but it

should be invoked where a careless farmer is grossly negligent and allows his fields to be destroyed by the development of a system of gullies. However such cases are rather exceptional. It is the moderate unnecessary erosion which takes place in connection with the current methods of agriculture which require the most attention. The remedy in such cases is not through invoking the law but by extending knowledge in regard to the importance of reducing erosion. This means a campaign of education from the rural schools to the university. At the earliest practicable time through the Agricultural College and soil survey there should be published a large edition of a bulletin giving the facts relating to soil erosion in the state. Such bulletin should contain a classification of the soils with reference to ease of erosion and indicate the methods which should be followed to prevent unnecessary erosion for each class. The commission therefore makes the recommendation below in regard to soil erosion.

Recommendation:

1. That the agricultural college and the soil survey in coöperation prepare a bulletin upon soil erosion in the state which shall include the facts regarding the situation for the various types of soil, and shall indicate the particular steps which are to be taken to reduce the soil erosion to a minimum for each of the classes of soils and the various topographic districts.

WEEDS.

The last report of the conservation commission contained a report by Mr. A. L. Stone of the agricultural college which showed the very serious extent to which noxious weeds have been allowed to spread in this state and especially in the northeastern part. This report is supplemented by one contained herewith by H. H. Hoard. The difficulties in the eradication of weeds are of three kinds. First, in a very large proportion of cases the farmers are not able to identify even the more important of the noxious weeds; second, there is lack of knowledge on the part of the farmers as to how seriously their crops are decreased where noxious weeds are allowed to extensively develop; and third, the farmers, even if they are able to identify the noxious weeds, and realize that their spread will be disastrous, do not know the methods to be pursued in their eradica-

tion. The most essential step is therefore a campaign of education which shall place the facts in these respects before all the farmers of the state. To this end a weed manual should be prepared, giving the necessary information to those who are to take part in the campaign. This manual should contain good illustrations of each of the important noxious weeds, with an accompanying description in order that the weeds may be identified. It should describe the method of eradication of each noxious weed and tell exactly how fields should be handled in succession on a farm for the various common combination cases which exist.

If this necessary information were before the people of the state, it is believed that the more intelligent farmers would utilize the same simply from the point of view of increasing the productivity of their lands. A farm from which noxious weeds had been eradicated would act as a demonstration farm for surrounding farms. Also once a man had eradicated the noxious weeds from his own farm, he would insist that his neighbors do likewise and thus there would be a growing sentiment in favor of the destruction of noxious weeds.

While the plan of education is regarded as fundamental, it is believed that it is inadequate and that the time has now arrived when the same principles should be applied to weeds that have been applied so successfully to pure foods. Instead of leaving the enforcement of the weed laws to local officials, there should be a central officer whose duty it is wisely to enforce the weed laws. Such an officer might be called the state weed commissioner. All local weed officials should be appointed and removed by him and be subject to his direction.

Before such an official can be an effective power in the eradication of noxious weeds, it is necessary that the weed laws be brought up to date, so as to conform with the existing facts in the state. The law should specifically name the weeds which are noxious. Also the law should be general in its terms laying down the broad principles to be observed. The weed commissioner should have large authority under the rules of law in making regulations to be enforced by his department. In short, the weed commissioner should have large discretion in regard to weed eradication similar to that of the dairy and food commissioner with reference to foods.

The recommendations below are in accordance with the above principles:

Recommendations.

1. That the college of agriculture prepare a weed manual to contain illustrations and descriptions which will enable the easy identification of the more important noxious weeds of the state and the methods of their eradication; and that the state provide for the publication of a large edition of such manual at an expense of about $2,500.

2. That there be created a state officer to be known as the state weed commissioner who shall be an expert and who shall have authority to appoint and remove local weed inspectors, that such inspectors shall work under the direction of the State Weed Commissioner and that it shall be the general duty of the weed commissioner to direct a campaign for the eradication of the noxious weeds of the state.

3. That the weed laws of the state be amended so as to name specifically the weeds which are noxious in the light of present knowledge, that such noxious weeds be declared to be a nuisance, and that the weed commissioner and his inspectors be given power to formulate and enforce regulations which shall require communities and individuals to eliminate noxious weeds from the lands for which they are responsible in the manner prescribed by the weed commissioner and his deputies.

4. That the legislature make a sufficient appropriation to put into operation the above plan for the eradication of noxious weeds within the state.

DRAINAGE.

In the state of Wisconsin there are very large areas of marsh and swamp lands. Professor A. R. Whitson estimates that the amount of this land in the sandstone and granitic areas to be about 2,000,000 acres, and in the limestone areas some 610,000 acres. He reports that of this land approximately 360,000 acres have been organized into thirty-five drainage districts, but even of this area not more than six or seven per cent has been brought under cultivation.

The marsh lands are frequently so low in available phosphorous and potash, that at the outset they need mineral fertilizers although they contain a large amount of organic matter. While some of the marsh soils are originally fertile, as a class they are of low fertility and therefore require special treatment; but by appropriate treatment and the use of proper fertilizers, extensive areas of the marsh lands may be made highly productive. In such cases, as shown by the work of Whitson and Jones, the increased value of the land due to drainage is several times the cost of the improvement.

It appears that many of the difficulties in the drainage of wet lands are due to imperfections in the present drainage laws of the state. These laws are complex; the expense of acting under them to form a drainage district is great; litigation is common. Also the law provides that no one individual or corporation may acquire more than 160 acres of marsh land from the state for the purpose of drainage. The above difficulties are discussed in detail in the reports contained herewith by W. O. Hotchkiss, E. M. Griffith, and E. R. Jones.

In the opinion of Professor Whitson it is desirable that there should be a well equipped substation in the north central part of the state where are extensive areas of marsh lands, which shall by demonstration show the proper management of these soils.

The general recommendations regarding drainage of swamp and marsh land correspond to the facts presented.

Recommendations.

1. That the drainage laws be changed so as to reduce the unwarrantably great expense now attendant on the organization of drainage districts and the litigation connected therewith.

2. That the present laws be amended to permit the acquisition from the state under suitable regulations, of more than 160 acres of marsh land by parties desiring to drain them, except such areas as are more valuable for other purposes than for agriculture.

3. That a demonstration substation be located by the College of Agriculture upon a typical tract of marsh land to illustrate the most advantageous methods of increasing the productivity of wet lands.

SURVEYS.

The handling of the great problems of soil erosion and drainage are very closely dependent upon a knowledge of the topography of the districts concerned. For wise action it is therefore necessary to have an accurate topographic map of the state. Also the establishment of reservoirs for the water powers is closely connected with the capacity of the marshes to retain waters temporarily—a question which has not been investigated.

The commission therefore believe that provision should be made for the completion of the topographic map of the state and that the state geological survey should undertake investigations upon the relation of marsh lands to floods.

The commission therefore make the following recommendations covering this part of the subject:

Recommendations.

1. That provision be made for the completion of the topographical survey of the state with the condition attached that the work be done through coöperation of the state and of the state and the United States geological surveys.

2. That the legislature provide for an adequate study of problems relating to drainage and its effects upon floods by an appropriation for the purpose to the state geological survey.

PEAT.

Peat has been mentioned in connection with the minerals. Consideration of the subject has been deferred to this place, since it also concerns the land.

Extensive areas of marsh and swamp in the state are shown to be underlain by peat. The question therefore arises whether such lands are more valuable for agriculture or for fuel. This question has been taken up by Mr. Hotchkiss, Mr. Griffith and Mr. Jones, and their conclusions are given in an appended paper. Their investigations show it is probable that where good peat is as much as twelve feet thick, the land is more valuable for

fuel than for agriculture. The commission do not propose any regulation be made regarding peat on lands privately owned. The above information once available to the holders, they will be able to decide whether their marsh lands should be drained or held as a future source of income through the extraction of peat. In the case of the state the situation is different. All considerable continuous areas of peat-bearing lands which contain good beds as much as twelve feet thick should be held for the future fuel supply of the state rather than drained and used for agriculture.

Many of the marshes which are held with the expectation of extracting peat in the future, whether privately held or owned by the state, may be used for the raising of wild hay.

In the matter of peat, the commission make the following recommendation:

1. That the state retain all large marshes owned by it, which contain twelve feet or more of good, clean peat, suitable for fuel and other purposes, until such time as the peat may be profitably extracted.

FISHERIES.

The commission submit three recommendations with regard to fisheries.

The first relates to the regulation of fisheries, especially those in inland waters. Many detailed regulations are necessary for the proper protection of the fish in such waters, and these necessarily differ in different parts of the state. The present method of regulation offers two difficulties: first, all regulation must be by legislative enactment; and second, the state is not in possession of sufficient knowledge to make its regulations intelligently. The effect of the first condition is to burden the legislature with a mass of details, involving no principle and not easily handled. As an example, fairly representing scores of measures which have come before recent legislatures is that permitting the use of wind-shields on the ice by fishermen in Dane county.* In regard to the regulation of the inland fish-

* Chapter 181 of the laws of 1911.

eries the commission recommend that the same principle be followed as for the public utilities, namely: that the legislature establish general rules for the regulation of the inland fisheries; that details relating to them be left to administrative action; and that the power to issue specific regulations be placed with the Commission of Fisheries.

The second subject—that of acquiring information on which to base regulation—should be treated by the legislature in the same way that has been adopted in the case of the Railway and the Tax Commissions. The Fish Commission should be empowered to collect information concerning the kinds of fish in the inland waters, their abundance, food, breeding habits, and such other matters as will enable them to issue proper regulations regarding the kinds of appliances to be used, the closed season, etc. The money to defray the cost of such investigation should come from the fund derived from fishing and hunting licenses.

The third subject concerns the regulations for fisheries in outlying waters. These should remain in their present form; at least until more knowledge has been collected. There is, however, an even greater necessity for information regarding the fish of the outlying waters than for knowledge relating to those of the inland waters. The maintenance and development of the commercial fisheries demand not only that the Fish Commission hatch and plant fry, but also that the system of regulation shall be based on knowledge far more extensive than any now in their possession. The Commissioners of Fisheries should be authorized to investigate the food, habits, and life history of the fish that they are planting, in order to ascertain the best methods of increasing the stock of commercial fish, both by cultivating them and by regulating the fisheries.

The following recommendations are, therefore, submitted:

Recommendations:

1. That the legislature establish by law the principles to be followed in the regulation of fishing in inland waters, and that the duty of issuing specific regulations be placed with the Fish Commission.

2. That the Fish Commission be granted from the hunting and fishing license fund a sum sufficient to investigate the facts

relating to fish in inland waters, so that such regulations may be properly and wisely formulated.

3. That a similar investigation be made of the fish in outlying waters on which the commercial fisheries depend.

(signed) CHARLES R. VAN HISE, *Chairman,*
E. A. BIRGE,
T. H. GILL,
E. M. GRIFFITH, *secretary-treasurer,*
H. H. HOARD,
V. P. RICHARDSON,
W. N. SMITH.

Adopted December 27, 1912.

LEAD AND ZINC.

W. O. HOTCHKISS AND W. N. SMITH.

In the report of the State Conservation Commission for 1911, Mr. W. O. Hotchkiss has a general discussion of the occurrence, production and uses of the lead, zinc and pyrite ores of southwestern Wisconsin, and in this report Mr. Hotchkiss makes a number of suggestions concerning the conservation of these ores.

