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Keeping Faith With the Swamp Land Fund

By

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Wisconsin has a swamp land fund which originally had a dedicated purpose but which has been pushed from pillar to post until it has now almost lost its identity. There is yet time to restore that fund to its intended channel without costing the tax payers of the state a cent.

The Source of the Fund

On September 28, 1850, "An Act to enable the state of Arkansas and other states to reclaim the 'swamp lands' within their limits" became a federal law. This act ceded to the state of Arkansas "the whole of these swamp and overflowed lands made unfit for cultivation thereby and remaining unsold at the passage of this act" in that state. It provided, however, that when Arkansas sold those lands it should apply the proceeds of such sales "exclusively as far as necessary, to the reclamation of said lands." The act ended with: "Section 4, and be it further enacted, that the provisions of this act be extended and their benefits conferred upon each of the other states of the union in which swamp or overflowed lands, known and designated as aforesaid may be situated."

Wisconsin accepted the swamp land from the Federal Government and in a letter dated June 3, 1851, Gov. Nelson Dewey chose to take the government plats and field notes as the basis for determining the lands to be included in the grant. By 1855 more than 1,651,062 acres had been selected, approved and accepted by the state, and Gov. Barstow estimated that the state was entitled to about a million acres more because a survey in a few counties showed that there actually was more swamp land than the government survey showed. Then followed a battle of words between the state and federal officials to have the basis of the grant changed, which ended in having an additional 523,161 acres ceded to the state, making a total of 2,174,223 acres of swamp land which the state had obtained from the Federal Government down to 1880.

Disposing of the Proceeds

The state of Wisconsin had promised to devote the proceeds of the sale of these lands "to the reclamation of the lands." There was but little demand in those days for the drainage of the swamp and overflowed lands for agricultural purposes, although Arkansas and other states did build dikes for flood protection and ditches for internal drainage. None of the states thought of saving these lands for game refuges or forest preserves at that time. They were sold as fast as buyers appeared. The average price appears to have been about a dollar an acre.

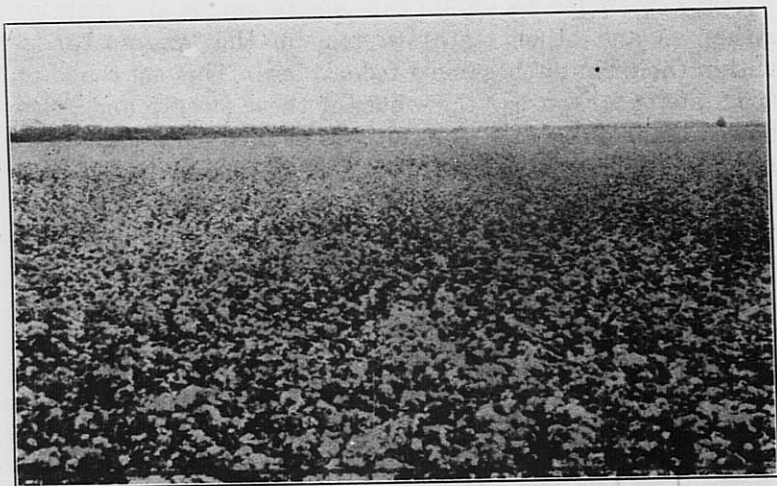


Fig. 1. FROM BALSAM TO BUCKWHEAT

Twenty-five years ago with the construction of drains the tamarack and sedge grass began to give way to farm crops on the marshes of central Wisconsin, but half of the drained marshes are still waiting for farmers. Now we don't need that land for farming. What next?

Wisconsin began to sell these lands at once. In 1852 she passed a law (Chapter 237) providing for draining the swamp lands thus sold, but did not provide for the use of swamp land funds for such drainage. That is, the buyers could drain these lands if they paid for the drainage themselves.

By 1855 considerable money had accumulated in the swamp land fund from these sales, and it became evident that Gov. Barstow had designs on the proceeds. In his message to the legislature he said:

"I can see no constitutional objection to appropriating the surplus proceeds, after their application to the extent required by the act granting them, to such purpose as the legislature may deem proper; x x x From the examination I have given this subject I am clear in the opinion that from the sale of these lands we may reimburse the treasury for all past outlays on account of public buildings of every character; and further erect all such buildings as the state may require for many years to come."

But the legislature did not act upon Gov. Barstow's advice. It put the swamp land money into the school fund. By Oct. 1, 1860 the sales had amounted to \$988,712.88 which, loaned at 6%, brought in \$69,209.90 a year, divided three ways: 25% to School Fund; 25% to Normal School fund; and 50% to Drainage Fund. This last sum was distributed annually to the several counties in proportion to the amount received by the state from the sale of the swamp lands in such counties. These counties divided these moneys among their several towns and there it was spent chiefly for roads and bridges.

