ECONOMIC REPORT

ER79-6 JUNE 1979

SOCIAL, ECONOMIC, AND INSTITUTIONAL INCENTIVES TO DRAIN OR PRESERVE PRAIRIE WETLANDS

BY

JAY A. LEITCH AND LEON E. DANIELSON

Department of Agricultural and Applied Economics

University of Minnesota
Institute of Agriculture, Forestry and Home Economics
St. Paul, Minnesota 55108

SOCIAL, ECONOMIC, AND INSTITUTIONAL INCENTIVES TO DRAIN OR PRESERVE PRAIRIE WETLANDS

Jay A. Leitch
and
Leon E. Danielson

June 1979

ACKNOWLEDGEMENTS

The authors extend their appreciation to the following persons for their comments and assistance:

Randy Cantrell,
Assistant Professor
Rural Sociology
University of Minnesota, for his assistance with the statistical analysis.

K. William Easter and Lee Martin,
Professors
Agricultural and Applied Economics
University of Minnesota, for their comments and suggestions during all stages of the study.

Carl Madsen and Jim Neville
U.S. Fish and Wildlife Service
Wetland Office
Fergus Falls, for their assistance.

Patti Schwarz, Carol Lieb, and Becky Thommen, for their typing of several survey forms and drafts of this report.

The reviewers within the Department of Agricultural and Applied Economics and those outside of the Department who provided useful comments on drafts of this report.

In addition, we appreciate the time and cooperation of farm operators in Douglas, Grant, and Ottertail Counties, who were interviewed.

CONTENTS

ABSTRACT

Theoretical aspects of the economics of wetland drainage are discussed. Major programs that provide landowner incentives to drain or preserve prairie wetlands are reviewed. The results of a farm operator survey in West Central Minnesota designed to analyze characteristics and attitudes that affect participation in wetlands programs are presented.

Summary and Conclusions

For several decades, governmental programs promoting drainage of wetlands for agricultural use have been controversial. As a result, these programs have slowly been modified and wetland preservation programs have been established. Legislation has been enacted in some states particularly in the Northeast that restricts drainage of wetlands. But the greatest effort has been made to develop programs and procedures designed to provide landowners with preservation incentives or inducements. Examples are the easement and fee simple acquisition programs of the U.S. Fish and Wildlife Service, the Water Bank Program, and explicit review procedures for public projects that might affect wetlands.

A great deal of research has been done in recent years on quantification of the public value of wetlands. However, higher estimates of wetland values as a result of sophisticated valuation studies will not by itself preserve additional wetland acreage unless the landowner accepts preservation offers made to him. Today, while the per acre level of easement and fee simple offers made to private landowners greatly exceed those of previous years, the "turn-down" rate is high. Thus, there apparently are political, attitudinal, economic, and other obstacles that tend to prevent wetland preservation. It is of more immediate importance to address these latter obstacles to preservation than to develop more sophisticated methods of wetland valuation.

In section II, a theoretical discussion of wetland economics points out the optimal amount of drainage, both in terms of private benefits and costs and social benefits and costs. The farm operator should drain until the marginal cost of drainage equals the marginal benefit received. The problem lies with the fact that there are social costs involved in wetland drainage that the private decision maker does not consider.

Public agencies have recognized the social values associated with wetlands and have offered various incentive programs to encourage preservation. But, at the same time, other government agencies have encouraged drainage through financial and technical assistance.

A survey of farm operators conducted to determine just what factors contribute to their decision to drain or preserve wetlands revealed several observations on their behavior. Perhaps the most striking conclusion from the survey is that farm operators do not know much about wetland preservation programs. More information was the most often cited way to improve wetland programs. Misconceptions or lack of information about taxes on wetlands also appear to be important.

The current popular reasons for being opposed to wetlands preservation were also brought out. These are the weed problems caused, the nuisance of farming around wetland, and taking adjacent cropland out of production.

Attitude toward wetlands and participation in wetlands programs were seen to be related. Attitudes were also related to other farm operator characteristics. Landowners with a pro-drainage attitude were found to have a strong commitment to farming, to have an intention to expand their cropland acreage, to be non-hunters, to favor government assistance for drainage, and not to participate in wetlands preservation programs. Those with pro-preservation attitudes were found to be more likely to participate in wetlands preservation programs, be hunters, not to live next to someone that had participated in a wetlands program, and to be more interested in retiring than in farm expansion. Although economics plays a role in the future of wetlands under private control, it is not the only nor perhaps the primary determinant.

One recommendation stemming from this study is that the agencies charged with wetlands preservation give greater attention to educating wetland owners. Farm operators want and need to become more informed about programs available to them. They should also be informed of actual procedures used in setting taxes on wetlands. An all around improved image of wetlands preservation agencies, developed both through information and education and through improved management of their lands, would be a step forward toward obtaining the socially optimal balance between wetlands in their natural state and wetlands converted to cropland.

SOCIAL, ECONOMIC, AND INSTITUTIONAL INCENTIVES TO DRAIN OR PRESERVE PRAIRIE WETLANDS

Jay A. Leitch and Leon E. Danielson

I. INTRODUCTION

The drainage of wetlands in North Dakota, South Dakota and Minnesota has had a long and controversial history. Biologists have long claimed that the wetland complexes in these states are prime habitat for waterfowl production. Being essential in the life cycle of waterfowl, wetlands are invaluable to those who treat waterfowl as a beneficial natural resource. This includes bird watchers, scientists, naturalists, hunters, and other similar groups.

On the other hand, wetlands provide a potential area for the expansion of arable land. They also may increase agricultural production costs because of the inconvenience and inefficiency of farming around them. Hence, farmers often have incentives to drain wetlands.

Over the years, wildlife interests have become increasingly alarmed over the ongoing loss of wetland that has occurred. Although questions remain concerning the private and public value of wetlands, the focal point of the controversy has been the use of public funds to promote wetland drainage while at the same time other public programs are designed to preserve wetlands. To reduce the conflicting nature of preservation and drainage programs, administrators of the Soil Conservation Service (SCS) and Fish and Wildlife Service (FWS) have maintained a dialogue, sponsored joint inspection tours, signed agreements, etc. going back at least to 1948.[1/] As a result, federal guidelines for programs that provide assistance for private drainage have been modified and programs that provide landowner incentives to preserve wetlands in their natural state have been initiated.

Yet many questions remain. How valuable are wetlands to society? What incentives do landowners have to preserve or to drain their wetlands?

1/ Based upon letters and reports in the files of the regional U.S. Fish and Wildlife Service Office, Minneapolis, Minnesota.

Should public policies be modified to provide additional preservation incentives? And, if additional economic incentives for preservation are provided, will the landowner participate? When do preservation incentives become so high that they exceed the public benefits accruing from wetland preservation?

Study Objectives

The purpose of this paper is to provide information for wetland policy decision-making through (1) a discussion of theoretical issues underlying wetlands economics, (2) a review of selected major programs that provide private incentives to drain or preserve wetlands, and (3) presentation of the results of a survey designed to identify and analyze landowner characteristics and attitudes that affect participation in the various incentive programs.

Study Area

The prairie pothole region of North America produces about one-half of this continent's waterfowl (Crissey, p. 161). This region covers about 300,000 square miles in the prairie provinces of Canada and the upper midwest of the United States (Figure 1.1). The United States portion, approximately 115,000 square miles, is bounded on the southwest by the southern limits of Wisconsinian glaciation, and on the northwest, north, and east by woodland. Glaciation erased natural drainage patterns and left the area pock-marked with potholes. Former portions of the prairie pothole region in Iowa and southern Minnesota have been almost completely drained.

About one-half of the duck production in the lower 48 states occurs in the prairie pothole region (Hammack & Brown). The area is also important for migration as well as production since it is in the center of the Central flyway with the Mississippi flyway on its fringe.

Within the state of Minnesota, the prairie pothole region coincides roughly with the area of tall grass prairie (Figure 1.2). An area of