During the past year, the State Geological Survey, the Mining Department of the University of Wisconsin, the Mining Trade School at Platteville and a considerable number of operators of southwestern Wisconsin, have coöperated along various lines with the view of promoting the efficiency of mining and concentrating operations, and of promoting the general development of the district along practical scientific lines.

First: At a conference between Mr. W. O. Hotchkiss, of the Geological Survey, Professor R. E. Davis of the Mining Trade School and a group of mine operators, it was arranged for Professor Davis to undertake the collection of data from all of the mining companies of the district so far as possible, to determine the average cost of production, the amount of capital invested, the average grade of ore, the number of men employed and the average wage of each class of work, etc. for the entire district. In securing this data, the information is divided into different headings, such as development cost, installation cost, mining cost, milling cost, and power cost. In this way it is believed that the average and extreme figures in each of the above classes of costs will be helpful in showing where the greatest immediate possibilities for increased efficiency for the district as a whole lie.

The data thus secured will also be available and should be invaluable in the discussion of a tariff on lead and zinc ores. It is further believed that the data will furnish more exact information which can be used in arriving at a graduated royalty basis for leased mining land, as suggested by Mr. Hotchkiss in his report for 1911.

The gathering of this data will be completed by Professor Davis this fall, and it is proposed to have this information kept up to date in the future.

Second: The development of the district has now reached a point, where sufficient new information is at hand to warrant a continuation of the detailed work which was begun by the Geological Survey some years ago. In this work of the Geological Survey, it was determined that the ore bearing limestone formation of the district was folded into a series of minor synclinal basins or troughs and anticlinal crests, and that these synclinal troughs seemed to bear a definite relation to the localization of the ore bodies. At that time the detailed information in reference to the location of these basins and the occurence of the ore within the basins was meagre, but maps covering the main ore bearing portions of the district were made, and the above structure platted on the map with as much definiteness as possible. These maps have been of great practical assistance in the development of the district. It is now believed that enough additional information is available to make it very desirable to continue this work and to map and study a number of the special areas in detail. To this end, Mr. Hotchkiss of the Geological Survey and Professor R. E. Davis of the Mining Trade School have arranged to take charge of and begin the work immediately, and to prosecute same continuously, in order to make the results available to the operators of the district, at the earliest possible date.

Work which Mr. Hotchkiss and Professor Davis already had in hand made it impossible to begin the work before this fall. It is believed that the present is a peculiarly desirable time to do this work, as an unusual amount of prospecting and development work is in progress in the district, and the assistance which the previous geological survey was able to give with the meagre data available at that time, had been quite thoroughly exhausted. It is believed that there is no one thing which the

Geological Survey and the Mining Trade School can do at the present time which will be more helpful to the lead and zinc district than the work outlined.

Third: In connection with the more detailed geological study mentioned above, it is proposed to extend the geological mapping over one or two areas in which mining and prospecting has progressed beyond the borders of the detailed sheets already made. In addition to these areas it is believed that the geological study will indicate that other districts which were formerly mined for lead, will be of sufficient promise to warrant the extension of the detailed mapping over large areas. If such should prove to be the case, the Legislature should be asked to provide sufficient funds for carrying on this work on an adequate scale, as it would be of great benefit in assisting the development of the zinc industry.

Fourth: It is believed that the efficiency of mining and concentrating operations in the lead and zinc district can be promoted by the Mining Department of the University of Wisconsin and the Mining Trade School; and it is believed that this can best be done by the above schools selecting certain problems for study and experiment. To this end a meeting between Professor R. E. Davis of the Mining Trade School at Platteville, Professor E. C. Holden of the Mining Department of the University of Wisconsin and a number of mine operators was held, and it is expected that during the coming winter various problems relating to the present mining and concentrating methods will be undertaken by the above schools.

Fifth: It is felt that there is a possibility of utilizing some of the waste rock incidental to mining operations for cement material, for flux in the iron furnaces, or for use in the sugar factories. To this end Mr. W. O. Hotchkiss is having samples from various parts of the district, and from various geological horizons collected and analysed.

Dated the Sixth day of November, 1912.

THE USES AND MARKET FOR GROUND LIMESTONE FROM THE LEAD AND ZINC DISTRICT.

W. N. SMITH.

During the past summer, the question of the possible agricultural value of the waste limestone from the lead and zinc mines of southwestern Wisconsin was taken up with the College of Agriculture. Two chemical analyses of samples of this waste material were made. One sample was of the finer sludge, and the other of the coarser tailings from the concentrating plants. The analyses were made by the Department of Feed and Fertilizer Inspection. After the above analyses were made, it was decided to supplement them by actual experiments by treating different plats of soils with different amounts of the powdered material, and trying such soils for different crops, and at the same time planting the same crops on the same kinds of soil to which the limestone would not be added. The experimental work was referred to the Department of Soils, and is now being carried on. Six samples of the sludge and tailings from the mines in different parts of the district have been furnished the Soils Department, and it is expected that within a few months definite conclusions can be arrived at.

Until the value of this material as a fertilizer is determined, it does not seem advisable to make any special investigation of the market situation for the material.

Dated this Sixth day of November, 1912.

THE CONSERVATION, CONTROL AND REGULATION OF WATER POWER.

T. H. GILL.

More than any other substance, which has been practically reduced to human control, the daily waste of energy not now saved from the moving waters of the state appeals to us as most important. If such energy is utilized as the water passes a given point, it yet robs the water of no physical element of value whatsoever, because the stream beyond carries the same benefits it ever had to the lower proprietors and contains even all the power it had above, awaiting only the favorable location that the same, or a greater power, may be utilized anew. On the other hand, once the water flows beyond each favoring site unused, the energy which might have been transmitted into controllable force is forever lost. A reflection upon the values which have been lost each hour since the world was new and which now momentarily flit into eternity because proper development has been retarded from whatever causes, illustrates the loss which occurs every day the powers remain unharnessed.

While many other forms of conservation, either within or beyond the limits of to-day's activities, promise almost incomprehensible savings of values, the utilization of water power energy appeals to men generally as the most desirable and immediate field of investment.

The state of Wisconsin is peculiarly adapted to the development of commercial power from flowing water. A casual study of the map discloses three great water systems flowing substantially southward, at least so close to the lower boundary as to be easily capable of distribution throughout and even beyond the limits of the state.

In the northern and eastern part, we have the boundary waters of the Menomonie river and the flowage of the Wolf river, and its tributaries, including the waters of Lake Winnebago, and the Fox river northerly to Green Bay. Both streams provide many available sites.

Flowing through the center of the state is the great Wisconsin and its many large tributaries, rich in opportunities for power dams. Beyond, towards the Mississippi, we have the Chippewa with its branches, extending almost to the northeast boundary, furnishing many favorable opportunities, as well as those found upon the St. Croix river.

Observation of water flow in these several valleys, seems to show that in no two of them are periods of flood or of low water concurrent, so that power is generally available in two when disturbed in the other. In this way, in harmony with practice and operation in other similarly watered areas, a development in parallel will insure much greater and far better results to commercial enterprises depending upon water made electrical energy. This can be insured where the current is the accumulated production of coupled power equipment in two or more of the independent streams. Thus a maximum energy is constantly maintainable, insuring the cheapest product either of manufacture or transportation.

The acme of conservation arises from the utilization of water energy both in obtaining what is forever lost, if once permitted to pass, and again in preserving the power equivalent in consumption of fuel, the only other available method of manufacture of this force.

Our state has clearly passed the educational stage. A strong effort was launched to make more certain the use of this great source of value, while the more surely preserving to the people the future control of and benefit from the stores of nature in the enactment of chapter 652 of the laws of 1911, generally known as the Water Power Act.

A new system to govern the development of power from flowing water was devised by which the right to use the necessary locations, improvements and plants, and to direct the production, transmission and sale of energy or electric current for public and private use was to be controlled and regulated by the state through its commission, with the prerogative of ulti-

mate acquisition by municipalities or the state, of all such producing plants.

The enforcement of the act was enjoined as unconstitutional by the supreme court of the state as the suit of certain private owners of improved sites. The decision is found in Volume 148 of Wisconsin Reports page 124, and greatly clarifies the questions which were found difficult when that act was before the legislature, and which it furnishes no certain guide to the true limits of regulative state authority, it may be that from what it declares may not be done, we can draw nearer to such desirable and encouraging regulation as will tend at least to invite and encourage the widest and most economical development of those powers not yet subjected to production, as well as the attendant and consequent increase of production in a multitude of ways, in addition to widespread public benefit in saving of costs and greatly added comforts and conveniences.

Without opportunity to examine records, from general knowledge, we assume that nearly every available water power site if not all, has now passed into private ownership. Many power sites, however, have not been improved in any way. Under the decision above referred to, the state cannot interfere except under its right of eminent domain for a public use and upon payment of compensation, or where actual interference with navigation is apparent with the riparian owner's use of the flowing waters upon his own land for the production of power, where the water is returned to the stream.

The title to the bed of the stream, the land below low water-mark, is in the riparian owner of each bank, to the thread of the stream, subject to the public rights of navigation, fishery, and some inconsequential uses. The submerged land is his and may, generally speaking, be used by him when not interfering with such public rights. Therefore, before a dam may be constructed for power or other purposes, consent of the state is necessary, so that the state may discharge its duty as trustee for the reserved public uses of the stream, generally navigation and fishing and fishways alone as a practical matter.

The state may not and should not arbitrarily refuse to one riparian what it has given to another riparian, and this policy certainly dictates some general system for the permission necessary for stream development. At any time the state in good

faith may refuse permission to any one to erect or use a dam, as an interference with public rights above specified. Or the state may attach conditions to the erection of such dams as it usually has heretofore in the requirement that the same should be in the improvement of navigation. The theory was beneficial, but political preferences, we find have long since made the grants possible through legislative special acts, for the mere private gain of logging and mill companies, and entirely without regard to public benefit from improved navigation. On the other hand, possibly, practical or commercial navigation of most of our streams, for other than raw forest products, except for short distances near their outlets has become a theory in place of a possibility, and the commercial utilization of such streams in the driving of logs is perhaps justifiable even at the expense of the common law methods of water carriage.

Undoubtedly the police power of the state extends to the flow of waters, and their contamination, as well as to the safety of structures in and across them, methods of construction as to economy, strength and permanence. It may go further. It certainly will when conditions arise to menace the lives, property, health or safety of the citizens.

It seems most feasible to approach the questions of regulation and state control therefore along the lines of police power.

But there is another doctrine, almost as imperatively demanding state action along those lines. In relation to common carriers and public utilities it is now well settled that where one offers his private property to the use of the general public, or so engages it as to render the public in large measure dependent upon its continuous service, such person has dedicated, and such property becomes incumbered with or subjected to a public use and the public right to its continuance under just and reasonable public control so far as it is thus devoted voluntarily to the public use or convenience becomes vested. Indeed this state right of regulation goes much further, following the rules of the old common law and extends to anything which has grown to be a public necessity so-called, including the charges of hotels, merchants, manufacturer, farms, cattle growers and dealers, possibly lawyers and doctors, though as yet not deemed necessary of active use.