At least 91 acts passed between 1860 and 1880 related to small allotments from the swamp land fund, as for example, Chapter 51, Laws of 1866, which authorized Manitowoc and Calumet Counties to use the proceeds of the sales of swamp lands in certain townships for drainage and "other" purposes. That "other" purpose was usually the construction of a road.

Despite these smaller leaks it appears that at least \$2,000,000 which came from swamp lands has stayed in the school fund and has been drawing interest for the state for nearly three quarters of a century. Some legislation during the nineties sought to destroy the identity of the swamp land fund as such. Nevertheless, these \$2,000,000 with accrued interest remain morally in the swamp land fund, which the state early and solemnly pledged to the reclamation of the swamps for some purpose, perhaps for agriculture, perhaps for game refuges and forest preserves.

There is now a continuing appropriation from that fund for the maintenance of the dike along the Wisconsin River at Portage.

Gov. McGovern in 1912 fell back upon the swamp land fund to get money for the relief of the city of Black River Falls, when that city was wiped out by a flood. On another occasion it is said that the legislature used some of these

funds for relief in a fire swept area. It was with swamp land money that the state equipped soldiers during the Civil War, and when 40 years later the Federal Government paid this back with interest the payment was put into the general fund.



Fig. 2. FROM BUCKWHEAT TO PINE

The partly drained marshes of Central Wisconsin are in an ideal condition for the planting of valuable forests for lumber and pulp wood.

It does seem that the time has come for a guarded use of these funds for a definite, logical, justifiable purpose.

To set at rest all comments that the swamp land fund can not at any time be retransferred to the purpose for which the state pledged its use, Gov. McGovern said in his message to the special session of the legislature on April 30, 1912:

"It is true that at present the greater portion of the money belonging to the drainage fund was years ago transferred by an act of the legislature to the general fund. Whether this transfer be legal or not is was plainly not required by the trust impressed upon these funds by the federal grant. To the extent that such funds may at any time be needed for the accomplishment of the purpose for which they were originally set aside there can be little doubt that the legislature has power to retransfer such portion of them as may be necessary from the general fund back into the drainage fund."

On February 12, 1915 the Supreme Court in the case of State ex rel. Owen, Attorney General, vs. Donald, Secretary of State, 160 Wis. 21, handed down a decision by Justice Marshall that held that the state could not at that time take swamp land money out of its resting place in the school fund to purchase cut over lands in northern Wisconsin. The decision is based upon Section 2, Article X, of the state constitution which provides that "all moneys rising from any grant to the state where the purpose of such grant are not specified" automatically goes into the school fund. It recognized that the state had pledged the proceeds of the sales of swamp lands to the reclamation of the lands "so far as



Fig. 3. AND FUR FARMING TOO

Trapping along the ditches in the Cutler Drainage District is better than ever.

necessary," but held that until the legislature found such reclamation necessary the proceeds should remain in the school fund. Furthermore, the cut over lands whose purchase was then in question were not a part of the swamp land grant and for that additional reason were not entitled to participation in the swamp land fund.

If the legislature of 1865, by failing to declare that reclamation was necessary, allowed the swamp land fund to

lapse into the school fund, the legislature of 1927 should, by the same token, be able to restore it to its pledged purpose by declaring that some form of reclamation is now necessary.

It is proposed that the legislature find and declare that the reclamation of swamp lands for forest preserves and wild life refuges is now necessary. That would automatically renew the original pledge of the state to use the swamp land fund for the specified purpose of reclamation. Such reclamation could mean none other than the re-acquisition of swamp lands by the state or by the counties together with such reclamation works as those lands now contain,—ditches for the forest preserves and perhaps dams for the wild life refuges.

The land office contains the data from which the number of acres of swamp land sold by the state in each county,