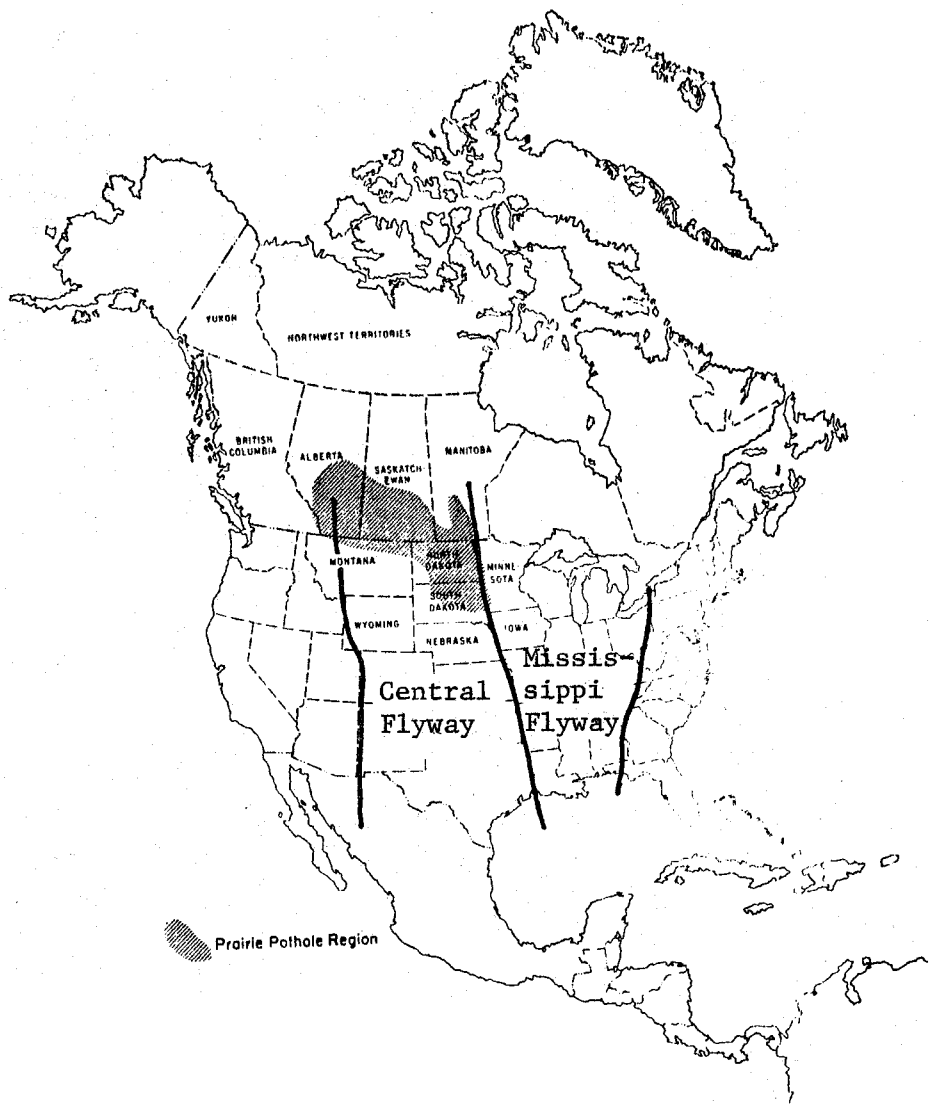

Figure 1.1 The Prairie Pothole Region

Source: Goldstein, Jon H. Competition for Wetlands in the Midwest. Resources for the Future, 1971.

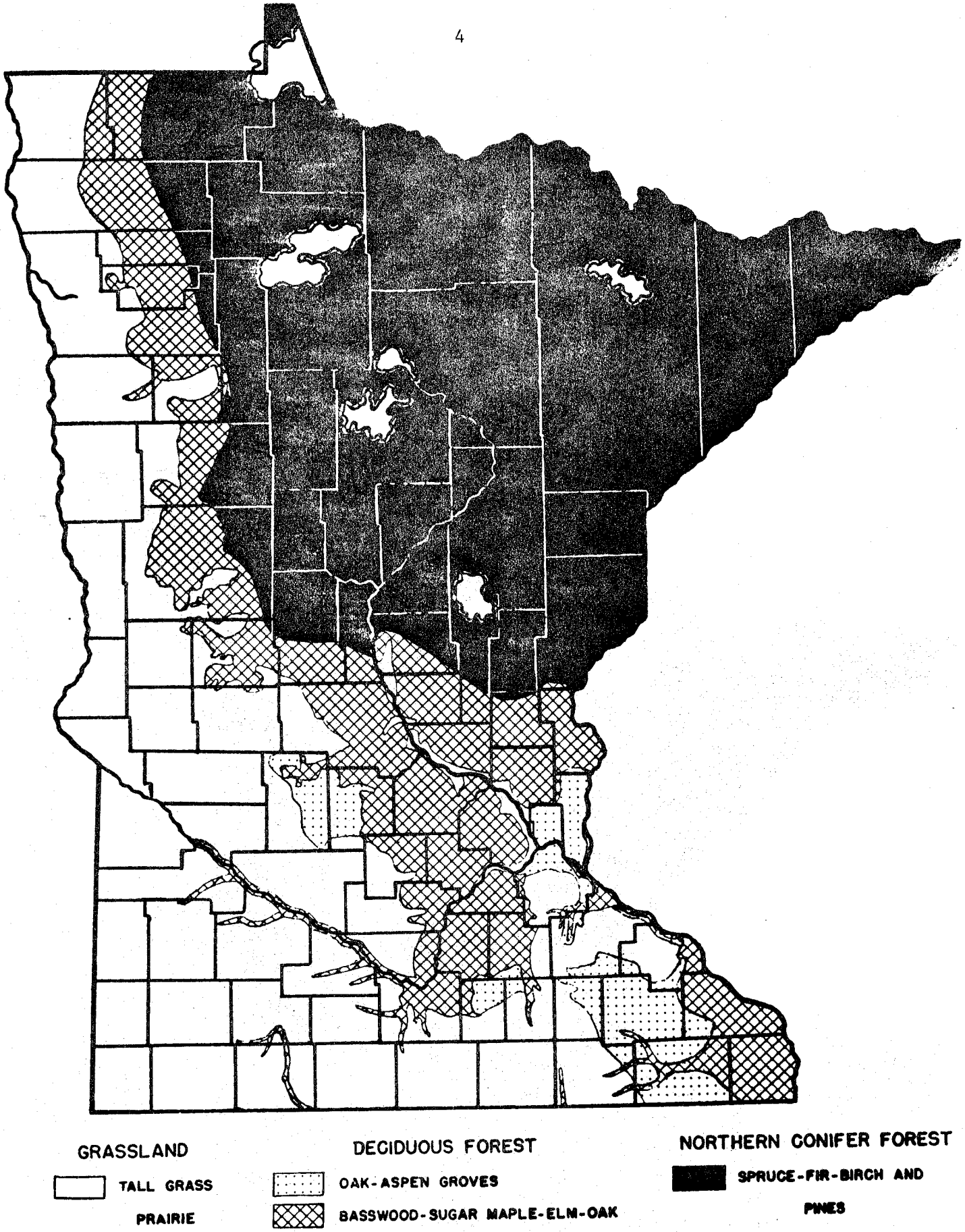

Figure 1.2. Natural Vegetation of Minnesota

Source: Mann, Grady E. Wetlands Inventory of Minnesota, U.S. Department of the Interior, Office of River Basin Studies, Minneapolis, Minnesota, 1955.

approximately 15,000 square miles in 19 counties from Polk in the north to Murray in the south remains today as having significant value to waterfowl (Figure 1.3). Many portions of the state had been reduced to very limited waterfowl value by as early as 1952 by drainage (Nord).

Minnesota wetlands were inventoried in 1952/53 (Mann), in 1964 (Haddock & Bates), in 1974 (Wallace), and a nationwide inventory is currently underway. Results of the 1952/53 survey indicated there were approximately 5 million acres of type 1 and 3 through 8 wetlands in the state.[2/] The 1964 inventory was only of types 3, 4, and 5 wetlands in the 19 county[3/] prairie pothole region. There were an estimated 340,000 acres of type 3, 4, and 5 wetlands in Minnesota's 19 pothole counties in 1964 of which approximately 50 percent were 3's, 32 percent 4's, and 18 percent 5's. Type 1 wetlands were omitted from the 1964 inventory because of their transitive nature and because they are difficult to identify from aerial photographs.

[2/] The following definitions of wetland types were adopted from Shaw and Fredine (Circular 39, 1971). Types 1, 3, 4, and 5 wetlands are generally considered as the most valuable for waterfowl in the midcontinent area:

Type 1 - Seasonally flodded basins or flats. The soil is covered with water, or is waterlogged, during variable seasonal periods but usually is dry during much of the growing season. They may be filled with water during periods of heavy rain or melting snow.

Type 2 - Inland fresh meadows. The soil is waterlogged to within a few inches of the surface. These are not considered to be of importance for waterfowl.

Type 3 - Inland shallow fresh marshes. The soil is usually waterlogged during the growing season; it is often covered with 7 inches or more of water.

Type 4 - Inland deep fresh marshes. The soil is covered with 6 inches to 2 feet or more of water during the growing season.

Type 5 - Inland open fresh water. Water is usually less than 10 feet deep and is fringed by a border of emergent vegetation.

Type 6 - Shrub swamps. Similar to type 3 with shrub vegetation. These are of little use for waterfowl.

Type 7 - Wooded swamps. Similar to type 2 and may have as much as 1 foot of standing water. Vegetation is primarily tamarack, spruce, balsam, red maple, and black ash in the northern states. Type 7's are of limited value to waterfowl.

Type 8 - Bogs. The soil is usually waterlogged and supports a spongy covering of mosses. Bogs have the lowest waterfowls value of all wetland types.

[3/] The 19 counties inventories were those authorized for fee and easement purchases by PL 85-585. See figure 3.2.