Applying these principles concretely to the subject in hand, it is our opinion that where the banks of the stream and the bed

subject to the navigation right, are owned by an individual or corporation, as presumably all now are in this state, the state cannot compel such owner to accept a franchise strictly so-called from the state giving the right thereunder to build and operate his dam. But the state can require such owner to obtain permission, privilege or authority to build and operate such dam in the navigable streams, under all reasonable conditions conserving the safety, health and property of citizens which may be affected thereby and subject to restrictions made necessary by the demands of any kind of navigation and the free passage of fish, and rights of citizens to fish and hunt upon and in such waters. This plainly grows from the police power.

As to all such dams and improvements as are initially intended or ultimately become subject to public use, or which in any part offer their product for public purposes of carriage, heat, light or power and at least so far as actually so public, the state power to regulate or control is undeniable to the extent of requring a public hearing and then if sufficient reason is shown, to a grant of authority to construct dams of the best standard of strength and pattern, and upon such plans as will most economically produce and in the future best provide for the full development and utilization of the maximum of current from the flow and volume of water obtainable.

Wherever the use shall be or become public, the charge per unit for power or the product of the use thereof, if sold to the public, should be likewise regulated as the price of service of public utilities is now controlled.

A due regard for the future, too, we think requires some standard of development so that, as to unused possibilities, the public may require additional development where ready and profitable market is assured therefor, just as the railroads are required to provide equipment and service for all traffic that may be offered however great in volume.

Further than this, we feel in the present view of the law, the state authorities may not go. And while these undoubted rights exist in the sovereign, and may be exercised within wide limits, it is to be hoped that these matters can and will be entirely removed from the field of political action, which while all powerful is not always all wise, all just or all reasonable. Private citizens, individual and corporate, own tremendous values both

present and potential, in water power sites, poorly or not at all developed and the waste which compounds day after day from the lack of improvement, becomes an economic loss beyond human power of calculation or comprehension. The policy of the state should be such distinctly as to put forever at rest all uncertainty as to an intent or even a desire to interfere with the rights of private ownership while inaugurating proper and reasonable plans to secure the most from those now or hereafter, even in part, devoted or to be devoted to public use. We should hold out to invested capital a positive assurance of continued security in its ownership and right of private operation, leaving to an enlightened citizenship and to progressive commercialism the expansion of poorly and partly developed opportunities now in hands which may not greet cheerfully an improved and enlarged opportunity of service. And more than our regulations and our policy should invite new capital that an early and aggressive development of additional sources of such power making, shall lead and create rather than wait upon a ready and assuredly profitable, market from the beginning.

We can see no new source of value created by existing or future power plants, which would justify an original or further tax than the same value would incur if invested in farm lands. Whatever of investment value there be, as a piece of property or as a tangible going business should pay its equal tribute to governmental expense but not more.

All that precedes has been based upon the rights and powers of the state. Before closing, we wish, however, to direct attention to another possible source of conflict of power or authority which occurs to us but which we have not found time to follow out.

In some instances, we have been informed that the United States authorities have constructed dams at headwaters in Wisconsin on the theory perhaps that under act of congress the Secretary of War has supervision over the navigable waters in every state of the Union. It is true that the Federal Government has jurisdiction over all such navigable waters within the United States, and requires its consent to and approval of all plans by the Secretary of War before construction of railroad or municipal bridges over such streams. To what small streams this may apply, we do not know. But it raises the apprehension

that in the last analysis possibly the consent of the Government and its regulations will supersede state authority, though perhaps for our present purposes this question need not be now considered.

Eventually it now seems to us that the general Government may desire to dictate the regulation of power dams and electrical transmission if it should be sought to market such power in other states. This might involve questions of interstate commerce for the state policy should require domestic distribution and consumption when conditions within the state create sufficient demand.

FORESTS.

E. M. GRIFFITH.

PROGRESS MADE.

Since the last report of the State Conservation Commission in January, 1911, distinct progress has been made in building up an adequate state forest reserve, in securing a force of well-trained forest rangers and patrolmen, who are the active field force entrusted with the duty of protecting the reserves from forest fires and also carrying on all the various lines of forestry management.

Following are some of the most important results which have been accomplished in the state forestry work during the past two years:

1. Over 94,000 acres of land have been purchased to block up and consolidate the state forest reserves at an average cost of $3.75 per acre. The total area of the forest reserves is now over 400,000 acres.

2. A large headquarters camp has been built at Trout Lake, Vilas county, and is the center of the forestry work on the reserves. A large forest nursery at this point contains over 2,500,000 seedlings and over 300,000 young trees have been planted on lands which were not reproducing naturally. The state forest reserves have been divided into districts with a forest ranger or patrolman in direct charge of the work in each district. In four districts comfortable ranger cabins have been built, and from six to eight more will be constructed as fast as they become necessary.

The heavy and well distributed rains of the past two years have greatly lessened the usual heavy losses from forest fires.

This very fortunate condition has allowed the forest rangers to devote most of their time to building up the forest fire prevention system on the preserves, which is absolutely necessary in order that fires may be held within a small area and also promptly extinguished.

The chief reason for establishing the state forest reserves in the counties of Forest, Oneida, Vilas, Iron and Price was on account of the wonderful lake region in that section of the state, comprising over 1,200 lakes, and it has been a comparatively easy matter to build short fire lines from one lake to another, and thus establish a network of lakes and fire lines which split up the reserves into small blocks and thus hold any forest fire to the block in which it originates.

During the field seasons of 1911 and 1912 over 150 miles of such fire lines have been constructed. About 140 miles of main roads have also been built so that the largest tracts of forest reserve lands are now easily accessible and these roads are a great boon to the few settlers, as well as to the thousands of summer tourists. Sixty miles of telephone lines have been constructed, dangerous slashings burned on 2,000 acres, and nearly all the old, dead stubs, which are such a source of danger in scattering fire, have been cut. Four steel lookout towers, fifty-five feet high, have been erected on high hills, and all the lookout towers and ranger cabins are connected by telephone with the headquarters camp and the nearest towns, so that where a forest fire is discovered, help can be secured in the shortest possible time.

Most of the rangers and patrolmen are equipped either with ponies or railway speeders and boxes filled with fire fighting tools are located at convenient points.

3. The state forest reserves should be used and enjoyed to the fullest possible extent by all the people, and with this idea in view, the Forestry Board has adopted the policy of leasing camp and cottage sites on some of the most attractive lakes within the forest reserve area. Leases are granted for twenty years, at prices ranging from $10 to $75 per annum and with the privilege of renewal for another period, at such terms as the state may then deem to be fair and reasonable.

This feature of the forestry work has already met with much public approval and there is no question but that many people will avail themselves of this opportunity, especially as they will

have the free use of the entire forest reserves. Through the untiring efforts of Congressman E. A. Morse, the Federal Government has granted to Wisconsin all the unsurveyed and unallotted islands in the inland lakes in the northern portion of the state, and under the terms of the grant these islands are to be managed as part of the state forest reserves. Wisconsin will get about 250 islands, many of them most beautiful, and these will be leased for camps or cottages just the same as the lake shores.

4. As both Michigan and Minnesota have forestry schools in connection with their state universities, which are fully equipped to prepare technical foresters, and especially as there is danger that at the present time more foresters are being trained in this country than can find positions, it has not seemed wise to start a forestry school at the University of Wisconsin. However, there is a great need and demand for trained forest rangers and therefore the College of Agriculture in coöperation with the State Board of Forestry, commencing January, 1913, will offer a course of one and a half years for forest rangers, which will fit the men for work on the state forest reserves, and also for positions with lumber companies and large timberland owners.

WORK TO BE ACCOMPLISHED.

During the session of the legislature in 1911, the senate favored appropriating $200,000 a year for a period of ten years in order to purchase the lands which it is absolutely necessary that the state should own in order to block up the forest reserves, and make forestry management possible. However, the assembly cut down the appropriation to $50,000 a year for a period of five years, and therefore it has only been possible to secure some of the largest and most desirable tracts. The privately owned lands, which are scattered all through the state's holdings, are a constant menace to the forest reserve, as they are not settled or cared for in any way, but are very largely in the hands of nonresident owners. The truest economy on the part of the state will be to acquire these lands as soon as possible, so that the valuable young timber on them may be protected. It is a most wasteful and expensive policy for the legislature to postpone purchasing these lands until some indefinite future date, as such unprotected lands are the source from

which start many of the most destructive fires, and the young timber which is destroyed has a much greater value than the cost of the land and the timber at the present time. The urgent necessity of making an appropriation sufficient to acquire the necessary lands has been strongly recommended by the State Conservation Commission in their reports to the legislature in 1909 and 1911.

The Senate studied the matter carefully and recommended that a sufficient appropriation should be made but the Assembly did not give this question the consideration which its great importance deserves. At each session of the legislature the cry of economy is heard and the statement is made that taxes will have to be increased if the appropriations asked for are granted, and yet in 1911 the state officers remitted $940,235 in taxes, and $2,000,000 in 1912.

No one can justify foolish and extravagant appropriations of state funds, but the prompt completion of the forest reserves is an absolutely necessary investment, which will yield large future returns, and when the state officers can remit nearly $3,000,000 in taxes in two years, the legislature must realize that funds are available for this important work.

It should be kept in mind that the purchase of forest reserve lands is an investment, and that an adequate reserve will yield a large direct and indirect revenue to the state as follows:

a, Protecting the headwaters of our rivers will mean that the stream flow will be more uniform, therefore more horse power will be developed in the water powers and bigger mills with a larger output will be the result.

b, Within twenty-five years the forest reserves should produce a net annual revenue of $1.00 per acre and at the end of fifty years this should have increased to at least $2.00 per acre.

c, The timber that can be produced on 1,500,000 acres of land under forestry management will be a big factor in supplying the wood-using industries with their raw material, thereby saving these very valuable industries to the state.

d, Our northern lake region when it is included in a big forest reserve and protected, will bring tourists, campers, fishermen and hunters from all over the country and they will annually spend millions in the state, and largely in the northern portion where it is most needed.

The State Board of Forestry is desirous of creating a game preserve and wild fowl refuge on state forest reserve lands near Trout Lake, Vilas county. It is proposed to enclose between 8,000 and 10,000 acres with a strong eight foot fence, and to include in the preserve moose, elk, deer, pheasant, grouse, partridge, beaver, mink, otter and that the lakes and marshes within the preserve shall be a refuge for wild fowl of all sorts. The government will bear all the cost of capturing and loading the elk on cars in Montana, the state only being obliged to pay the freight, and the Boone & Crockett Club of New York have very generously offered to coöperate in capturing some moose, probably in Minnesota.

A Chicago gentleman has offered to present the preserve with a large number of Mongolian pheasants, and the deer, beaver, mink and otter can all be secured in various sections of the state. A number of gentlemen who are anxious to preserve the wild fowl of this country are working to secure a string of wild fowl refuges throughout the entire country tributary to the Mississippi river, from New Orleans to the Canadian boundary. Through their efforts Mrs. Russell Sage of New York has lately established the first link in the chain by purchasing Marsh Island, near New Orleans, containing 75,000 acres, and it is to be held for all time as a bird and wild fowl refuge.