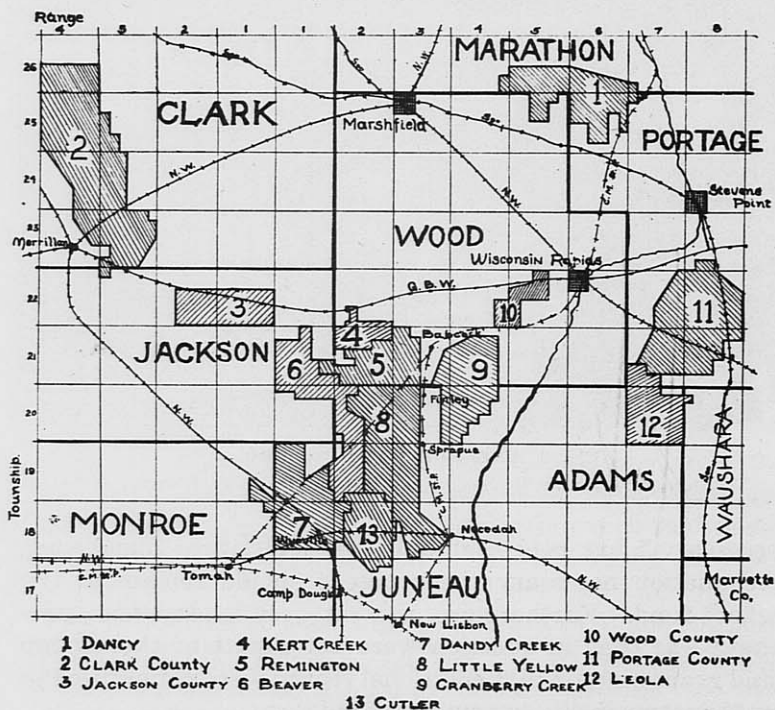


Fig. 4. DRAINAGE DISTRICTS OF CENTRAL WISCONSIN

Outlet ditches were dredged on most of these lands more than 20 years ago. Large blocks of vacant, tax delinquent lands in them and not needed now for agriculture are good sites for forest and wild life preserves.

may be computed. It requires considerable clerical work to get the totals for each county, but the clerks were kind enough to assemble the records in nine counties containing about one-third of the swamp land. It is highly desirable that similar summaries be made for the other counties to show where the remaining two-thirds of the swamp land was located. The summary obtained to date for swamp lands sold by the state, is as follows by counties:

Adams -----	70,157	Wood -----	144,789
Clark -----	30,189	Monroe -----	47,472
Jackson -----	83,763	Portage -----	106,642
Juneau -----	155,358	Waushara -----	45,909
Marathon -----	66,704		

These figures are acres or dollars, because a dollar an acre was the standard price.

The swamp land fund is not all needed in the school fund at the present time. The Biennial Report of the Commissioners of Public Lands dated June 30, 1926, is evidence of this. Out of a total of \$7,321,872 in the productive school fund, only \$4,747,795 is loaned to school districts. To find some use for that not needed for loans to school districts the commissioners had to purchase bonds and notes of villages, cities and counties and still had \$787,030 lying idle in the state treasury at the close of the fiscal year.

Where the Fund Belongs

The fund belongs where it will serve best both these swamp lands and the general welfare of the state. With the low demand for new agricultural lands at the present time, it is manifest that these lands are not needed for agriculture until conditions change. Wild life refuges and forest preserves are more timely. The state would be making good its promise to the federal government if it used the swamp land fund to reclaim these swamp lands for such refuges and preserves.

For the present, selective drainage of the wet spots in cultivated fields is sufficient—even urgent—for agriculture. Almost every farm in Wisconsin is susceptible to some such drainage that would increase farm profits. Farmers are proceeding intelligently with that kind of drainage.