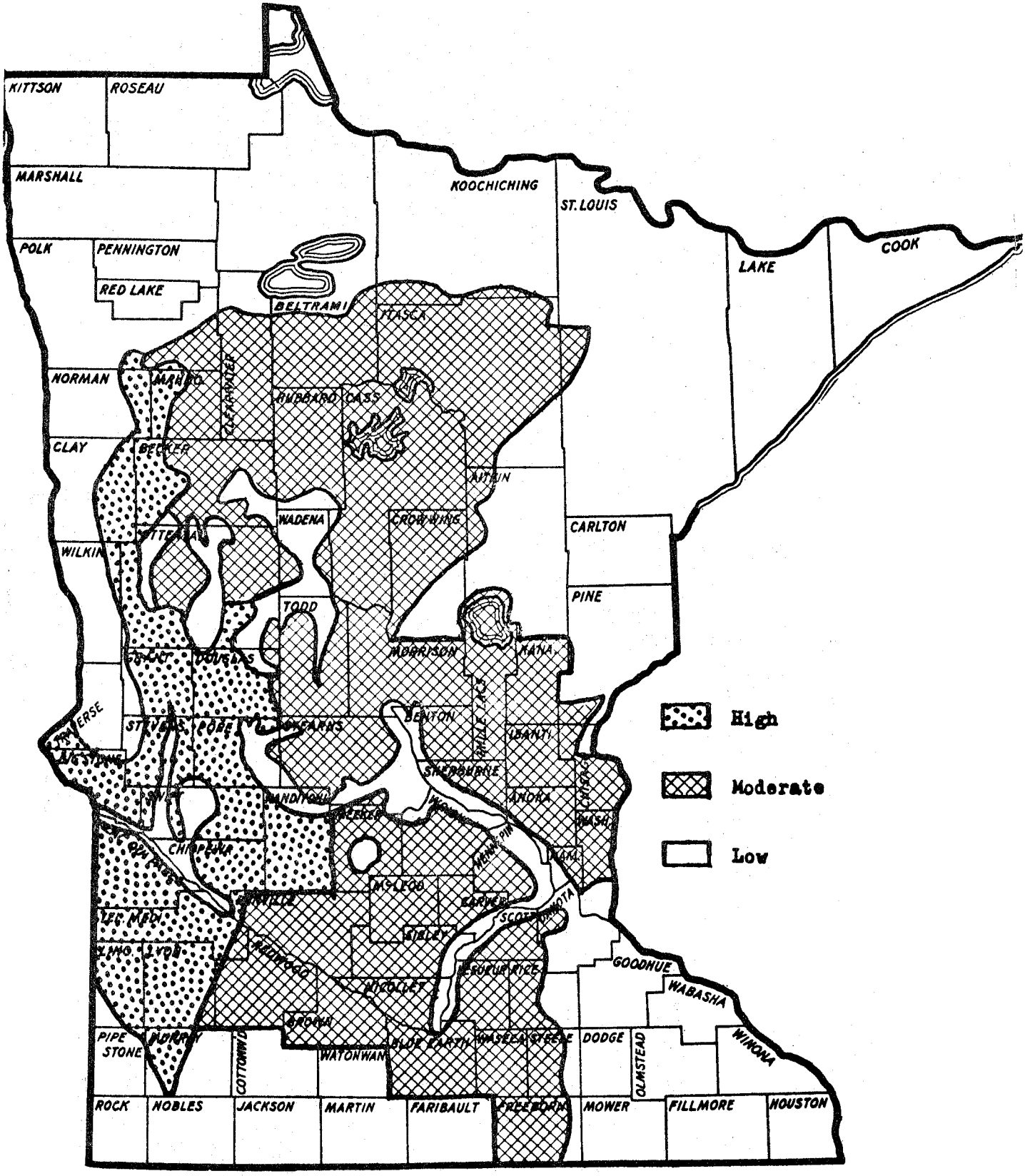

Figure 1.3. Regions of Waterfowl Value

Source: Mann, Grady E. Wetlands Inventory of Minnesota, U.S. Department of the Interior, Office of River Basin Studies, Minneapolis, Minnesota, 1955.

The report of the 1952-53 inventory stressed that preservation of waterfowl production habitat should be concentrated in the northwestern half of the prairie pothole region in Minnesota due to wetland and soil associations with high relative value to wildlife. Results of the 1969 survey and analysis of drainage in Minnesota by Haddock and DeBates indicated drainage rates to be approximately 3.17, 4.90 and 5.25 percent for the years 1966, 1967, and 1968, respectively in Minnesota - a much higher rate than reported for either North Dakota or South Dakota.

Wetland drainage in Minnesota continues to occur. Since the 1974 inventory, over 8 percent of the wetland acres, or 16.5 percent of the wetland basins identified by the U.S. Fish and Wildlife Service as being significant for waterfowl production in the counties where they have programs have been drained (Nelson).

The Minnesota prairie pothole region is generally important because of its location in waterfowl flyways. The state has also received attention regarding wetland issues due to its inclusion in the federal Water Bank Program, the Fish and Wildlife Service's wetland acquisition and easement program, and ASCS cost-sharing programs for drainage.

The three county region in west central Minnesota chosen for this study - Douglas, Grant, and Ottertail - is important for several reasons (Figure 1.4). First, they are all in the prairie pothole region. Second, they have all been included at one time or another in state and national preservation and drainage programs. Also, these three counties have been selected by the FWS as sample areas for a pilot study relating duck production to a variety of geographic variables.[4/] Fourth, within these three counties, there exists a wide range of farm types, topography, and land use such as is found throughout the pothole region. And, finally, considerable local opposition has been expressed against purchase of farm lands by the federal government in this area. Some selected statistics for the three study area counties are presented in Table 1.1.

4/ Study currently underway by personnel at the U.S. Fish and Wildlife Service Wetlands Office, Fergus Falls, Minnesota.

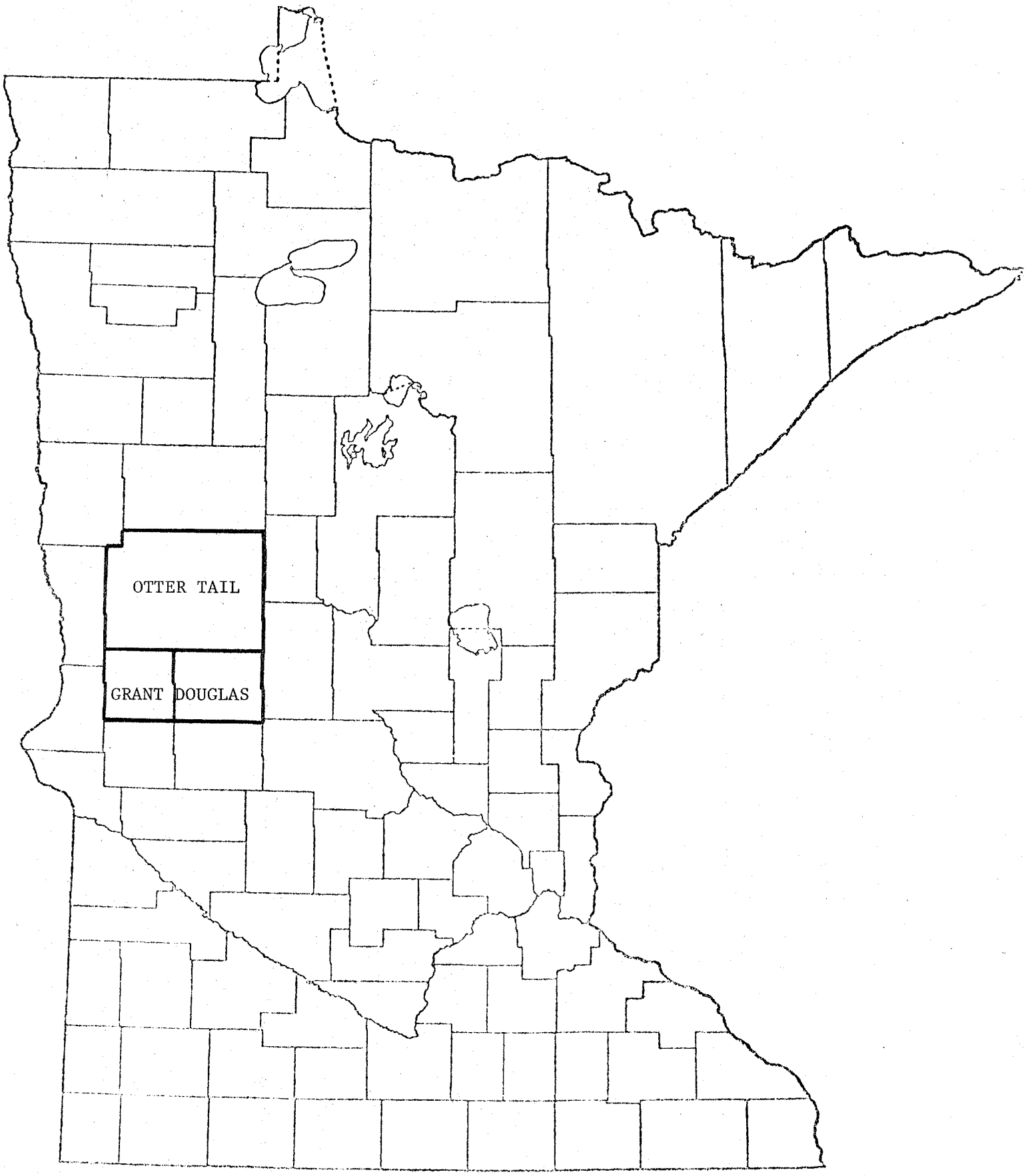

Figure 1.4. Location of study area.

TABLE 1.1 . Selected Statistics for Three County Study Area

Item	Douglas Co.	Grant Co.	Ottertail Co.	Minnesota
1975 Population	25,400	7,600	49,100	3,805,069
Land Area	413,952 ac.	349,632 ac.	1,255,872 ac.	50,744,768 ac.
1977 Total Land in Farms	360,900 ac.	333,800 ac.	1,057,200 ac.	30,600,000 ac.
1974 Total Land in Farms (Percent)	77.2	85.4	75.9	54.4
1977 No. of Farms	1,720	800	5,145	116,000
1977 Avg. Farm Size	210 ac.	417 ac.	255 ac.	264 ac.
1976 Avg. Cash Farm Income	$19,800	$39,800	$22,800	$35,900

SOURCES: U.S. Census of Population, 1975.

Minnesota Agricultural Statistics - 1978.

U.S. Census of Agriculture, 1974.