Our proposed game preserve will form another important link, and if it proves successful as a wild fowl refuge, other large marsh areas within the forest reserve can also be set aside. When the moose, elk, and fur bearing animals have increased to sufficient numbers, they should gradually be released from the preserve, but even then should be protected by law for a number of years. An appropriation of $20,000 is necessary to cover the cost of securing the game, and erecting the fence, but if the amount of game, and the number of fur bearing animals in northern Wisconsin, is thereby increased, this small appropriation will be repaid to the state many times over.

The doctors of the state who are in closest touch with the great problem of consumption, have long felt the urgent need of securing light out-door work for convalescent tuberculosis patients. The State Board of Forestry now has one large forest nursery containing about 2,500,000 tree seedlings, and within a year or two other nurseries will be built so that probably the

annual production of the nurseries will be about 2,000,000 seedlings, which will be nearly sufficient to reforest 2,000 acres a year.

Work both in a forest nursery, and in planting the seedlings, is light work which can be arranged so that it would be especially suited to the weakened condition of a convalescent consumptive patient. It is proposed to ask the legislature for an appropriation of $5,000 per year which would cover the cost of building and keeping in repair the wooden shacks in which the patients would live, and also the salaries of a doctor and nurse. The State Board of Forestry would set aside the land required for the sanatorium, forest nurseries and tracts to be reforested and would pay the patients for the time in which they were actually employed in working for the state.

At first a patient might not be able to work more than four hours a day, but at 15c per hour, he would have earned 60c, or more than his board for one day would cost, and all that he earned over and above the cost of his board, would be credited to him, so that when cured he could leave the sanatorium with at least a small amount of money to start life anew.

Some patients will find that they must continue to live in the cool dry climate of northern Wisconsin, and in such cases the State Board of Forestry could lease them small tracts of arable land near the public resorts, hotels, and private camps, and the patients would find that they would have a ready sale at good prices for all their vegetables, chickens, milk, etc.

There are also hundreds of men and women workers in Wisconsin, who though not consumptives are so run down and worn out that they are an easy prey to the disease. It is a good sound policy for the state to aid such people in regaining their health and thus avoid their becoming public charges, and the state could well afford to encourage them to build camps on many portions of the forest reserves and also to give them work in reforestation to a very considerable extent.

As a few months' out-door life in the bracing climate of northern Wisconsin will often make certain the complete cure of the convalescent consumptive, and also ward off possible consumption from the weak and debilitated worker, and as the state must reforest its denuded lands which are unfit for agriculture, it would seem both a sane and humane policy to give

the patient a chance to do the work for which he is so suited, bringing to him health and to the state future wealth, through the forests which will be grown.

During the summer of 1912, Professor O. L. Sponsler, of Michigan Forestry School, was employed by the State Board of Forestry, to make a careful study of farm woodlots in three typical counties in Wisconsin, and his report will be published during the winter. The counties of Sauk, Manitowoc and Lincoln were studied in detail, and it was found that in the majority of cases the farm woodlots were in poor condition, and were not being managed with the same care and thought that the farmer would devote to his other crops. This was not due to any lack of interest on the part of the farmers, for most of them fully appreciate the money returns which they receive from the sale of saw logs, ties, posts, poles and cordwood, but they did not appreciate how destructive the grazing of cattle in a woodlot is to the young growth, or how they can greatly improve the character and value of their woodlots by systematic cutting and protection from fire. The State Board of Forestry should coöperate to the fullest extent with the College of Agriculture in improving the management of farm woodlots. In eighteen of the northern counties the state owns timberlands which are under the supervision of the State Board of Forestry, and in these counties from 40 to 80 acres should be set aside and managed as demonstration woodlots in coöperation with the agricultural experiment stations, which are maintained by the College of Agriculture.

THE WEED SITUATION.

H. H. HOARD.

A study of weeds as related to the conservation of natural resources reveals some interesting facts. By inquiry and observation it has been found that weeds cause economic loss in several ways, some of which may be more or less closely demonstrated in dollars and cents, while others are impossible to measure at all accurately.

Farmers generally agree that any serious amount on a farm of such weeds as Quack Grass, Canada Thistles, Sow Thistles and Wild Mustard, materially reduces its value, the judgment as to the extent of damage varying from twenty-five to seventy-five dollars per acre. Farmers are also learning that the seeds of weeds will retain their vitality for several years, even when buried in the soil. Because of this they are loath to purchase farms where weeds have been allowed to go to seed along roadsides and in the fields unless a material reduction in price can be secured. Some allowance is necessary for the labor required to exterminate the weeds which will certainly appear as a result of allowing them to go to seed.

Another injurious effect of weeds is evident in the reduction of crop yields on the badly infested fields. The weeds are hardier, usually have wider leaf expansion and reach maturity sooner than the grain crops. They thus crowd and dwarf the grain. They remove greater amounts of plant food and moisture from the soil and in seasons of drouth often render crop production impossible. At the same time the rain or dew remains on the grain longer where shaded by weeds. In the warm growing season, this moisture combined with the summer heat

furnished the best environment for the development of rusts and smuts which in some fields have reduced the yield by forty-five per cent.

The presence of weeds causes greater wear and tear on machinery and horses during harvesting, a greater amount of twine to bind it, and may cause delayed drying or possible moulding of the grain.

The threshed grain from weedy fields is docked severely in price when exposed for sale on the market and elevator men have been known to dock grain to the extent of 24 lbs. per bushel because of weed seeds in it.

The report of the chief grain inspector of Minnesota shows that in 1903 the average dockage on wheat delivered at the Minnesota elevators was 18.3 ounces per bushel. In 1908 it had risen to 32.6 ounces per bushel. In seven years 863,592 carloads of wheat were inspected by the Minnesota inspectors with an average dockage of 24.9 ounces per bushel, or a total dockage of 196,420,800 lbs. Hence there were 3,273,680 bushels of weed seeds produced instead of wheat. With wheat at an average price of $1.00 per bushel there was a loss of the same number of dollars. The same rate of dockage applies to other small grains so that the loss was immensely greater than here shown where the figures are for wheat alone. In twenty years the loss from dockage on all small grain delivered at the Minnesota elevators amounted to nearly $70,000,000.

This same rate of dockage applied to Wisconsin crops would reduce the farm income of the state $1,600,000 annually and this does not take into account the reduction in price caused by impurities in alfalfa, clover, and grass seeds.

Many weeds are poisonous to live stock and serious losses have been reported at various times and in various localities, particularly on the Western ranges. The stockmen agree that the losses on the Great Plains amount to hundreds of thousands of dollars annually.

Weeds also reduce the crop producing power of the soil by secreting poisonous elements which are harmful to the cultivated crops. The extent of the damage in this case is hard to estimate but it is undoubtedly extensive. The losses above mentioned although great are insignificant when compared with the cost of the labor necessary to control and eradicate the weeds.

The Experiment Station reports an average expenditure of $38.83 per farm on 489 farms solely to cut, dig, or pull the weeds on the farm. While asked to report cost of cultivation of crops also the farmers reporting failed to do so. It is probable that had they done so the tax imposed by weeds would undoubtedly have been a big factor in the farm profit.

Two hundred and twenty-eight farmers reported an average of 3.32 acres of quack grass; 262 an average area of 5.6 acres of Canada Thistles; and one hundred and twelve an average area of 20.5 acres of Wild Mustard per farm. Five and one-half per cent of the pasture land was reported as useless because of weed growth. In one block of eight counties where the farms averaged one hundred and twenty-nine acres the farmers themselves reported an average area of fifty-five acres of the weeds which are defined as noxious in the Wisconsin statutes. It is probable that in these badly infested areas the crop production has been reduced at least twenty-five per cent.

From these reports from farmers and from data gathered in weed surveys of several counties in the state, the Agronomy Department of the Experiment Station has found that certain weeds are much more prevalent in some parts of the state than in others and that there are some localities where noxious weeds have not yet become well established.

In fact a very large area of Wisconsin farm land is free from noxious weeds and other large areas are infested but slightly. Herein lies the hopeful phase of the situation because there exists the possibility of preventing the inoculation of these now weed free lands.

How can this be accomplished? What methods will be most efficacious? Weed control has not appealed to the farmer as a necessary item of farm economy and very little has usually been done by the average farmer toward ascertaining the identity, habits, and character of the farm weeds. Other lines of farm work have seemed more important; and the farmer has allowed weeds to become established, forgetting that weeds like Quack Grass and Canada Thistles might eventually render all farming operations difficult at least, if not actually unprofitable. Hence the legislature of the state found it necessary to enact a law naming the weeds considered as noxious in character and requiring property owners to prevent them from seeding. The

enforcement of the law was vested in either a township weed commissioner or in the highway commissioner or "roadmaster." In the latter case the problem became even more localized as there may be several roadmasters in one township. Whether the enforcement of the law is delegated to a township commissioner or the various roadmasters in the township is decided annually at the town meeting.

A survey of the results is interesting. The Agronomy Department of the Experiment Station reports an effort to ascertain to how great an extent this law was being enforced. Return post cards were sent to every town clerk in eighteen representative agricultural counties, asking information concerning the amount expended annually in paying the per diem of weed commissioners and other necessary expenditures under the law. Of three hundred and fifty-two town clerks addressed but one-hundred and forty-seven responded. Of these one hundred and thirteen reported poor law enforcement, sixty no expenditures whatever for executing the law's provisions and eighty-seven report expenditures amounting to $9,109.88. Even with this expenditure of over one hundred dollars per township very little of permanent value was accomplished.

The law fails of its purpose for two reasons.

In the first place the remedy named in the law, viz.: the prevention of seeding, falls short of producing the desired results because our worst weeds spread even more rapidly by running roots and rootstocks than they do by seed. Hence were the law strictly enforced it would still fail in accomplishing that for which it was designed.

In the second place its enforcement depends upon local officials who hesitate to arouse the dislike and possible enmity of neighbors by insisting upon obedience to the law. Hence the taxpayers of the state are paying large sums annually with no adequate return.

The facts herein presented indicate clearly the gravity of the situation and the futility of attempting to improve it by means of the methods heretofore used. What then is to be done about it?

The weeds have been allowed to multiply and spread because landowners have considered other phases of farm economy more important than their eradication until the condition is

acute. The areas of noxious weeds in some sections are so large and have taken such complete possession of the fields that any legislation looking to their control must be very carefully thought out before it is finally enacted into law. It would not do, for instance, to require a man to eradicate forty acres of Quack Grass or Canada Thistles in a single year, especially if the field were already in a crop which he would be compelled to lose. Undoubtedly the enactment of more satisfactory and enforceable laws would be helpful but they should be so framed as to do away with local enforcement and be of such character as to cover all phases of weed control. No law can be enforced without the support of public opinion and farmers must learn to know the noxious weeds and how to eradicate them before anything effective can be accomplished. They must also be convinced of the heavy financial burden imposed by them. The average farmer possesses practically no knowledge of the identity of our most noxious weeds. For this he is not wholly to blame as the worst weeds we have are introduced weeds and not those to which farmers have become accustomed by years of association.