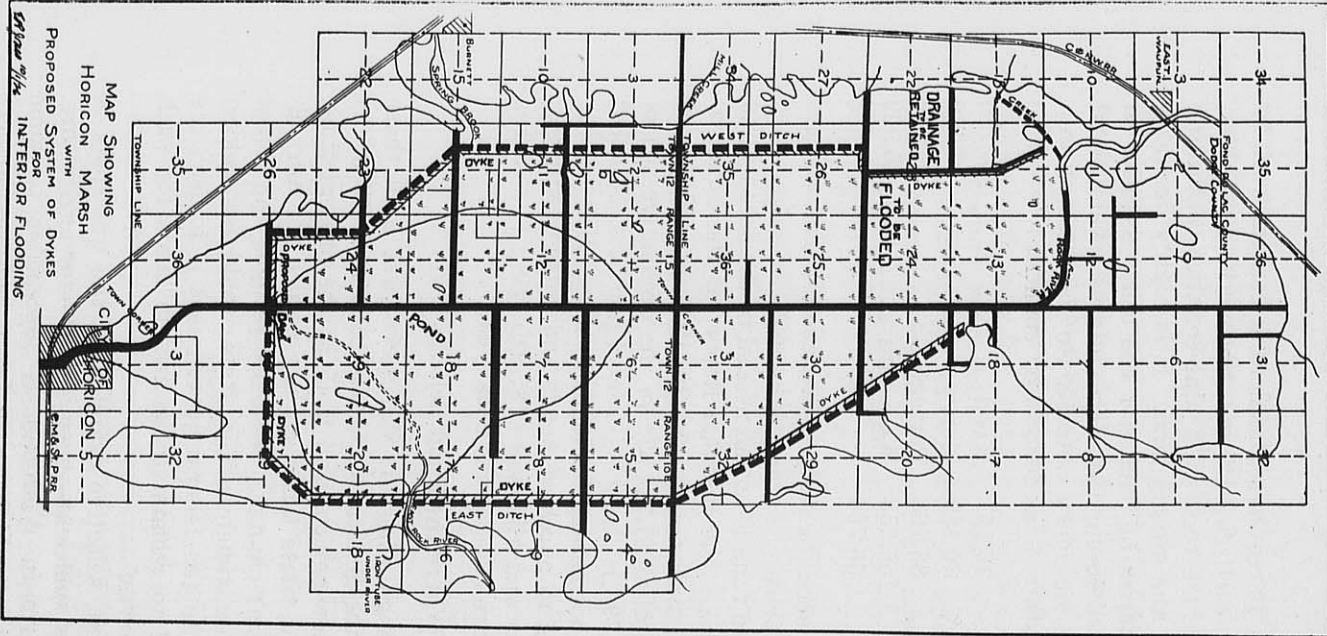


Fig. 5. THE HORICON MARSH

Year Organ- ized	District	Acres	Cost	Debt 6-1-'24	Delinq. Acres 6-1-'24	Deedable 1924 Acres	Dollars	Needed from S L Fund	County
1901	Little Yellow	60,000	\$ 412,648	\$ 250,000	26,394	18,400	\$ 27,642	\$113,000	Juneau
1902	Beaver	33,480	176,303	72,903	12,800	8,500	24,338	31,000	Juneau, Jackson and Monroe
1902	Dandy Creek	33,920	122,988	0	9,360	5,720	7,778	11,000	Juneau and Monroe
1903	Remington	25,920	146,552	63,227	14,534	7,534	12,653	19,000	Wood and Jackson
1903	Cranberry Creek	19,139	188,481	114,839	11,194	7,640	20,427	32,000	Juneau and Wood
1903	Kert Creek	8,867	142,998	132,688	7,249	4,654	26,979	80,000	Wood
1903	Dancy	36,082	315,775	81,478	10,241	10,245	78,361	100,000	Wood, Marathon and Portage
1912	Cutler	20,745	104,990	69,990	9,200	8,640	16,326	23,000	Juneau
1912	Wood County	6,000	40,000	35,000	4,000	3,000	9,000	20,000	Wood
1916	Clark County	98,000	152,500	165,000	64,000	32,202	6,180	60,000	Clark and Jackson
1918	Jackson County	25,000	85,000	92,000	20,000	0	0	40,000	Jackson
	Totals	367,153	\$1887,235	\$1077,125	188,972	106,535	\$ 230,284	\$529,000	

With equal intelligence they are avoiding the drainage of new blocks of marsh land at this time.

Without doubt the most profitable use of these large blocks of land would be for forestry. Studies in four drainage districts in Wisconsin show that the growth of tamarack and black ash is about ten times as fast after partial drainage than before. Pulp wood would be particularly profitable in central Wisconsin. White spruce, under conditions no more favorable than those now found in these drainage districts, have been found to produce 43 cords of pulp wood per acre in 34 years in Wisconsin, or about 1 1/4 cords per acre per year. Such pulp wood sells for \$10.00 a cord at the track or about \$6.00 a cord on the stump. Planting costs about \$10.00 an acre, but the crop at the end of 34 years is worth \$258.00 an acre. It is obvious that a county can easily pay back to the state any money it borrows from the swamp land fund for such reclamation, and have a handsome profit left.