Farm operations within the three county study area range from small dairy operations to large cash grain farms. The eastern portion of the study area is in Minnesota's wooded hill and lake country where dairy cattle make good use of land not fit for cultivation due to slope, rockiness, wetness, or tree cover. Most of these farms are small, around 250 acres in size, with a milking herd of 25 or 30 cows. Tillable land per farm may be around one-half of total farm size. The principal crops grown are corn, oats, and hay as feed for dairy cows while wheat, barley, rye, soybeans and sunflowers are grown as cash crops.

Cash crop farming is practiced in the western portions of the study area. The topography here is flatter than the dairy region and the rainfall is somewhat less. This flat rich prairie land grows wheat, sunflowers, barley, and other small grains. The farms are somewhat larger than the intensive operations in the dairy belt. Large scale farm equipment predominates in the cash farming region where a very high percentage of the land is tillable.

The northernmost tip of Minnesota's corn belt accounts for the third type of farming found in the study area. Corn belt farms are among the most valuable in the state due to their rich prairie soil, long warm growing season, and adequate rainfall. The principal crops grown here are corn, soybeans, hay, and sunflowers. Hogs and beef cattle are fed on home grown forage crops. There is little pasture land since most of the land is suitable for crops.

II. WETLAND ECONOMICS

Economic issues have a direct bearing upon whether or not wetlands are drained or preserved. Private owners of wetlands compare net returns from the land in its natural state to the net return from the land if it were drained when making drainage decisions. If the present discounted values of the returns to drainage exceeds the cost there is economic incentive to drain the wetland.

However, there are also benefits arising from wetlands which do not accrue to the private landowner and which consequently do not enter his

decision-making process. These benefits are often referred to as "social benefits" because they accrue to society in general. This divergence of private and social benefits of wetlands used in their natural state has given rise to public concern over the extent to which drainage of wetlands occurs.

Theoretical Issues

Let TC and TB in Figure 2.1 represent total private benefits and costs of drainage. TB is assumed to be linear with slope MB, as additional land is drained.[5/] Marginal costs (MC) of drainage are assumed to increase because the least costly land to drain is drained first. Optimal drainage from the landowner's viewpoint occurs at X^*, where marginal benefits and marginal costs of drainage are equal. Net private economic benefits equal the vertical distance ab.

However, in the case of wetland drainage, there is increasing evidence and acceptance that there is a social cost due to the loss of public value attributable to wetlands that is not reflected in private costs. Let these marginal social costs (values) be depicted by MSC in Figure 2.2. The upward slope reflects the fact that some wetlands have greater public value than do others. At X^*, the optional drainage level based upon private costs and benefits, the social cost of draining the marginal acre is gd.

Adding the marginal social cost of drainage (MSC) to the private marginal cost (MPC) gives the marginal social plus private cost of drainage (MTC). Similarly, total social costs (TSC) can be added to total private cost (TPC) to give total social plus private cost (TC). At X^*, in this case, net private benefits equal ab as before as net benefits to society are only ac because the total social cost of drainage equals cb=hj. Thus part of the private return (cb) is an indirect transfer from other people in society (through the loss of wetland value) to those who drain wetlands.

5/ Alternatively (or in addition), marginal benefits could have been assumed to be curvilinear due to declining productivity of the more marginal lands. The basic analysis would be unchanged.

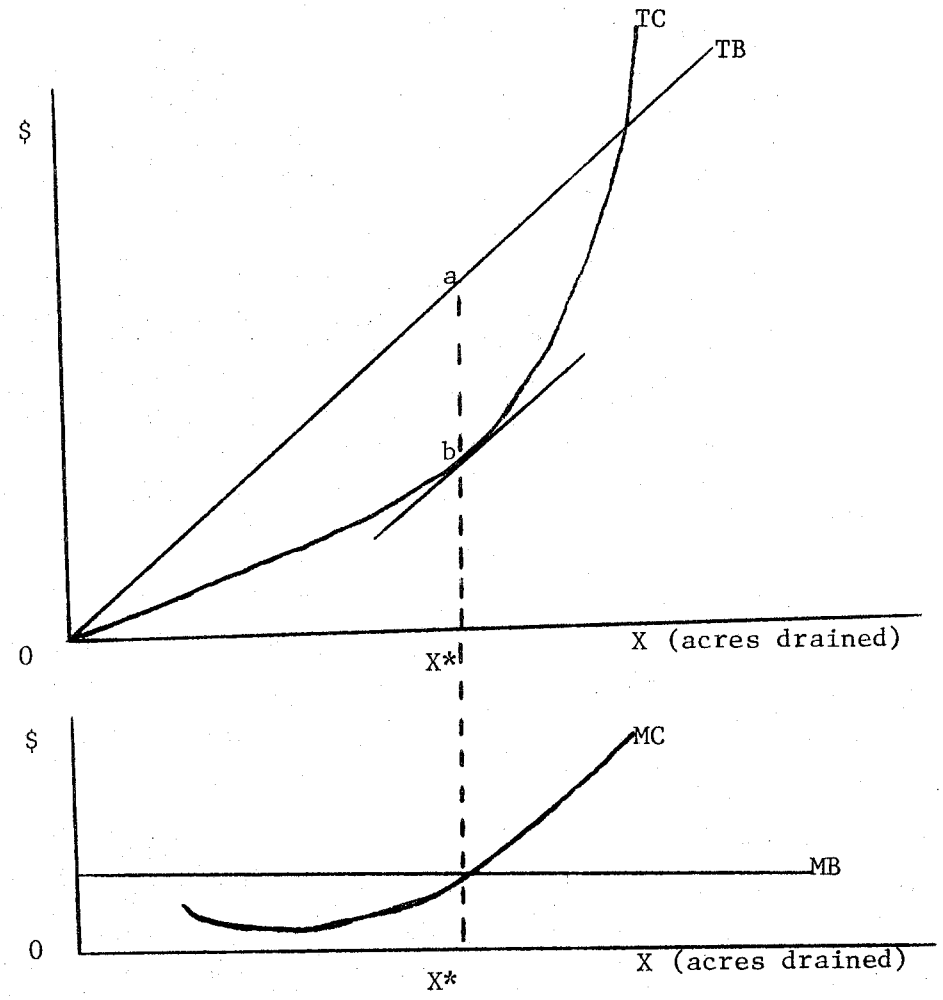

Figure 2.1. Private Benefits and Costs of Wetland Drainage.[a/]

[a/] This approach draws upon R. H. Haveman, "Common Property, Congestion and Environmental Pollution," Quarterly Journal of Economics 87: 278-287; and L. R. Rigoux and R. H. Singh, Benefit-Cost Evaluation of Improved Levels of Agricultural Drainage in Manitoba, Research Bulletin No. 77-1, University of Manitoba, Department of Agricultural Economics and Farm Management, June 1977.

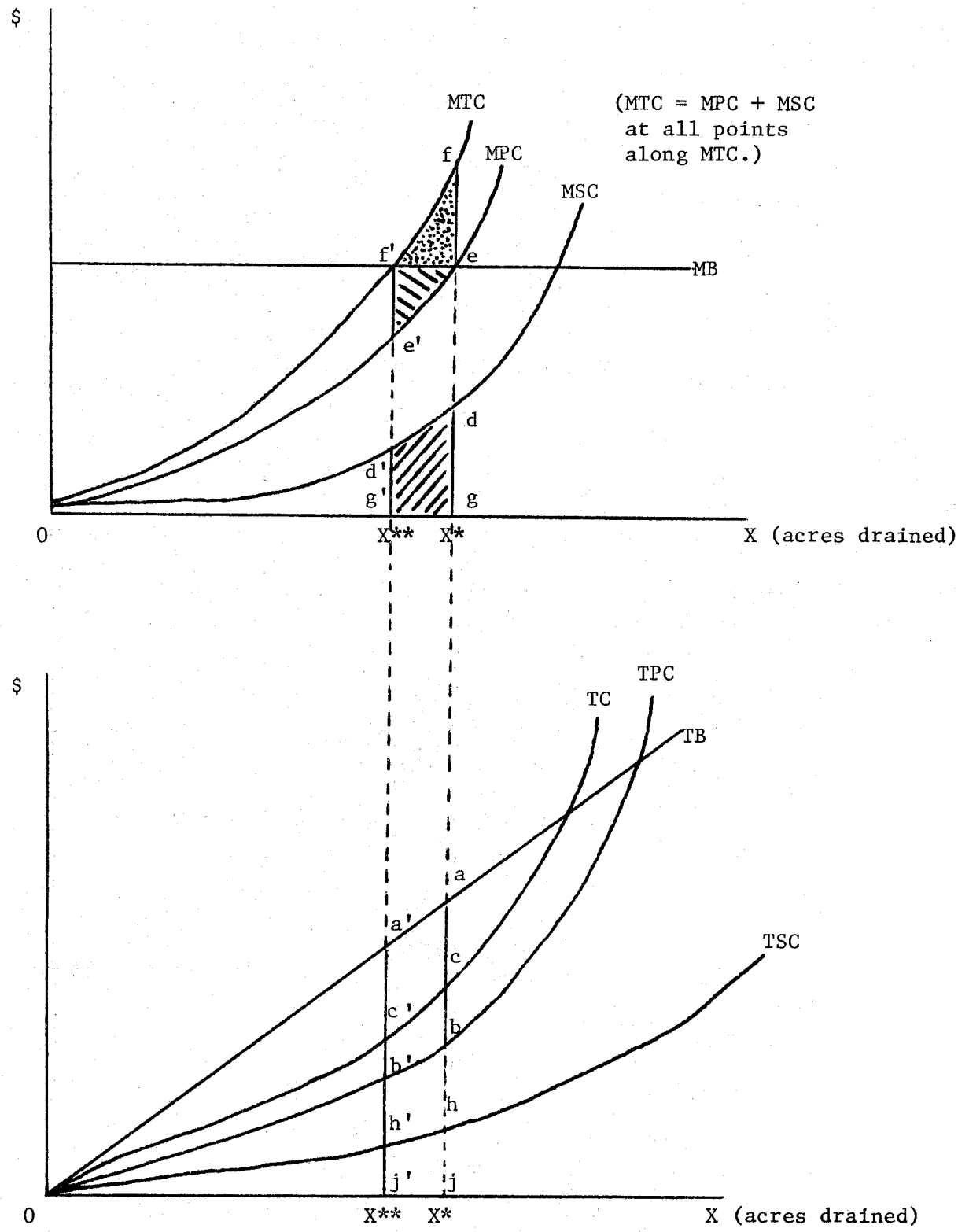

Figure 2.2. Social Benefits and Costs of Wetland Drainage.