The first essential, then, is some method by which this necessary knowledge can be imparted to the farmers of the state in the shortest possible time. Funds should be furnished by the state to publish a book containing cuts of at least fifty of our most harmful weeds in their natural colors so that any one could easily recognize them. This book should also contain the cuts of the seeds of the same weeds in their natural colors and with their characteristic shapes and markings. This book ought to be not only available to farmers desiring it but at least one copy should be placed in every school in the state, at the state's expense. If desirable to do so a price might be fixed at which the book could be sold to those not engaged in educational work and thus meet a portion of the cost of publication.

The book should contain not only the illustrations but information concerning the weed, its habits, and methods of eradication. Thus any teacher could arrange exercises in which the pupils were required to bring to school those weeds which were proving troublesome on the farm. They could also be required to make collections of the seeds and associate seeds and weeds. Work done by the children interests the parents and each school

would become a distributing center for information. The whole community could thus be educated to know pure seed, to recognize weed seeds, to identify weeds, and to learn the ways in which weeds do harm or cause serious loss. The latter phase of the problem should be strongly impressed, as a direct demonstration of loss is a most convincing argument.

Already the crop production has been alarmingly reduced in some sections and the weeds are gradually but surely spreading to new areas. In some cases owners of badly infested farms have abandoned them in despair and sold them at greatly reduced prices rather than contend with the weeds.

The state can no longer afford to ignore so serious and important a phase of conservation and should take steps at once to provide suitable educational facilities and suitable legislation to correct the evil.

DRAINAGE.

W. O. HOTCHKISS, E. M. GRIFFITH AND E. R. JONES.

The question of land drainage is of great importance at present and is bound to increase in importance as more and more of our unoccupied lands with natural drainage come under cultivation. These drainable marsh lands are one of the greatest natural assets we possess, and as such, demand most careful consideration at the earliest possible moment. Such lands comprise nearly 3,000,000 acres—about 7.8 per cent of the total area of the state. These lands are susceptible of three possible uses, so far as our present knowledge of them extends, and their proper economic development entails a careful consideration of their value for each of the three purposes.

1. They may be drained and used for agricultural purposes.

2. They may be held until such time as economic conditions will permit the profitable marketing of the two and a quarter billion tons of finished peat they are estimated to be capable of producing.

3. They may, when favorably situated, be submerged and used as reservoirs for the regulation of stream flow, both for the benefit of water power and for the prevention of floods. It is probable that many marshes in their natural state are of importance as reservoirs. In connection with this the effect of drainage of swamps upon flood conditions of the streams below them must be studied and the facts ascertained.

1. USE OF MARSH LANDS FOR AGRICULTURAL PURPOSES.

As a class drained marsh lands are among the most fertile of our soils. Much of the marsh in the state is suitable for no

other purpose. It is not favorably situated so as to be available for reservoir purposes, or the peat which it contains is too thin or contains too much sand, marl and other impurities to permit of its being used for fuel. These lands should be drained and put to productive use, and such laws should be passed as are needed to facilitate this work.

The present drainage laws are cumbersome and inadequate. They result in placing grievous unnecessary burdens upon those who undertake to drain marshes. They forbid the sale of state marsh lands in parcels of more than 160 acres, and require each purchaser to bind himself never to enter into a combination with others to pool his land. As a result, much state marsh land in the well settled southern part of the state is held back from development. It seems to this committee that true conservation of this resource would be furthered by passing a law permitting individuals or corporations to acquire larger areas—under such regulation as the legislature may see fit to impose—for the purpose of draining these lands and putting them upon the market, unless such lands are of greater value for purposes other than agricultural in which case they should be held by the state. Or the state might, with propriety, proceed to drain the lands and afterward dispose of them to actual settlers. This would require an amendment to the state constitution, but inasmuch as the legislature has before it an amendment to permit the state to take up the development of water storage and stream development, this subject might well be considered along with that.

Since the greatest difficulty is the lack of knowledge in the beginning of the work, it is believed that much of the litigation on drainage matters can be done away with by requiring the petitioners to have a preliminary survey and assessment of damages made by the College of Agriculture at the expense of the petitioners. Remonstrants would then have something definite against which to protest and not merely the indefinite fear, as at present, that the assessments would be unduly high.

A second important provision for reducing the amount of litigation and for promoting drainage would be to have one man, an expert in drainage matters, appointed by the Dean of the College of Agriculture to be one of the three commissioners of each drainage district. This expert would be of the greatest possible assistance as he would not only be thoroughly familiar

with the difficulties of all the districts but also with the law, and he could guard the commissions from many of the difficulties which they now get into unawares.

At the request of this committee one of our members, Mr. Jones, has made a special report on drainage of lands and changes in the present laws that are desirable for the purpose of removing the present difficulties of this work. His report is embodied herewith.

2. USE OF MARSH LAND FOR PEAT CONTENT.

The last biennial report of the State Conservation Commission contains a report by the chairman of this committee on the value of marsh lands for the development of the peat which they contain. Under his direction a report on the peat resources of the state and their use is being prepared for the Geological and Natural History Survey. This report is preliminary in character and further detailed studies should be made as need arises.

At present there are in this country no commercially successful operations developing peat for fuel purposes. Coal is too cheap, and the public is too thoroughly accustomed to its use to permit the production of a new and strange fuel to attract the attention of capital. It is acknowledged, however, by all men who have looked into the question at all carefully, that the time is coming, and coming rapidly, when Wisconsin and other states with great areas of peat marsh, must find these marshes an important source of fuel. The drainage and cultivation of a marsh are almost certain to destroy the peat for fuel purposes. It becomes highly important then to ascertain in so far as possible what of our marshes can most profitably be preserved for future utilization of their peat content for fuel.

Obviously the practicability of commercial utilization of a marsh for the production of peat fuel will depend chiefly upon the character and extent of the market, the size of the marsh, and the thickness and character of the peat. The market must be such as to warrant a reasonable profit on the investment. The marsh must be large enough to justify the installation of necessary apparatus, and the peat must have sufficient depth to permit economical working, and be clean enough to make a satisfactory quality of fuel.

An acre of peat one foot thick will produce slightly more than 200 tons of finished peat. With this as a basis we can make certain reasonable assumptions and find the total profit per acre to be made when conditions are such as to permit development, and give the various assumed amounts of profit per ton, and the present value of this profit.

1. Assuming that conditions will be such as to permit the development of peat for fuel in 50 years' time;

2. Assuming net profits of $0.50 per ton and $1.00 per ton in the table, and $0.25; $0.50; and $1.00 per ton in the diagrams.

3. Assuming 8 per cent interest, compounded annually, as the return necessary for capital invested in such a speculative venture, and

4. Assuming that the rate of taxation will continue to be 1½ per cent of the true value throughout the fifty year period, the total profit per acre and the present value per acre are readily computed and found to be as given in the following tables for various thicknesses of peat.

Thickness of peat.	Tons per acre finished peat.	Total net profit per acre at end of 50 year period.	
		At 50 cts per ton.	At $1.00 per ton.
6	1,200	$600	$1,200
9	1,800	900	1,800
12	2,400	1,200	2,400
15	3,000	1,500	3,000
18	3,600	1,800	3,600
21	4,200	2,100	4,200
24	4,800	2,400	4,800

To find the present value of these profits, which are assumed to be returned at the end of 50 years, we must find what sums put at compound interest at the rate of the carrying charge—8 per cent for interest on investment and 1½ per cent for taxes—will equal these various profits. These present values will give the price that might be paid per acre and return 8 per cent net interest after 50 years. The following table gives these figures with approximate accuracy.

Carrying charge 9½ per cent per annum.

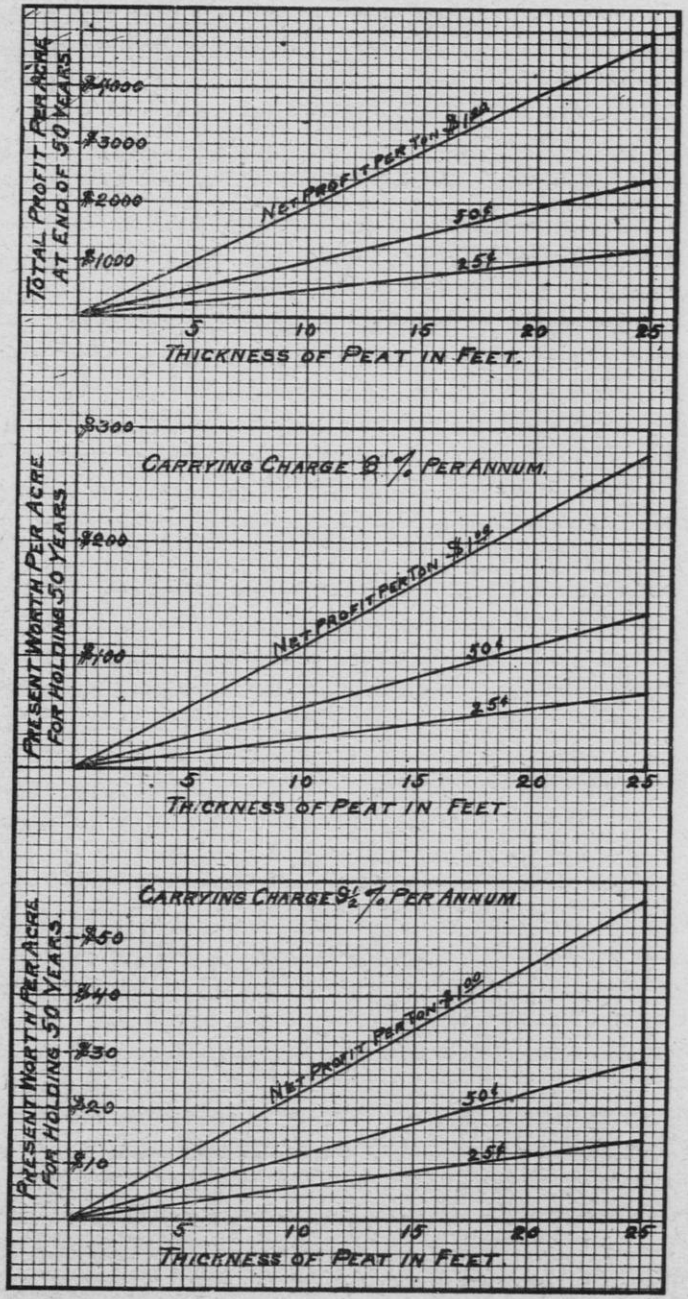
Thickness of peat.	Present value per acre.	
	At 50 cts. net profit per ton.	At $1.00 net profit per ton.
6	$7.05	$14.10
9	10.58	21.15
12	14.10	28.20
15	17.62	35.24
18	21.15	42.30
21	24.65	49.30
24	28.20	56.40

If the carrying charge be figured at 6 per cent per annum,—which would be amply large if the state were to hold such marshes as are in its possession until they became available for fuel purposes—the present value per acre would be as shown in the following table:

Carrying Charge 6 Per Cent Per Annum.