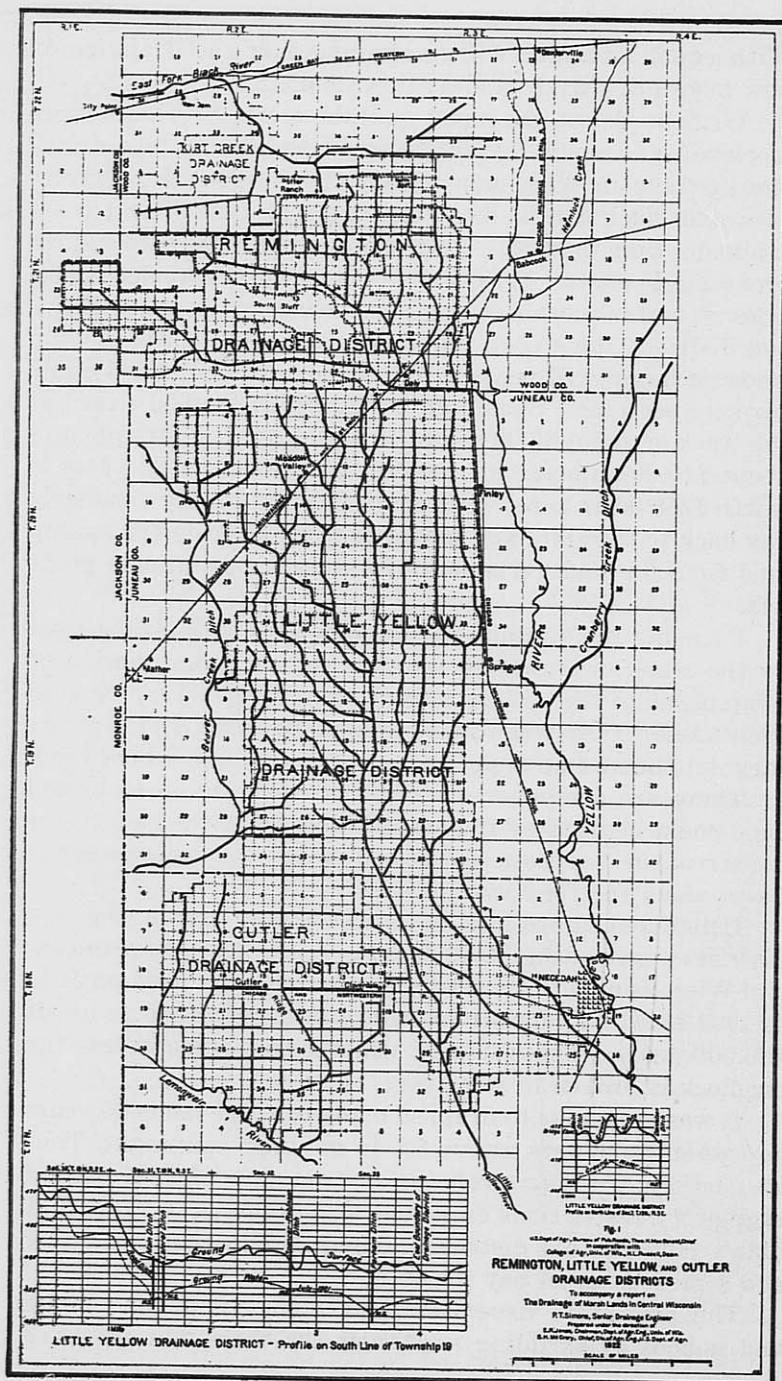
By using the swamp land fund as a revolving fund used by the state, or loaned to counties for such reclamation of swamps, all of the swamp land in the state could be forested eventually. Then when such reclamation is no longer necessary, let the swamp land fund go back into the school fund.

There are a number of ways in which the swamp land fund could be used by the state or loaned to the county for conservation purposes connected with the swamp lands from which the fund was derived.

Delinquent Lands in Drainage Districts. Eleven drainage districts aggregating 367,000 acres in eight counties in central Wisconsin had 110,833 acres subject to tax deed on June 1, 1924 and that number has since been increased to about 180,000 acres. The situation will become worse unless the deadlock is broken in some way.

It was a mistake to drain so many of these lands 25 years ago when promoters attempted to get rich over night. That was before the new drainage district law of 1919 placed regulatory restrictions on new drainage districts. But that didn't help the old districts. Their ditches had been dug and somebody must pay for them.

The promoters have lost their money and gone broke and nobody is shedding any tears for them, but we have



These are the ditches intended to serve agriculture but better adapted to the needs of forestry.

a real concern in the 350 settlers scattered over these districts and threatened with obligations to pay additional drainage assessments to make up the deficiency caused by the failure of vacant lands to pay drainage taxes. These men can pay their own taxes and prosper, but it will break their backs to have to pay the other fellow's taxes too.

In Minnesota, on a bigger area than this, the counties were bound to take over the delinquent lands in their drainage districts and to pay the drainage bonds. Wisconsin counties are not under that obligation and are unwilling to assume it. They are afraid to take deed to these lands because of entailed drainage assessments.

The vacant lands are as a rule just as good as those occupied by the resident farmers. It was the pocket book of the owner rather than the quality of the land that determined what lands should lie delinquent. At that, over half of the drainage bonds have been paid off, but strangely enough, the second half is harder to pay than the first. Bond holders, many of limited circumstances, and residents of Wisconsin, are holding bonds four or five years past due. They do not care to foreclose because they do not want to go into the land business. In the Dancy district the bond holders have forced an additional assessment against the lands that have been paying taxes promptly, but they will not gain anything thereby. The resident land owners simply refuse to pay these additional assessments; first, because they can't; second, because they wouldn't pay the other fellow's taxes if they could.