The amount of drainage that is socially optimal is X^{**} (Figure 2.2) where marginal total cost (MTC), which is the sum of marginal social cost (MSC) and marginal private cost (MPC), equals marginal benefit (MB). Total net benefit to society (a'c') is maximized and the total social cost of wetlands drained is reduced to c'b'=h'j'. Landowners' net returns declines from ab to a'b' as acres drained declines from OX^{*} to OX^{**}.

To move more closely to social optimality and to reduce the social cost of wetland drainage, private groups and federal and state agencies have established a variety of incentive programs to preserve wetlands. To be effective, these programs must offer monetary return to preservation at least equal to the private returns a landowner expects to attain through drainage of his wetlands. Net private returns are depicted by the difference between TB and TPC or by the area below MB but above MPC in Figure 2.2. To move from X^{*} to X^{**} the preservation incentive offered directly to those who own potentially drainable wetlands, must equal area f'ee' (also equal to ab - a'b'). The reduction in social cost is area d'dgg' (also equal to cb - c'b'). The net social gain is the difference between the two and is equal to area f'fe. With preservation there again is a transfer from society to the wetland owner, but in this case it is a direct payment to preservation program participants rather than an indirect transfer to those who drain their wetlands.

The dollar cost of inducing wetland preservation is related more closely to the returns from drainage expected by landowners than it is to the value of a natural wetland to society. That is, in Figure 2.2 at X^{*}, the relevant net benefit is the amount ab and not cb because it is the landowner that must be given the incentive to preserve his wetlands. On the other hand, the value of wetlands to society is represented by cb. In analyzing the attractiveness (and therefore the effectiveness or lack of effectiveness) of preservation programs it may be more important to estimate empirically the net private return expected by landowners than the social cost of draining wetlands. However, to know whether or not preservation programs are getting "good buys" or to know at what point optimality is reached does require knowledge of the social cost curve.

Estimating marginal social costs and benefits requires data and analyses on landowner incentives to drain wetlands and on the public value of wetland preservation. Goldstein studied the optimal allocation of Minnesota wetlands between agricultural production and waterfowl production as a function of landowner incentives. He was primarily concerned with (1) the severity of bias toward drainage of wetlands when their natural amenity values are not included in private landowner decisions to drain, and (2) the impact of noncompetitive agricultural prices, cost sharing of private drainage activities, and related subsidies upon the amount of wetlands drained. Some of the variables he included in estimating private costs and returns were the extent to which production increases with drainage, the price of the commodity grown, the costs of production (seed, fertilizer, interest), the nuisance cost of having wetlands in fields, and the costs of draining the land. Such drainage budget data provide information for the private marginal cost and marginal benefit functions. To estimate public values of wetlands in their natural state, Goldstein attempted to determine the rental value of wetlands and the value of ducks raised per acre. Although private cost and benefit estimates were obtained, Goldstein did not succeed in estimating public values.

In recent years research has been focused on estimating public values of natural amenities because of increased acceptance of the view that individuals who do hot have property rights can still suffer damages through decisions regarding common property use (Krutilla and Fisher). Important considerations have been the irreversible nature of the destruction of natural amenities and asymmetric technological change (i.e. production of commodities is expected to achieve technological gains over time whereas production of natural amenities is not).

Davis developed an interview "self-estimate" approach to estimate consumer surplus from recreational use of the Maine woods. Hammack and Brown used the same basic approach to estimate the marginal value of bagged waterfowl. Bidding games, or contingent valuation, go a step further by replacing the open-ended questionnaire with a personal interview and feedback process where the respondent is allowed to get a better

feel for the hypothetical market in which he is supposed to be operating (Randall and Brookshire). Hedonic pricing is another, but theoretically quite different, approach based on household production function theory, Lancaster suggested it is the "characteristics" of an experience that are valued rather than the experience itself. With respect to wildlife valuation it is the characteristics of the hunting or fishing experience such as bag or catch that give the experience value. And, as these characteristics change, consumers' expenditures on the experience are expected to change also. Households are assumed to maximize utility subject to the household production function and to budget constraints. (Brown, Charbonneau and Hay; Bockstael and McConnell).

These studies address the problem of attaching a value to the amenities produced by the natural environment. Other functions, such as groundwater recharge, retention of floodwaters and nutrient assimilation, are also claimed for wetlands (Jaworski and Raphael). Estimates of these values, when taken together, provide the type of data needed to estimate the "social cost to wetland drainage" function in Figure 2.2.

Private Drainage Costs and Returns

The cost of wetland drainage varies considerably with wetland characteristics and location. Variables significantly influencing drainage costs include size, outlet location, soil type, legal restrictions, and weather patterns; all of these jointly determine whether the wetland can best be drained by open ditch, underground tile, pumping, or land shaping. This cost variability is especially prominent in undulating topography where it could cost more to drain a small remote pothole than a rather large wetland close to a county drain.

Leitch and Scott estimated costs of open ditch drainage from empirical data collected in northeast North Dakota, which has topography not unlike the study area. They reported per acre costs (1974 dollars) to be $11.24, $14.18, and $18.56 on types 1, 2, and 3 wetlands respectively. However, they alert the reader to the difficulty of estimating such costs because of the great cost variability.

Goldstein estimated drainage costs of temporary wetlands in southern Minnesota. His estimates ranged from $124 to $228 with an average of $157 per acre for tile drainage, and from $16 to $111 with an average of $50 per acre for open ditch drainage (1971 dollars).

Results from the present study indicated costs ranged from $250 to $371 per acre for tile drainage and from $21 to $400 per acre for open ditch drainage.[6/] The majority of drainage done by respondents was by open ditch, with drainage reported as early as 1928 by one respondent.

The most obvious benefit of drainage to private individuals is increased crop production, either from increased cropland area or improved yields on existing cropland. However, other benefits also exist such as squaring up fields, getting rid of noxious weed or wildlife depredation problems brought about by wetlands in cropland areas, and timely seeding of whole fields.

Several examples of improved yields are cited by Anthony, who investigated yield improvements under a variety of drainage conditions. He cited Ohio studies where corn yields improved by as much as 53 percent with drainage. Other areas showed increases of up to 34 bushels of corn per acre on drained soils.

Goldstein estimated corn yields on ditch drained lands in west-central Minnesota would increase by 43 bushels over similar but undrained land. Yield increases for soybeans, wheat, and oats were estimated to be 18, 15, and 40 bushels respectively in this same area. At current 1979 price levels, these yield increases imply an increase in gross revenue per acre of $120 for corn, $130 for soybeans, $60 for wheat, and $63 for oats.

Ultimately it is the individual landowner who makes the decision to drain. He can most accurately estimate the private costs of drainage and make a reasonable prediction of the benefits he would receive. Even when the benefit is merely squaring up a field or removing a nuisance wetland which does not increase output the farm operator may feel the expense is worthwhile. It is only at the individual site level that an accurate

---

[6/] The survey of 137 farm operators, which included 48 (35%) who had drained wetland on their farm, is explained in detail in section IV.

assessment of the private drainage benefits and costs can be made, as evidenced by the wide variability of both costs and benefits.

III. INCENTIVE PROGRAMS

Several state and federal programs for wetland preservation or drainage are on the books in Minnesota, many with conflicting objectives. Only a few of these have had any significant impact on the fate of wetlands in the state. Others have suffered from a lack of funds, excessive red tape, changing legislation, or lack of participation.

Incentive programs come and go depending on public attitudes, political climates, agricultural prices, and other factors that have an influence on attitudes toward land use. Drought years bring about increased demand for soil and water conservation, while wet years stimulate interest in drainage. Recent years have seen a trend toward increased environmental awareness and preservation of natural ecosystems such as wetlands.

This section will highlight some of the significant programs on both sides of the issue - drainage and preservation - and provide an indication of the impacts of those programs.

Drainage Programs

The United States Swamp Land Act of 1860 granted the new state of Minnesota 4.7 million acres of "swamp and overflow lands unfit for cultivation." The purpose of this act was to enable the state to reclaim its swamp lands and promote private agriculture. Most of this land is now in private ownership and much of it has been drained. From the time this initial legislation was enacted until the present, both state and federal government have been involved with wetlands drainage.

Figure 3.1 shows drainage projects in the state in 1952. Most of the drainage in the southern part of the state is complete today, with active new projects now concentrated in the west central area. Large scale public projects have all but disappeared, having been replaced by private on-farm drainage. Some county and judicial ditches are still in progress however.