Thickness of peat	Present value per acre	
	At 50 cts. net profit per ton	At $1.00 net profit per ton
6	$34.50	$69.00
9	51.75	103.50
12	69.00	138.00
15	86.25	172.50
18	103.50	207.00
21	120.75	241.50
24	138.00	276.00

The following curves give in diagrammatic form the information contained in the tables:


TOTAL PROFIT PER ACRE AT END OF 50 YEARS.
$4000
$3000
$2000
$1000
NET PROFIT PER TON $1.00
50¢
25¢
5
10
15
20
25
THICKNESS OF PEAT IN FEET.
PRESENT WORTH PER ACRE FOR HOLDING 50 YEARS.
$300
CARRYING CHARGE 3 % PER ANNUM.
$200
$100
NET PROFIT PER TON $1.25
50¢
25¢
5
10
15
20
25
THICKNESS OF PEAT IN FEET.
PRESENT WORTH PER ACRE FOR HOLDING 50 YEARS.
CARRYING CHARGE 3½ % PER ANNUM.
$50
$40
$30
$20
$10
NET PROFIT PER TON $1.00
50¢
25¢
5
10
15
20
25
THICKNESS OF PEAT IN FEET.

When peat is suitable for specially valuable uses, such as the manufacture of fibre board, its value is considerably greater than for use as fuel. Marshes of this kind should in all probability not be drained but kept for the more profitable use.

3. USE OF MARSH LAND FOR WATER STORAGE.

The value of marshes for this purpose is a matter which should be investigated in detail, so that the facts may be known. At present it is observed that streams flowing from some marshes preserve a very desirable uniformity of flow. It is quite likely that such marshes have a considerable value for reservoir purposes if left in their natural condition. If these marshes are full of good peat the value for water storage would probably be more than sufficient to pay carrying charges, so that the peat would be practically clear gain when it could be utilized. After removing the peat a lake valuable for water storage would be the result.

In some cases marshes can be flooded by the erection of dams where it is desired to increase the storage. Such a proceeding would not injure the peat, unless the streams entering the reservoir were bringing in sediment. The later working of the peat by dredges might even be facilitated by the existence of the reservoir, and its removal would usually serve to enlarge the storage capacity. Where peat marshes are susceptible of such double use it seems quite probable that the most economic use will be this rather than for drainage.

The effect of the drainage of marshes upon the run-off, particularly as affecting the flood heights of streams below the drainage districts, is a subject that needs careful investigation. The common idea is that expressed in the report of Senators Husting and Krumrey of the Water Powers, Forestry & Drainage Committee of the legislature of 1909. "Drainage has for its object the hurrying away of waters. Drainage is repugnant to the conservation of waters. Conservation means the saving of waters, and drainage means the wasting of them."

This idea is at best only a half truth, and it is believed by many engineers that drainage is an efficient help in conserving water. Mr. C. B. Stewart, a consulting hydraulic engineer, who has investigated storage reservoirs for the State Forestry Board, and is now looking after reservoirs on the Chippewa for the

Chippewa River Improvement Co., states*; "for a watershed already under control by a reservoir * * * it will be advisable to drain all swamp lands and keep the ground water table as low as possible, so as to increase the yield to the reservoir." The reasons for this are that marshes filled with water cannot absorb the rainfall like those that are drained and have several feet of porous material at the surface to absorb the rain and give it out gradually to the ditches. Water in filled marshes is subject to material loss by evaporation, while if it can rapidly penetrate below the upper few feet of soil it is protected from all losses of this character.

The preceding paragraph applies to watersheds controlled by reservoirs. Where the watershed is not controlled it is impossible to say with assurance whether the drainage of marsh lands will increase or diminish the flood heights of the streams below. It appears probable, from our present very insufficient knowledge, that the increased absorption of rainfall by drained marshes may in many cases delay the run-off after heavy rainfall until the flood height of the stream is passed. In such cases the absorbed water would be given off later and increase the flow in the succeeding low water stage of the stream. In other cases it is just as probable that the presence of ditches may increase the flow in the stream at flood stage. The design of the drainage system will play an important part in determining whether this is to be the effect. Before it will be possible to determine this a careful study must be made of the effect of drainage systems upon the run-off from particular areas, and such study should be made at an early date, so that our drainage work may be more intelligently planned.

Based upon the foregoing statements your committee would respectfully make the following recommendations:

RECOMMENDATIONS.

1. That the drainage laws be changed so as to reduce the unwarrantably great expense now attendant on the organization of drainage districts and the litigation connected therewith, and so hasten the development of this important part of our soils.

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* Personal communication.

For this purpose that the law require a preliminary survey and assessment of benefits and damages to be presented with the original petition to organize a district; and that one man be appointed by the Dean of the College of Agriculture as an expert member of all drainage commissions in the state.

2. That the present laws be amended to permit the acquisition, under suitable regulations, of more than 160 acres of state marsh land by parties desiring to drain them.

3. That the legislature consider the advisability of amending the constitution so that the state itself will have the right to acquire, drain and develop marsh lands and open them for settlement.

4. That the state retain the large marshes it already owns, which contain 12 feet or more of good, clean peat suitable for fuel and other purposes, until such time as they may profitably be disposed of for these purposes.

5. That the legislature provide for an adequate study of problems relating to drainage and its effect upon floods by an appropriation for the purpose to some properly qualified state body.

THE DRAINAGE OF WET AND MARSHY LANDS FOR AGRICULTURAL PURPOSES.

E. R. JONES.

THE AGRICULTURAL VALUE OF MUCK AND PEAT.

That peat and muck marshes can be drained and made valuable agricultural land is firmly established. On a bed of peat from four to ten feet deep M. J. Vea at Stoughton has raised three successive crops of corn, the yield in 1911 being over 80 bushels per acre on 33 acres. About one half of this was sold as seed corn for more than two dollars a bushel. Carl Foll at Deerfield reports yields almost as good as this for a period of years on about 80 acres of the same kind of land. Both of these areas were tiled with lines laid from 3 to 4 feet deep, from 66 to 100 feet apart and costing about 25 dollars an acre. Previous to drainage these areas were too soft and wet for satisfactory pasture, and too boggy to admit of cutting the poor quality of grass for hay. Formerly these lands found no buyers at ten dollars an acre. To-day in these localities undeveloped marsh lands are bringing from 30 to 60 dollars an acre and Messrs. Vea and Foll would not sell their drained peat lands for 100 dollars an acre. With drainage the reddish peat had become a solid, well decomposed black muck. Immediately after drainage all adjacent fires were guarded to prevent the possible burning of the peat. The muck of to-day is less subject to damage by fire, and a great deal of it has become so solid that it will not burn at all.

Many areas of peat and muck have produced satisfactory crops along the sides of outlet ditches from six to eight feet deep. W. B. Coddington at Plover, W. S. Braddock at Mather, J. Q.

Daniels and Fred Gunther at Babcock. D. Burkey and Fred Albrecht at Valley Junction, J. M. Andrew at Marinette, D. Van Ostrand at Phillips, and many others have had results to confirm this. In 1909 the Department of Soils of the College of Agriculture observed a yield of 31 bushels of wheat per acre on 90 acres of Mr. Coddington's land.

The marsh soils contain a higher percentage of the nitrogen fertilizers than do the upland soils. The probable deficiency of marsh soils in the mineral fertilizers can be supplied by commercial fertilizers at a cost not exceeding two dollars an acre annually. This is less than the cost of keeping upland soils in a good state of fertility by the application of barnyard manure.

Bulletin 205 of the Wisconsin Experiment Station may be referred to relative to the management of marsh soils. Likewise Bulletin 199 deals with their drainage. This bulletin concludes that there are about 2,500,000 acres of undrained muck and peat marshes in Wisconsin. A vast majority of these lands depend for their drainage upon the construction of outlet ditches, involving the coöperation of sometimes 100 landowners. Circular 6 of the Experiment Station summarizes the state laws which prescribe the method of such coöperation. The improvement of these laws to meet existing conditions is a vital factor in the agricultural development of Wisconsin.

THE HISTORY OF THE DRAINAGE MOVEMENT.

The success which had attended the drainage of marsh lands in Illinois sent many capitalists into Wisconsin in search of cheaper marsh lands. These men were attracted by the abundant fall, the broad extent of continuous marsh land and the low land values in the central part of the Wisconsin river valley. They bought vast quantities of these marshy lands during the years between 1900 and 1905. By 1906 nearly 300,000 acres had been organized into seven drainage districts. It was then that disappointments were met. The acid peat marshes dotted with islands of sand and surrounded by sandy uplands, are more raw and decompose more slowly than do those within the glacial area of the southern and eastern parts of Wisconsin or of Illinois. Furthermore, these areas receive no reflected value from a highly developed adjacent upland. New settlers have been slow in com-

ing, and old settlers, too often because of a feeling of resentment against the drainage movement, have been slow to avail themselves of the benefits of the better drainage possibilities. The result is that some of these drainage districts are standing still.

The development of a large marsh by a few deeply interested capitalists who have purchased the holdings of the smaller owners has many advantages. The organization is made less cumbersome thereby. But when these capitalists demand an exorbitant pay for their enterprise and risk, before they resell to the small holder, they are retarding the development of the community, and usually injuring themselves financially.

In the southeastern part of Wisconsin organized drainage has had a slower but a more healthy growth. Here the marshes are uniformly smaller and usually long and narrow. When drained they have been operated in conjunction with the adjacent uplands with mutual advantages. Forty acres of thoroughly drained marsh land is better corn land than the upland included in the same farm.

Too often, however, in the southeastern part of Wisconsin, as well as in the central, either due to negligence or bad judgment, poor drainage has attended the attempted improvement. Some districts have installed good outlet ditches 8 feet deep, but have not put in the lateral drains to collect the water within the area or to cut off the water seeping or flowing into it. Others have made outlet ditches only five feet deep which is usually too shallow for an outlet. Others have put in a network of ditches only three feet with no outlet at all. The crops produced by marshes thus imperfectly drained indicated, not what good drainage will do, but what poor drainage will not do. The drainage has been sufficient to kill the natural marsh grass, but not good enough to permit the deep rooting required by tame grasses or cultivated crops.

Our supreme court has decided that drainage commissioners may not enter a navigable stream for drainage purposes. The term "navigable stream" is so broad in its legal definition that the powers of drainage commissioners are seriously crippled by this decision. The court hints, however, that the legislature may give to drainage commissioners jurisdiction even in navigable streams.

There has been a lack of uniformity in apportioning the cost of construction in drainage districts. Some have simply put in an outlet ditch and based the assessment of benefits upon the distance of the different parcels of land from the ditch. Others have put in lateral drains in addition to the main to equalize the drainage so as to justify a flat one-rate assessment. Others have made a flat assessment with no lateral drains at all.

Most of the drainage districts have employed engineers to make their final plans. These engineers have usually taken kindly to the preliminary and final suggestions of the Department of Soils of the College of Agriculture. In many cases, however, drainage commissioners have not carried out some of the important features of these plans. The commissioners of the Dancy Drainage District decided to make the main ditch at the outlet end half a mile shorter than called for by the engineer's plans. Thereby they lost several feet of fall and the main ditch has been almost a total failure. With no machinery at hand it will be very expensive to do this work now.

Other ditches have been installed, particularly by town boards, without the aid of an engineer at all and with sad results. In one case there was evidence that the drainage commissioners had assessed the benefits to each piece of land in their attorney's office without examining each piece of land for themselves. Drainage commissioners are usually, as they should be, practical farmers and as such they can render valuable service. Without criticising the good intentions of the commissioners, the interests of the landowners demand that they should be guided in the engineering features of the work, not by their own judgment or that of their attorney, but by that of a competent engineer, who may, and should be, held responsible for the formation and execution of the plans.