Fortunately, the drainage has improved the land for forest, fur and dry land fowl. The young tamarack are growing fast and Norway pine is starting to grow by natural seeding on the drained peat. This bears out the experience of Sweden where for 50 years they have been draining the stagnant water from the government owned swamps to stimulate forest growth. Fur bearing animals are trapped on the ditch banks in the Cutler district. Prairie chickens and partridge are more plentiful in the Little Yellow district than before drainage. Fish, even trout, are found in the fresh water of the ditches, in contrast to no fish in the slimy pools that existed before drainage. Lastly the ditches are a fire protection. A wet ditch is a barrier to a fire. In

1893 when the last bad fire swept over this area there were no ditches to check its progress.

These lands would be valuable to the counties as game refuges or forest preserves. The height of the water in the ditches, outside of the blocks devoted to agriculture, could be controlled.

To finance the acquisition of the land, let the county buy the drainage bonds of holders that are anxious to sell. It is probable that many of the bonds can be bought at a substantial discount. Then let the county apply these bonds at face value to pay the delinquent and future drainage assessments against the lands which the county would acquire by tax deed. Let each county draw upon the swamp land fund up to the extent of its credit in that fund to finance the

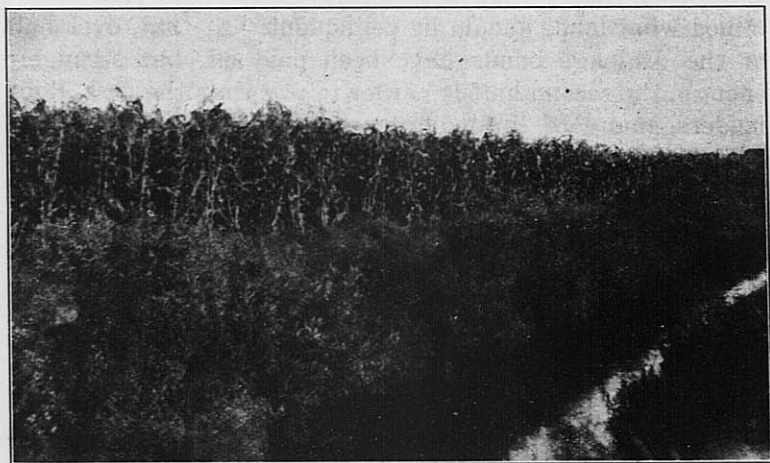


Fig. 7. CORN WHERE CORN IS NEEDED.

Eventually some of these lands may be needed for agriculture

project. Resident farmers would keep on paying their drainage taxes and occupying their land. Certain blocks like a school district would be set apart for agriculture and the county should exchange lands in that block for the lands of settlers scattered over the preserve. When the county sells the preserve or forest products therefrom, it must begin to pay back to the swamp land fund the money it got from that fund without interest.

The county might might go to some expense in reforesting this drained swamp land. In that case, the county should

be permitted to reimburse its own treasury for such expenses before beginning to pay back the loan from the state.

According to the accompanying table it would require only \$529,000 from the swamp land fund to give these eight counties title to 186,000 acres of land. This could be done without reducing the amount which is now loaned from the swamp land fund to the school districts of the state, even though it were all done in a year. Since it may take five years before any county would decide to take over the delinquent lands in all of its drainage districts, the demand on the swamp land fund would be so distributed that the school districts desiring loans would be certain not to suffer. It is the amount that is now loaned to cities and villages that would be reduced by the amount loaned to counties.

The Horicon Marsh. Given, a horseshoe four miles wide and seven miles long, enclosing 16,000 acres of low marsh and radiating 12,000 acres of higher marsh. That, fringed by Dodge County's best Wisconsin farms is a picture of the Horicon Marsh. Rock River enters the open end of the shoe and flows in a straight canal unobstructed until it strikes the Hustisford Dam protected by law, six miles below the toe calk. This dam keeps the low marsh too wet for corn and the canal has made it too dry for ducks. Neither farmer nor hunters are satisfied. Hence, the battle of words.

Now the agricultural engineer suggests a ditch and dike in the track of the horseshoe, restoring the power dam at the toe calk, and draining the higher marsh into the canal below the dam. This happy horseshoe would enclose a hunter's paradise, protect a border of cornfields, and generate electricity to help pay the bill.

Let the law be broad enough to enable Dodge County, upon request of its board of supervisors and with the approval of the Conservation Commission to borrow money from the swamp land fund to start this project in cooperation with the power company, and with the aid of voluntary contributions of funds from conservation clubs or individuals. Dodge County's share in the swamp land fund is probably not over \$50,000. It would take over \$200,000 to construct the horseshoe ditch and to purchase the 16,000 acres of land to be flooded. On this marsh the aim would be to

make a water fowl refuge and feeding place. This would make it too wet for forestry and there would be no income from that source. Commercial fur farming might be made to pay part of the cost of the preserve.