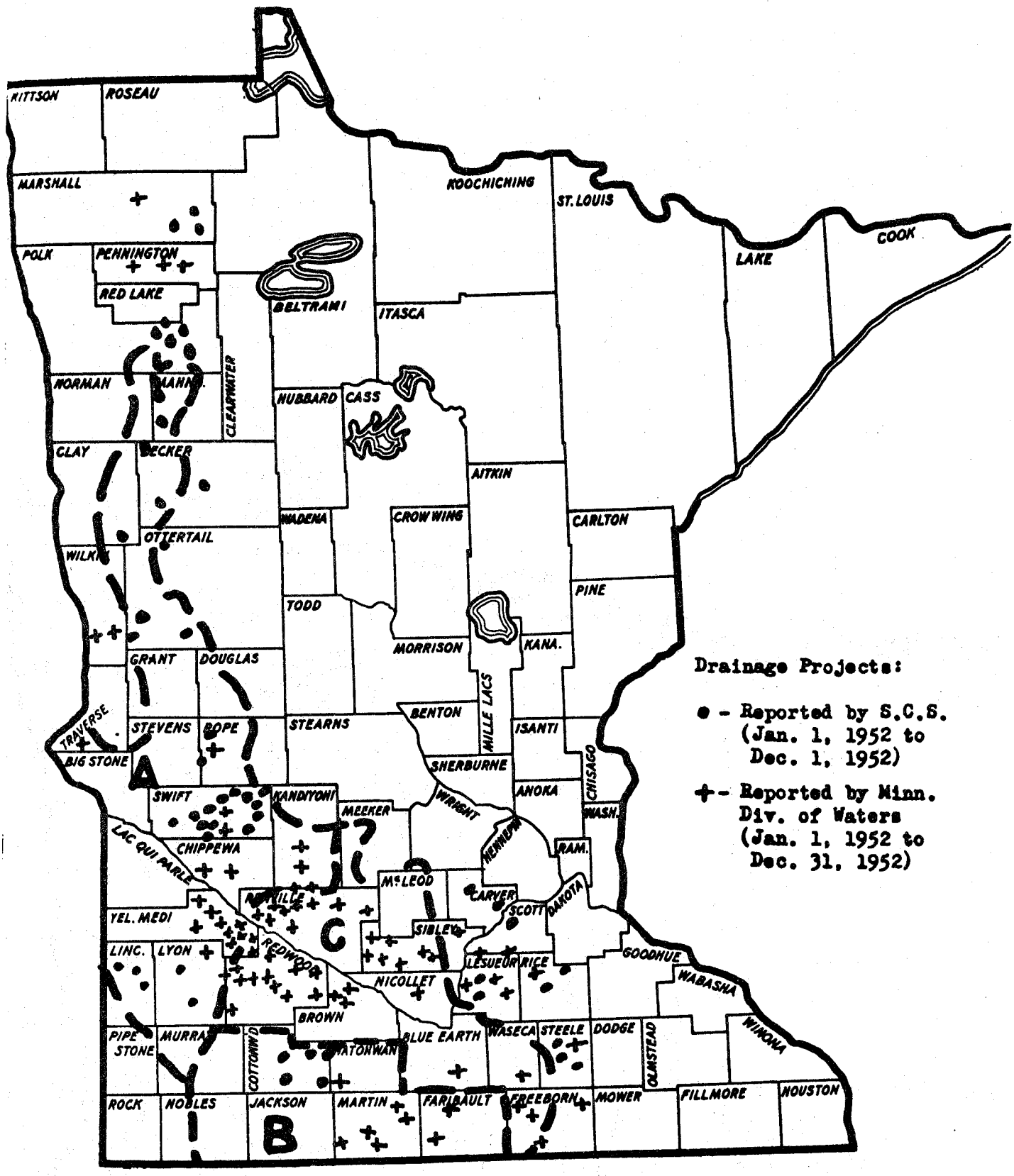

Figure 3.1. Drainage projects Reported to the Minnesota Bureau of Wildlife Development - 1975

Source: Mann, Grady E. Wetlands Inventory of Minnesota, U.S. Department of the Interior, Office of River Basin Studies, Minneapolis, Minnesota, 1955.

Agricultural Stabilization and Conservation Service

The first significant program to provide assistance to individuals to improve their land through drainage was the Agricultural Conservation Program (ACP).[7/] A USDA program administered by the ASCS, the ACP provided cost sharing starting in 1943 for open ditch drainage (C-9), tile drainage (C-10), and land leveling to facilitate drainage (C-11). The program name was changed in 1971 from ACP to Rural Environmental Assistance Program (REAP) then in 1973 to Rural Environmental Conservation Program (RECP) and back to ACP in 1977, but the program has remained essentially unchanged.[8/]

Acres served by ACP C-9, C-10, and C-11 practices in Minnesota have ranged from a low of 14,314 acres in 1977 to a high of 725,650 acres in 1947 (Table 3.1). Although the Reuss Amendment added to the Agricultural Appropriations Act in 1962 forbid cost sharing for drainage on types 3, 4, and 5 wetlands the total acres served did not taper off until several years later. Cost sharing for these three practices ceased completely in 1978 due to a shift of program emphasis.

The effect of the ACP on wetlands is not easy to measure. Financial assistance of approximately 50 percent of the total cost of drainage was available to landowners. This varied from $1.67 per acre served for open ditch drainage in 1947 to $37.44 an acre for tile drainage in 1963 (Table 3.2). The reason these costs are low relative to estimates cited earlier may be due to the definition of "acres served". The amount of cost sharing varied by type of practice and also by year and county. This was an incentive to landowners who were unsure of the profitability of drainage, and was surely a windfall gain to those who would have drained without assistance. Due to the way statistics were compiled by the ASCS, it is nearly impossible to tell what percentage of the 5 million "acres served" between 1943 and 1977 were actual wetlands.

[7/] ACP was authorized by the Agricultural Adjustment Act of 1933.

[8/] Annual summary reports of ASCS ACP programs and state handbooks provide detail on various program accomplishments.

TABLE 3.1. ASCS Acres Served and Cost-Share for ACP C-9, C-10, and C-11 Conservation Practices in Minnesota 1943-1978[a/]

Year	Acres Served[b]	Cost-Share	Year	Acres Served[b]	Cost-Share
	(acres)	($)		(acres)	($)
1943	45,600	d	1962[c]	111,201	1,296,239
1944	234,670	985,772	1963	137,421	1,948,350
1945	210,840	883,920	1964	116,488	1,413,566
1496	380,692	944,524	1965	99,885	1,229,861
1947	725,650	1,433,036	1966	106,153	804,153
1948	0	0	1967	193,824	795,061
1949	263,690	939,398	1968	62,316	450,031
1950	192,859	715,231	1969	102,601	670,217
1951	161,554	615,743	1970	94,239	630,674
1952	138,313	784,443	1971	50,874	411,086
1953	172,683	845,678	1972	91,653	535,633
1954	82,360	516,992	1973	73,591	354,306
1955	188,731	939,713	1974	d	d
1596	113,413	505,662	1975	34,870	302,206
1957	91,158	575,029	1976	21,273	155,814
1958	239,988	1,647,593	1977	14,314	137,504
1959	138,855	928,909	1978	0	0
1960	168,655	1,257,273			
1961	129,543	1,381,207	TOTAL	4,996,447	-

SOURCE: Annual Summary Issues of ASCS ACP Programs

a/ C-9: open ditch drainage
C-10: tile drainage
C-11: land shaping to facilitate drainage, this practice did not occur in Minnesota until 1966.

b/ Acres served is a measure of toal land area benefited by practice.

c/ Reuss Amendment which forbids assistance in drainage of types III, IV, and V wetlands was enacted in October 1962.

d/ Not available.

TABLE 3.2. Statewide Average ACP Cost-Share Payments for Practices C-9, C-10, and C-11 in Minnesota, 1943-1978.

Year	ACP COST-SHARE PER ACRE SERVED			
	Practice			Weighted Average
	C-9	C-10	C-11	
	($)	($)	($)	($)
1944	4.08	4.58	X	4.20
1945	4.08	4.57	X	4.19
1946	2.18	4.54	X	2.48
1947	1.67	4.40	X	1.97
1948	0	0	X	--
1949	3.02	13.53	X	3.56
1950	3.36	10.14	X	3.71
1951	3.49	5.63	X	3.81
1952	4.08	10.77	X	5.67
1953	3.14	12.87	X	4.90
1954	a	a	X	6.28
1955	2.41	13.10	X	4.98
1956	1.98	9.91	X	4.46
1957	3.11	16.18	X	6.31
1958	4.54	17.91	X	6.87
1959	4.39	21.00	X	6.69
1960	4.30	24.18	X	7.45
1961	6.50	25.41	X	10.66
1962	5.87	29.46	X	11.66
1963	4.76	37.44	X	14.18
1964	a	a	X	12.13
1965	3.47	32.84	X	12.31
1966	3.40	18.47	4.11	7.58
1967	2.63	5.46	3.97	4.10
1968	3.05	14.22	3.02	7.22
1969	3.10	11.09	3.06	6.53
1970	3.03	12.00	3.06	6.69
1971	2.51	12.73	2.53	8.08
1972	2.84	10.65	2.60	5.84
1973	2.12	7.78	2.68	4.81
1974	a	a	a	a
1975	5.77	17.65	2.69	8.67
1976	5.53	30.79	2.54	7.32
1977	6.75	15.96	3.00	9.61
1978	0	0	0	0

SOURCE: USDA, ASCS, Agricultural Conservation Program: 30 Year Summary 1944 through 1974; Practice Cost-Shares by States, Washington, D.C., May 1976.