A great many mill pond dams hold water on thousands of acres of otherwise valuable land. Other ponds are kept merely for boating purposes, but the damage they do is none the less. In other places hunting clubs, desirous of keeping the marshes to harbor game for shooting purposes, have successfully resisted the organization of drainage districts.

Litigation, arising usually out of misunderstanding, and encouraged by the liberal provision of our drainage district law for the hearing of remonstrances, has made the cost of organization of some drainage districts excessive. It has averaged about 20

per cent of the total cost of the work. The following gives an itemized statement of the cost of two districts that have been organized.

APPROXIMATE COST OF YELLOW RIVER DRAINAGE DISTRICT.

Excavation	$7,800.00
Discount on Bonds	1,500.00
Attorney's Fees	4,000.00
Printing	500.00
Clerk's Fees	500.00
Survey	500.00
Commissioners' Earnings	1,000.00
Total	$15,800.00

Organization expense 51% of total.

EXACT COST OF LARSEN DRAINAGE DISTRICT.

Earnings of Commissioners up to July 1st, 1911	$1,076.83
Attorney's Fees	681.65
Premium on Surety Bonds	84.00
Printer's Fees	86.65
Clerk's Fees	90.15
Engineer's Expenses	49.14
Moving Bridge	195.00
Miscellaneous	182.26
Excavating	9,000.00
Building Railroad Bridge	1,460.00
3 Town Bridges	900.00
Total	$13,805.68

Organization expense 16% of total.

THE REMEDY FOR EXISTING EVILS.

From the foregoing it is evident that it is the abuse of marsh land together with shortcomings in our drainage laws that has caused any prejudices that may exist against the organized drainage of marshes. These causes may be summarized as follows:

1. Misunderstanding of the apparent failures that are recorded.
2. Constitutional or legal restrictions.
3. Excessive expenses of legalized organization.

The Department of Soils of the College of Agriculture is lending all the aid its funds permit by field demonstrations and lectures to direct in the proper drainage and management of marsh soils. The funds of the department make it barely possible to make preliminary surveys of only those marshes where drainage has been agitated. There are many marshes lying idle whose drainage possibilities are greater than are those of the marshes whose drainage has been accomplished. Farmers need to be awakened to these possibilities.

Three thousand dollars a year would keep a drainage survey party in the field continuously. The Appendix shows the nature of the report such a party could make. The cost of this survey was about two cents an acre without the assessment roll and about five cents an acre with it. It would seem best to engage the drainage survey party in a systematic survey of the state by counties or river basins with administrational provisions that would permit of withdrawing the party from the regular work to engage them upon a special area whereon a drainage district is contemplated, and a survey is asked for.

In the cost of the Larsen Drainage District the opposition to drainage was as bitter as is found anywhere. Only a substantial minority favored drainage at first. The report tempered this opposition with reason. Before the petition was handed to the court, all opposition had vanished. A few minor remonstrances were handled by the commissioners in an informal way, so that no contests reached the circuit court. This accounts for the low organization expense. In every district in the state prejudices would be removed and differences would be adjusted out of court if the people were advised in a preliminary way of the possibilities of their marsh.

Drainage commissioners should be given authority to enter navigable streams for drainage purposes where the public welfare seems to demand it. There should also be legislation that will remove all technical obstacles to the drainage of cat-tail wallows that are a menace to a community, but which are held in trust by the state as so-called lakes.

The report of the drainage surveyors should be given a legal status that will enable it to take the place of the tedious and expensive testimony that is now taken in circuit court to bear upon the merits of a proposed drainage work.

Only two of the commissioners should be appointed by the circuit court. The other should be designated by the Dean of the College of Agriculture as ex officio a commissioner in all drainage districts in the state.

To review the action of the commissioners there should be access by appeal to a state drainage commission, the expense of the action of this commission to be borne by the losers in the contest. The only duty of the circuit court would then be to confirm by order the findings of the drainage commissioners, or of the state drainage commission.

THE LARSEN MARSH*

E. R. JONES.

Location. This area lies in Ranges 15 and 16 East, Town 20, North in Winnebago county. The Chicago & North Western Railroad extends through the marsh and the Village of Larsen is at its edge.

Present Condition. The area indicated on the map as marsh is too wet for satisfactory pasture. Continued pasturing has made the surface boggy and brought in a heavy growth of weeds upon portions of it. It is too boggy to admit of mowing the marsh grass for hay. Some portions of the marsh are so wet that cat-tails grow there. Near the center are two islands of hard land. These are inaccessible now except with difficulty and drainage would benefit them for this reason.

The Soil. The soil consists of muck and some peat to a depth of about six feet near the center of the marsh. Under this clay is generally found, but several streaks of sand have also been discovered. Near the exterior of the marsh the muck decreases in thickness to less than one foot. No portion of the marsh has been drained to an extent that would admit the production of farm crops. For this reason no real test has been made of the fertility of this soil. However, soils more peaty than any found on this marsh have been made to produce corn and timothy hay with proper management.

The Topography. At the head the marsh slopes northward into another basin. Only at the sides does foreign water enter in large quantities. The levels taken showed 13 feet of fall from the head of the marsh to the lake in Section 35. This is distributed remarkably evenly the whole extent of the marsh. At

*Copy of report to owners following a preliminary survey by the Department of Soils of the College of Agriculture.

the lower end the marsh becomes narrow, but it will be necessary to extend the proposed ditch to the lake so that all the fall that is available may be used. There is a lateral fall toward the water course of about one foot in 80 rods. This is sufficient for any supplementary drains which may be put in discharging into the main ditch.

The Outlet Ditch. The location of the proposed outlet ditch is shown on the accompanying map. The location was not staked except in a general way, and minor changes may be made in the location upon the final survey before the final estimates are made. It will not differ substantially from the preliminary location shown, however. Open laterals have been omitted from the plans for the reason that surface water can be carried into the outlet ditch by means of road ditches and other surface runs that can be made with teams at a very small cost. The slope toward the outlet ditch is sufficient that such drains will be ample for surface drainage. For under drainage main lines of tile 8 inches in diameter and serving perhaps three or four landowners are advised to collect the seepage water by means of laterals at the edge of the marsh and to lead it into the outlet ditch. These supplementary drains will be more economical than open laterals dug with a dredge. A floating dredge, with perhaps a one-yard dipper, will be the most economical means of digging the outlet ditch.

This ditch should have a bottom width of 4 feet at the head, increasing to 6 feet, then to 8, and finally to 10 feet as the lower end of the marsh is reached. With a depth of 6 feet at the head, one of 8 feet near the center will give an ample gradient. To increase the carrying capacity of the ditch it should be dug at least 3 feet below the water in the lake near the lower end of the marsh. This would mean a cutting decreasing to 4 feet in depth. The side slopes of this ditch should be one to one, thus making the top width vary from 16 feet at the head to 22 or 24 feet near the center and lower part of the marsh.

Obstacles. Gravel, boulders, and perhaps some ledge rock will be encountered in the prism of the ditch on the center of Section 36 westward for half a mile. It is not probable that more than 200 cubic yards of ledge rock will have to be removed. At a cost of a dollar a cubic yard the additional expense of this would be trifling.

Two highway bridges will have to be replaced by larger ones and one large bridge on the west line of Section 36 will have to be removed from its foundation to permit the dredge to pass through. Likewise the railroad bridge will have to be replaced near the Larsen station. The benefit which the proposed ditch will be to the town in making it easier to maintain a road on the marshy land will be enough that the town can be assessed for benefits equal to the cost of removing and replacing the bridges. The railroad company will also be benefited perhaps more than the cost of the new bridge will amount to.

The Cost. As nearly as can be estimated the proposed ditch, a little over five miles in length, will cost about $2000 a mile or about $10,000. There will be some costs connected with the organization of the drainage district, amounting perhaps to 20 per cent of this. This will bring the cost up to $12,000. This is distributed over the 2700 acres of marsh land within the area and will make the average cost about four and one-half dollars an acre.

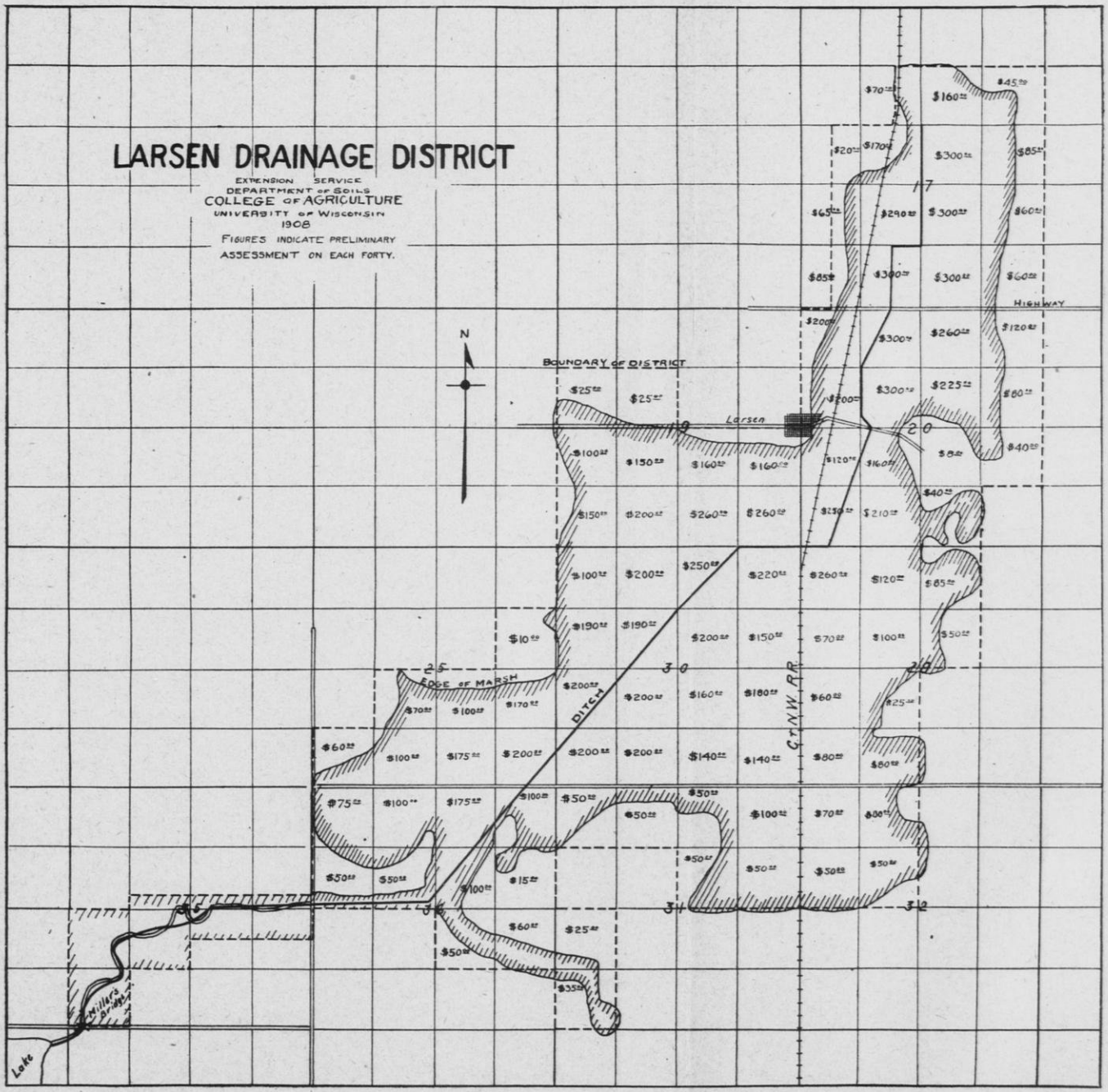
The Rating. A few of the tracts of land near the head of the marsh and lying adjacent to the ditch were assumed to receive a maximum benefit. Farther away from the ditch the benefit is not so great, due to the distance from the ditch. Near the lower end of the marsh the benefits are comparatively small because the elevation of the lake prevents drainage to a satisfactory depth. The figures in the tax column of the assessment roll are the products of these two factors.