A law to bring the swamp land fund back to its pledged use through county preserves might read substantially as follows:

89.80. Upon request of the board of supervisors of a county, and with the approval of the conservation commission of the state, for the purpose of reclaiming and developing swamp and marsh lands for county preserves of forest and wild life, the state treasurer shall loan without interest to such county or counties a sum of money from the swamp land fund of the state, originating with the federal swamp land act of Sept. 30, 1850 and other swamp land acts and grants subsequent thereto, the identity of which fund is hereby restored for reclamation hereby declared necessary, to enable the county to acquire swamp or marsh lands either by purchase or tax deed and to improve such lands for forest or wild life purposes, providing the county shall repay such loan to the swamp land fund from the proceeds of the subsequent sale of such lands for any purpose or the products therefrom. The officers of such preserve shall be the chairman of the county board of supervisors, the county clerk and the county treasurer, and they shall have power to do all things necessary for the profitable management of the preserve, including the employment of technical assistants and the exchange of lands in a block reserved for agriculture for the scattered holdings of settlers within the preserve.

Many counties have tracts of marsh land that could be purchased or leased at a low price for such preserves. The conservation commission would probably make hunting grounds out of some, and refuges out of others. Under public control these areas could be made to serve the public better. Furthermore it would be fairer to the owners than under present conditions. Now the land owner is expected to keep his marsh as a public hunting ground, yet he must pay the interest and taxes on it himself. That is fair to neither fish, fowl nor farmer. It forces the farmers to drain their marshes to make them produce something to help pay the high general taxes on them.

State Ownership

It may be that it is the state, rather than the county, that should acquire these marshes and swamps. In that event, let the state use the swamp land fund for the acquisition and development of these areas for conservation purposes. That would be real reclamation and fulfilling to the

letter the trust which the state assumed when it accepted these lands from the federal government.

In the event of state ownership of the preserves the law would read substantially as follows:

89.80. Upon request of the board of supervisors of a county, and with the approval of the conservation commission of the state, for the purpose of reclaiming and developing swamp and marsh lands for state preserves of forest and wild life, the state treasurer shall loan without interest to commissioners of public lands a sum of money from the swamp land fund of the state originating with the federal swamp land act of Sept. 30, 1850, and other swamp land acts and grants subsequent thereto, the identity of which fund is hereby restored for reclamation hereby declared necessary, to enable the state to acquire swamp or marsh lands either by purchase or tax deed and to improve such lands for forest or wild life purposes, providing the commissioners of public lands shall repay such loan to the swamp land fund from the proceeds of the subsequent sale of such lands for any purpose or the products therefrom. The officers of such preserve shall be the commissioners of public lands and they shall have power to do all things necessary for the profitable management of the preserve, including the employment of technical assistants and the exchange of lands in a block reserved for agriculture for the scattered holdings of settlers within the preserve.



Fig. 8. DIFFICULT ROAD MAINTENANCE

The problem of road construction as well as school maintenance is expensive in the sparsely settled drainage districts.

The removal of large tracts of swamp and partially drained land from competition with agricultural lands will reflect an added value upon all agricultural lands in the state and to that extent relieve the agricultural depression due to deflation.

Counties will be saved the expense of maintaining roads and schools in the sparsely settled portions of the drainage districts. This more than compensates for the loss of general taxes now paid by the scattered settlers.

County boards of supervisors have authority by resolution to sell delinquent general tax certificates at whatever they will bring. If the county acquires these delinquent lands, the board would in effect cancel these delinquent general tax certificates. Without doubt, the county boards would do as much as that or more for the state in the event of the acquisition of the delinquent lands by the state.

Men high in educational circles who have been consulted declare that the schools would not suffer in the least by loaning a portion of the swamp land fund for the proposed relief. They go farther and say that if some of the money now loaned to cities and villages from this fund were loaned for the relief of the localities suffering from tax delinquent lands in drainage districts the counties could finance their schools at a saving. With settlement consolidated in these drainage districts one good compact school district will take the place of two or three poor ones. Until some legislative action is taken the counties will remain under a burden that makes the administration of schools difficult.

At any time when there is a demand for more agricultural land, the block reserved for agriculture can be extended into the non-forested portion of the preserve. The state or county could then sell these lands to new settlers at a profit and put the proceeds back into the swamp land fund.

The federal government has never loaned money to drainage projects as it has to irrigation projects. Evidently the theory was that the states would live up to their pledges and loan the swamp land fund for the reclamation of such lands. That emphasizes the force of the pledge made by the states in accepting the swamp lands from the federal government—a pledge which Wisconsin to date has broken.