USDA, ASCS, Agricultural Conservation Program: 35 Year Summary 1936 through 1970; Practice Accomplishments by States, Washington, D.C., October 1971.

a/ Breakdown not available.

Soil Conservation Service

The U.S. Soil Conservation Service (SCS) has provided technical assistance to landowners wishing to drain. They provided engineering assistance, such as staking out ditches and tile lines, and technical advice on drainage. Much of the SCS technical assistance has been provided in cooperation with the ASCS's ACP program. The ASCS annually paid approximately 5 percent of its total ACP cost-sharing budget to the SCS for such technical assistance. However, there was no restriction on providing technical assistance for drainage with other funds.

It is not possible to quantify the value of SCS technical assistance provided to landowners who drained their wetlands. It can be assumed, however, that it was certainly a positive incentive to drain, and at the margin resulted in drainage of lands that would have gone undrained without SCS technical assistance.

Research and Extension

Research in agricultural engineering, largely done by commercial companies, has resulted in large scale farm equipment that operates most efficiently in large fields free of obstruction such as wetlands. Modern high horsepower tractors capable of pulling very wide farm implements make pothole drainage advantageous for the most efficient use of this equipment.

Improved methods of soil drainage and drainage made necessary by irrigation development have also been a positive incentive to drain wetland areas.

It is difficult at best to correlate wetland drainage rates with these technological advances, both because drainage itself is difficult to monitor and because the speed with which new technologies are adopted is dependent on several variables. All difficulties of measurement aside, it can be argued that research and extension programs have been an inducement to wetland drainage, although it is not clear whether the magnitude of the impact is large or small.

Price Supports

Government price support programs have provided an incentive for farmers to improve their cropland and bring more land into production. Price supports increase returns to crop production and provide incentives to spend more on production practices such as drainage. Price support programs have been a part of this country's agricultural program since the 1930's.

Goldstein (1971) argued that much drainage in the prairie pothole region of Minnesota would not have been economical without government price supports. The highest overall level of price supports in Minnesota in the past 25 years was during the sixties when government payments were above 8 percent of cash receipts from farm marketing in 3 years (Table 3.3). Johnson believes government farm programs did not increase prices by more than 10 to 15 percent above free market, but this increase may have been significant at the margin in inducing drainage.

Other Drainage Incentives

Various national flood control measures have stimulated private drainage. The Flood Control Act of 1944 (PL 534) contained provisions for federal assistance in major regional projects for flood control. Similarly the Watershed Protection and Flood Prevention Act of 1954 (PL 566) was implemented to coordinate private drainage with large federal and state projects. Although provisions in these acts legislate against new drainage or bringing new land into production, the large channels are indeed an incentive to adjacent land owners to drain - regardless of the law. Erickson (1975) estimated the effects of PL 566 with a case study in South Dakota. He concluded that a 25 mile section of channelization in an SCS watershed project increased drainage feasibility, stimulated drainage, and was a major factor in influencing land owners to drain.

Pressure from county weed boards to take care of weeds encouraged landowners to drain and get the board off their back.

There are various tax advantages to drainage, including credits on federal taxes for reclaiming land. These in effect reduce the actual

TABLE 3.3. Total Cash Receipts from Farm Marketings and Government Payments in Minnesota, 1954-1977

Year	Cash Receipts from Farm Marketings	Government Payments	Percent Government Payments Were of Cash Receipts
	(millions)	(millions)	(percent)
1954	1,237.2	9.2	0.74
1955	1,237.1	7.0	0.57
1956	1,265.6	19.0	1.50
1957	1,337.4	27.7	2.07
1958	1,460.8	41.7	2.86
1959	1,379.1	31.0	2.25
1960	1,437.1	31.7	2.21
1961	1,468.6	78.7	5.36
1962	1,455.7	90.5	6.22
1963	1,465.6	101.4	6.92
1964	1,490.4	121.1	8.13
1965	1,590.3	131.2	8.25
1966	1,813.7	136.1	7.50
1967	1,841.6	95.3	5.17
1968	1,849.0	134.5	7.27
1969	1,986.1	171.2	8.62
1970	2,177.9	151.8	6.97
1971	2,230.3	112.4	5.02
1972	2,479.1	180.0	7.26
1973	4,008.2	105.0	2.62
1974	4,430.4	68.4	0.42
1975	3,805.6	33.9	0.89
1976	3,902.5	59.1	1.51
1977	4,141.0	a	--

SOURCE: Minnesota Agricultural Statistics.

a/ Not available.

cost of draining wetland.

Practices of agricultural lending institutions have also encouraged drainage. Lenders are more apt to loan money to farm operators with well drained cropland and often promote drainage as a way to improve the value and productivity of land under mortgage.

There are social and cultural forces that foster drainage as well. Second or third generation farm operators in the prairie pothole region have been raised with the notion that wetlands are there to drain. Neighborhood pressure encourages those who may not be active drainers to drain. Once drainage gets started in an area its development often proceeds rapidly due to the availability of ditches, drainage contractors, and encouragement from neighbors. Also, benefits are assessed in county and judicial ditch systems whether the landowner intends to drain or not.

In summary, many incentives have encouraged private drainage of wetlands. They range from those offering direct payments such as ACP, to those that stimulate drainage inadvertently, such as improvements in agricultural technology. In a farm operation where profits depend directly on farm production, operators will manage their land for optimum crop production with maximum profits in mind. This usually means drainage of wetlands. Monetary incentives for drainage provided through public programs will increase the likelihood of drainage by individuals.

The incentives to drain wetlands reviewed in this section - namely financial assistance - reduce the actual costs of drainage facing the landowner. This encourages him to drain more than he optimally would if he paid the full cost. The TC curve in Figure 2.1 is shifted down by the amount of drainage subsidy received. MB equals MC at a point to the right of X^*, or acres drained will be greater than the optimum from the individual's viewpoint without the added incentive.

Preservation Programs

In an effort to slow or reverse the amount of ongoing drainage, several state and federal agencies have instituted incentive programs to reward landowners for not draining.

Significant steps toward wetlands preservation were first taken with passage of the Migratory Bird Hunting Stamp (Duck Stamp) Act of 1934. Since

passage of the Duck Stamp Act, a variety of state and federal programs has been implemented. These programs either preserved wetlands as a primary objective or incidental to achieving other land use goals.

U.S. Fish and Wildlife Service

By far the most important and best known federal agency efforts at wetland preservation evolve from the Duck Stamp Act and its subsequent amendments and companion legislation. The Duck Stamp Act provided for collections of $1 from waterfowl hunters when passed in 1934. The price of a duck stamp rose to $2 in 1949, to $3 in 1959, to $5 in 1972, and to $7.50 in 1979 to keep up with rising land costs. Proceeds initially were to be used for waterfowl habitat improvement and management. PL 85-585 of 1958 amended the Duck Stamp Act to allow purchase and lease of wetlands. Through June 1976, 1.2 million acres of land for migratory birds had been purchased in the U.S. In addition, easements prohibiting drainage on 1.1 million acres were obtained.

There are two methods of wetlands preservation available through this program. The first is outright purchase, where the U.S. Government buys wetlands and adjacent upland from willing sellers at current market values. The average price paid per acre by the FWS in the original 19 county authorized area[9/] in Minnesota in 1977 (Figure 3.2) was $568 (Table 3.4). Lands purchased through this program are usually classified as Waterfowl Production Areas (WPA). These lands are managed by the

---

9/ The FWS was originally authorized to purchase land and wetland easements in only 19 counties in Minnesota. An additional nine counties were subsequently added.

U.S. Fish and Wildlife Service (FWS). There were 120,000 acres of WPA's in Minnesota as of January 1, 1979. Approximately 35 to 40 percent of that area was actual wetland, with the remainder being adjacent upland (Harrison).[10/]

A second alternative for the FWS is to buy from landowners the easement rights to drain, fill, burn, or level wetlands. With the above limitations, the landowner retains all other rights and responsibilities of land ownership on the wetland area.

Easement payments are made in a one-time lump sum and vary depending on the land values in the immediate area and the development potential of the wetland. Payments in the three county study area averaged $260 per acre in 1978 (Table 3.5). Appendix A presents a history of the wetlands easement evaluation process.

The easement program has been used more extensively in North and South Dakota than in Minnesota. Total wetland area under perpetual easement in the three states in 1978 was 1,105,000 acres; with 33,000 acres, 769,000 acres, and 303,000 acres in Minnesota, North Dakota, and South Dakota respectively (Harrison).

ASCS

The USDA acting through the ASCS has had programs that preserved wetlands as a primary goal and also preserved them incidental to other program goals. The Agricultural Conservation Program discussed in the drainage incentive section had practices until 1973 that cost-shared for creating shallow water areas for wildlife (G-2). The long-term effects of G-2 cost-sharing for shallow water areas are uncertain but as many as 64,000 Minnesota acres were included in this practice in one year (Table 3.6).

10/ North Dakota had 221,000 acres of WPA of which 40 percent was wetland and South Dakota had 81,000 acres with 42 percent wetland as of October 1978.

TABLE 3.4. Fish and Wildlife Service Fee Purchases by Year for the Three County Study Area and the 19-County Wetland Area, 1962-1978.