The Steps to be Taken. The project is feasible from every standpoint. Its nearness to the market and the high value of the surrounding upland reflect a value upon the marsh. We recommend that steps be taken at once to organize a drainage district. This report and this map should be turned over to a reliable attorney as a basis for drafting a petition. There should be no difficulty in securing the signatures of a majority of the land owners concerned. When your commissioners have employed their engineer to make the final survey our department will gladly coöperate by way of consultation. We will also furnish him a duplicate copy of the field notes of the survey that has been made so that he may locate the bench marks we have used.

LARSEN DRAINAGE DISTRICT

EXTENSION SERVICE
DEPARTMENT OF SOILS
COLLEGE OF AGRICULTURE
UNIVERSITY OF WISCONSIN
1908

FIGURES INDICATE PRELIMINARY ASSESSMENT ON EACH FORTY.



THE REGULATION OF FISHERIES.

E. A. BIRGE.

There are probably few subjects on which legislation is at once more abundant and less satisfactory than that of the fisheries. This is in some part inherent in the nature of the subject itself. It is no easy task to frame regulations which, on the one hand, will permit the widest possible use of fish for purposes of sport and for food, and, on the other hand, will limit that use so as to prevent the depletion or exhaustion of the stock of fish contained in our waters. The difficulty of the general problem is much increased by conditions which add greatly to the natural difficulties and which may be removed. These may be classed under two heads:

1. The inland fisheries, especially, need many regulations which are properly local in character. These at present have to be treated through the legislature by amendments to the general statutes of the state.

2. The state has not at hand sufficient knowledge on which to base its regulations.

As example of the kind of legislation specified under the first head consider chapter 181 of the laws of 1911. This permits the use of wind shields in Dane county by persons fishing through the ice; a practice elsewhere prohibited. This statute permits a practice whose wisdom or unwisdom is a question depending solely on local conditions. The fish in the lakes of Dane county may be so abundant that they will not suffer undue depletion from the increased fishing which will naturally follow the increased comfort due to the wind shield. If they are

so abundant, or if the kinds of fish ordinarily caught through ice are so abundant, the wind shield should be permitted. If the facts are other than as stated above, wind shields should not be allowed.

In selecting this illustration, no point is made against the justice or the wisdom of the law to which reference is made. The point is that the law belongs to a class of subjects which in other departments have ceased to come before the legislature and which in this department should be regulated by methods similar to those that the legislature has appointed in other cases. No public policy is involved; no legislative question is presented. It is a local detail of a general subject which should be controlled by administration order, issued under principles laid down by the legislature and by authorities to whom the legislature has committed the duty of issuing such orders. It should not be regulated by statute any more than the charges of a local electric light company should be so regulated, or a local street railway should be directed by statute to extend its service.

On the other hand, the matter is by no means of local concern. The state, as the owner of its fish and interested in conserving the fisheries for the benefit of the people, has an immediate and great concern in regulations of this sort, which are intended at once to permit the maximum enjoyment of the fisheries and at the same time to prevent their depletion by selfish or thoughtless interests.

An examination of the fish and game laws of the state will show numerous regulations of the same kind as chapter 181 of the laws of 1911. No one may fish through the ice on Pardeeville mill pond, or spear fish at any time in "Lake Mason, commonly known as Briggsville pond;" or have in possession in any one day more than twenty-five pounds of bullheads "caught in the waters of Dodge county." Until January 1, 1912, it was unlawful to catch any fish except carp in the mill pond at Wautoma, and no one may fish with nets in Beaver Dam Lake before July 1, 1913. These regulations, and many others which might be cited, are necessary for the control of the inland fisheries. More, rather than fewer, are needed if the purposes of the state with regard to the fisheries are to be properly carried out. But these local regulations should be issued, not by the legislature, but by some body empowered to investigate the local conditions

and to issue regulations under general principles fixed by legislative enactment. In this way the control of fisheries would be assimilated in method to that of other matters in the state which are primarily local in character but whose conduct is of concern to the public.

The second point to consider is that the state has not enough knowledge to enable it to take intelligent or wise action in many of these matters. For an example, consider the question of fishways in dams. Much legislation of very various import has been passed on this subject in the past twelve or fifteen years; yet there is no person who is so well informed as to know positively whether this legislation was wise or unwise, and there never has been such a person. The Commissioners of Fisheries have investigated at several fishways the number of fish which have ascended them during the "spring run." These have been among the best constructed and best maintained fishways in the state. Practically no use was made of them, except by a very few suckers. No single case was found of a game fish ascending them. Now, no person would pretend that an investigation of this sort, limited to a few cases only, ought to settle so important a question as that of fishways. But at present there is no other direct evidence from Wisconsin. The point to be made is that much more knowledge and much more direct evidence is necessary if wise action is to be taken on this subject. Here is a question of great importance. It involves many questions of interest to the fisheries of our streams. It also involves considerable money, for the construction and maintenance of fishways in dams means an expenditure of many thousands of dollars, which ought not to be spent to no purpose. Yet the state is wholly without the knowledge which will enable it to legislate wisely in this matter. That knowledge ought to be obtained and a legislative policy regarding fishways established on it.

Take another case of a different kind. All persons agree that the closed season for black bass should include the spawning and nesting period, and that this protection is fundamental for the maintenance of a stock of bass in lakes and rivers. The legislature should fix this principle of protection during the spawning season by statute, and, indeed, it has sought to do so in fixing the dates of the closed season. But in the waters of a

state like Wisconsin, extending for 300 miles from north to south, the dates of spawning are not uniform, nor are the dates the same when the fry leave the nests and scatter to look out for themselves. This matter ought to be studied in all the various types of waters in different sections of the state and regulations issued fixing the closed season in accordance with the dates thus ascertained.

A third case may be cited, relating to one of the most valuable fish in the outlying waters—the lake trout. The state is raising great numbers of the fry of this fish and planting them in the Great Lakes. The hatcheries on the Great Lakes represent a large investment and a considerable sum is annually expended for their maintenance. Some 25,000,000 of lake trout fry will probably be planted in 1913. But no one can answer, with even approximate certainty of knowledge, the question as to the minimum size which the lake trout should be allowed to reach before it may lawfully be caught. It is generally agreed that the minimum size for a commercial fish should be at least that which will allow it to have spawned, and this is no doubt the end which the law tries to reach. In the case of the whitefish, it is known that protection until the fish reaches a weight of about two pounds is sufficient, and this is the protection which our laws afford. But no such knowledge has been acquired regarding the breeding habits of the lake trout to be sure that protection until the fish reaches a length of fourteen inches is, or is not, sufficient. Yet since the state is raising and planting lake trout fry on a great scale, it should also ascertain the facts which will enable the legislature to give suitable protection to the young. It is not asserted that the limit of fourteen inches is wrong, but that we are not sure that it is right.

In the case of the commercial fisheries, matters of great importance depend on wise regulation. The Great Lakes are a most important source of food of our people and the fisheries are one of our most important industries. The state is deeply interested in these fisheries. The regulations should be such as will make possible the largest returns from the lakes in food for the people. They should protect the fish to the point which will make possible the largest permanent catch and should permit the fisherman to take fish at the size which will yield the greatest catch, consistent with

the maintenance of the stock of fish in the lakes. Thus the interests of the public and the fisherman are in the long run identical and both are concerned in having the regulations so adjusted as to secure these ends.

In all of these cases, and many more which could be instanced, the state ought to procure the knowledge which is necessary for wise action. The position of the state regarding the fisheries has gradually, but inevitably, undergone a radical change, so far as its attitude is determined by the support which it gives to the work of the Fish Commission. Thirty-five years ago the Commission began its work and planted a few thousand brook trout fry and a limited number of whitefish and lake trout. No one then thought that the success of our fisheries, both for the ends of sport and commerce, would come to depend on the work of the Commission; no one thought that the annual crop of our waters would come to be, in large measure, a planted and cultivated crop, as much as that of our soils. Yet such is the case, and the state has recognized the fact by establishing new hatcheries and by providing the Commission with constantly increasing income. More than 200,000,000 fry are now planted every year, and no one doubts that the number will increase rapidly in the near future. It must increase if the annual crop of fish is to be as large as it ought to be. In a word, the state is now carrying on fish culture, not as a small accessory enterprise, chiefly intended to aid the development of sport. Fish culture and fish protection are now business undertakings as much as agriculture. If they are to be wisely and successfully carried on, and if the people are to receive the largest possible returns for the money put into the work of fish culture, the state must make the same kind of provision for careful investigation and study as it has done for agriculture.

It is not difficult to draw the two practical conclusions which should be reached in the light of the facts stated above.

First, the state should recognize that for the proper control of the fisheries two kinds of regulation are necessary, which may be called legislative and administrative. The legislature should establish by law the ends to be sought and the principles to be followed in regulating the fisheries. It should establish by law all regulations which are state-wide in extent and which are not subject to frequent change. The Fish Commission should

be charged with the duty of making orders in specific cases. They should control such matters as the kinds of apparatus which may be used in certain inland waters, the conditions and times under which fishing through the ice may be carried on, whether pickerel shall be classed in certain waters as a rough fish or as a game fish. They should decide in what waters rough fish may be netted and in what waters this practice should not be allowed; where dip nets may or may not be used; where and how minnow seines may be used. In short, such matters as the provisions regarding specific localities in Sec. 69, 72, 73, 74, 77, 78, 79, and such as those in Sec. 88b of the Fish and Game laws should be treated under administrative orders and not by general legislation.

Second, in order to enable the Fish Commission to perform this duty, they should be granted money from the hunting and fishing license fund sufficient to enable them to make proper impartial investigation of the facts in any case that may come before them.

Third, the Fish Commission should be charged with the duty of investigating matters relating to fisheries on which legislation is necessary, and of reporting their findings regarding them to the legislature. These would include such subjects as the usefulness of fishways, the closed season for bass, the minimum size for game or commercial fish. Such investigations should be regarded as a necessary part of the work of cultivating fish, and funds should be provided to defray their cost. The necessary money could also come from the hunting and fishing license fund.