The state now has an opportunity to keep faith with the federal government; become the owner of marsh lands drained enough for forestry; and to develop for itself profitable resources thereby. The re-acquisition of these lands by the state is made particularly advantageous at this time because the necessary drains have been constructed and more

than half paid for by men who on an inopportune agricultural venture have lost their money and passed out of the picture. Their loss can be coined into the state's gain. And, best of all, it will relieve the resident farmers of the liability of having to pay drainage taxes on somebody else's land. It will leave them happy paying their own.

Drainage Necessary for Trees

A good stand of timber on a swamp does not require that the soil be kept an oozy quagmire with the water table at or near the surface of the ground. Just the contrary. Drainage to a depth of about three feet, except in coarse sandy soils, is found to be essential to the healthy growth of the saplings. They knew this fifty years ago in Sweden, but we are just finding it out now in America.

Ditches shot 3 feet deep with dynamite, or those dredged 8 feet deep to serve as outlets for large swamps, or combinations of the two show the same beneficial results except in coarse sand subsails where there is a danger of excessive drainage for the older trees. There dams for sub-irrigation are valuable in dry seasons. This control of soil water is one of the links of agricultural engineering in the chain of forestry.

TABLE I

Growth of Black Ash Tree on a Swamp in Ozaukee County, Wisconsin,
Before and After Drainage Installed in 1919

Year	Stump Diam. Inches	Age Years	Height Ft.	Vol. Cu.Ft.	Increase in volume Cu. Ft. per yr.
1919	2.25	40	14	.12	.003
1925	3.25	46	24	.44	.053

Studying Table I, it appears that the increased rate of growth due to drainage for this typical tree was .05 cu. ft. per year. Multiplying this by 200 for 200 trees to the acre, it may be computed that drainage increased the growth by 120 board feet per acre per year. This is easily worth one dollar an acre a year. Capitalized at 6% it appears than an expenditure of \$16 an acre would be justified for the drainage of this black ash swamp. This is three or four times as much as shallow drainage costs.

John Fechter, Belgium, Wisconsin, one of the farmers who intended to clear his part of the swamp after drainage, has been so encouraged by rapid growth of the saplings after drainage that he has set off a 10 acre wood lot for permanent forestry.

Studies in Wisconsin were undertaken in the face of an accepted theory that the drainage of a swamp was inimical to the forest growth thereon. The study by the author dates from the year 1906 after ditches 6 to 8 feet deep had been dredged through the sand bottomed marshes and swamps of Central Wisconsin. In a tamarack swamp near Mather in Juneau County, the ditch was 6 feet deep and reached through 3 feet of peat to the underlying sand. The water ran about one foot deep, leaving about two feet of drained coarse sand between the water table and the bottom of the peat at the ditch. Within two years all of the tamarack trees more than 8 inches in diameter and within 200 feet of the ditch had died, presumably for lack of water. Farther back than 200 feet there were not any trees that died.

The younger trees did not die, even near the ditch. On the contrary, after two or three years it was noticeable that they were in a more thrifty condition than they were before drainage. Examination of cuttings showed that they began to grow faster in 1906, the year the ditch was completed. Part of this increased rate of growth may be due to the admission of more light by the dying of the larger trees, but since growth was stimulated 500 feet from the ditch also, in both large and small trees where there was no increase in light, it appears that better drainage was the greater factor.

A study of the ground water showed that the water table was in the sand for about 200 feet from the ditch. Then upon entering the overlying peat it rose rapidly to about two feet below the surface of the ground, varying somewhat with the rainfall.

Before drainage the roots of the trees were shallow and spread horizontally just below the surface of the ground. After drainage the trees developed new and deeper root systems, reaching down to the water table. Only in the case of the older trees near the ditch, where drainage was exces-

sive, was there a failure to adjust the root systems to the drainage.

On the clay bottomed tamarack swamp in the Sheboygan Valley Drainage District, excessive drainage was not apparent even close to ditches 8 feet deep. The rate of growth of all trees examined increased with the inception of drainage in 1919.

The advantage of deeper root systems are at least two-fold. They give the tree a bigger volume of soil from which to extract plant food, and they open up a larger reservoir of soil water in time of drouth. The drainage also reduces the acidity of the soil. One Wisconsin swamp that would have required 40 tons of lime to sweeten 8 inches of the surface soil before drainage required only 5 tons to do the same thing after 20 years of drainage.

Both white and Norway pine respond to drainage. In sandy central Wisconsin these species were formerly confined to the sandy islands. After 20 years of drainage the natural seeding of young pines has extended well out into the drained marshes unused for agriculture. Artificial planting would hasten this process.

This offers a new and popular use for partially drained marsh lands not now needed for agriculture.