Year	Study Area		19 County Wetland Area	
	Acres Purchased	Average Cost Per Acre	Acres Purchased	Average Cost Per Acre
	(acres)	($)	(acres)	($)
1962	677	47		
1963	3,197	78		
1964	3,901	69	NOT AVAILABLE	
1965	5,094	86		
1966	2,733	98		
1967	1,438	93		
1968	1,721	103		
1969	1,437	86		
1970	1,839	104		
1971	2,002	106		
1972	483	174	3,492	157
1973	132	169	2,810	197
1974	276	334	5,847	302
1975	2,574	365	6,590	356
1976	1,034	492	3,662	449
1977	1,337	637	2,523	568

SOURCE: U.S. Fish and Wildlife Service Wetlands Office, Fergus Falls, MN

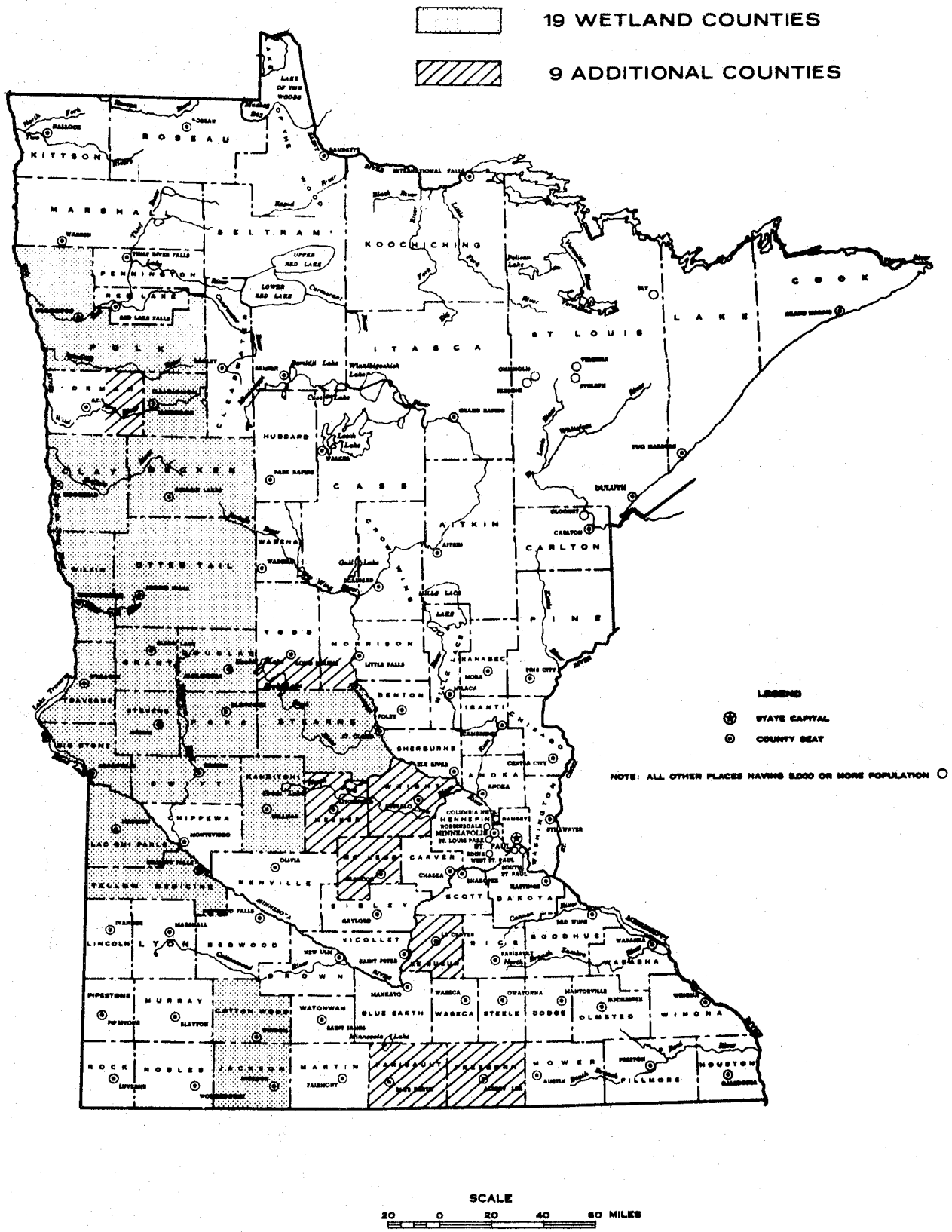

Figure 3.2. FWS Authorized Wetland Counties.

TABLE 3.5. Fish and Wildlife Service Easement Payments by Year for the Three County Study Area.

Year	Average Payment per Acre
1962	no contracts
1963	$13.60
1964	$20.00
1965	$21.00
1966	$21.00
1967	$19.80
1968	$22.10
1969	$16.54
1970	$19.56
1971	$26.36
1972	$17.65
1973	$30.05
1974	$25.00
1975	no contracts
1976	$175.00
1977	$320.00
1978	$260.00

SOURCE: U.S. Fish and Wildlife Service Wetlands Office, Fergus Falls, Minnesota.

TABLE 3.6. Acres Enrolled in ACP G-2[a/] Practice in Minnesota by Year, 1962 to 1973.

Year	G-2 Acres[b/]	Number of Agreements
	(acres)	(no.)
1962	35	10
1963	306	37
1964	773	51
1965	2,734	36
1966	4,759	40
1967	17,014	32
1968	13,809	49
1969	24,570	68
1970	64,222	282
1971	11,927	791
1972	17,900	986
1973	4,867	400

SOURCE: Annual Summary Issues of ASCS ACP Programs.

a/ Development or restoration of shallow water areas for wildlife.

b/ Total lands not just impoundment.

Another ASCS program that affected wetlands drainage was the Conservation Reserve Program authorized by the Soil Bank Act of 1956 (PL 84-850). "The purposes of the Conservation Reserve Program were to divert land from the production of crops, livestock, and their products; to conserve the soil during the diversion period; and to stimulate tree planting, water impoundment, and wildlife conservation" (ASCS, 1961). This program provided payments to participating landowners for 3 to 10 year contract periods. Payments were established through competitive bidding by landowners and averaged about $10 per acre in Minnesota during the program's 17 years (Table 3.7). The final year for enrollment in Soil Bank was 1960. In that year nearly 2 million acres were under contract in Minnesota. A large portion of acreage under contract consisted of whole farms while the average acreage per contract was approximately 100 acres. The last of the Soil Bank contracts in the state expired in 1972. This program had the effect of delaying drainage on lands in Soil Bank, but once the contract expired, drainage was once again at the option of the owner.

Other programs of limited extent were instituted by the USDA and administered by ASCS to alleviate the oversupply of agricultural production. One was the Cropland Adjustment Program (CAP) authorized by the Food and Agriculture Act of 1965 (PL 89-321). Similar to the Soil Bank, this program was designed to shift cropland to conservation uses. CAP offered landowners an additional payment if they would allow public use, without charge, for hunting, trapping, fishing and hiking. Another feature of CAP was grants to government agencies to help them acquire eligible cropland and convert it permanently to use as open space, natural beauty, wildlife or recreational facilities, or for the prevention of air or water pollution. CAP had money appropriated for contracts only during the first two years with only about 8 million acres enrolled nationwide.

The Cropland Conversion Program (CCP) was authorized by Title I of the Food and Agriculture Act of 1962 (PL 87-703) to provide long-term (3-10 year) agreements with landowners to convert cropland to grass, forests, outdoor recreation, or wildlife development. Participating farmers received adjustment payments, costshare payments, and technical assistance.

TABLE 3.7. Conservation Reserve Program (Soil Bank) Acreage Under Contract and Average Rental Rate for Minnesota, 1956-1972.

Year	Acreage Under Contract	Average Acreage Per Contract	Average Rental Rate per Acre Under Contract
	(acres)	(acres)	($)
1956	13,825	b	9.28
1957	552,011	b	9.39
1958	1,030,567	b	9.18
1959	1,761,904	b	10.89
1960	1,944,476	94	11.23
1961	1,903,973	95	11.30
1962	1,662,420	98	11.50
1963	1,448,119	100	11.79
1964	946,661	113	10.98
1965	798,961	121	10.50
1966	789,294	121	10.52
1967	557,668	115	11.05
1968	384,884	109	11.99
1969	101,142	84	11.90
1970	15,832	49	9.74
1971	1,477	74	9.40
1972	5	5	b

SOURCE: Conservation Reserve Program and Land Use Adjustment Program, USDA, ASCS, 1964.

Conservation Reserve Program of the Soil Bank, USDA, ASCS, August 1963.

a/ No new contracts were entered into after 1960. The Food and Agriculture Act of 1965 (Sec. 601) repealed the Soil Bank Act.

b/ Not available.

The Federal Water Bank Program (authorized by PL 92-559 in 1970), was designed to preserve and improve wetlands and habitat for wildlife along with other soil and water conservation objectives (Appendix B). The Water Bank Program provides for annual payments to landowners to maintain an upland area adjacent to wetland during a 10-year contract period. These payments (adjusted annually since 1972 for new contracts) are based primarily on the value of potential agricultural production from contract lands. Per acre payments in the program's first year ranged from $10 to $17, while in 1978 they ranged from $6 to $45 (Appendix B). Rates in 1979 will be based on production potential of land accepted in the program, rather than countywide administered payments.

In Minnesota[11/] during several years prior to 1979 there were funds remaining at the end of the fiscal year. This was due to low participation caused by low payments relative to private returns from the land. The new method of figuring payments initiated in 1979 raised payments sufficiently to exhaust all of the Water Bank money allocated to Minnesota. However, the Dakotas and Wisconsin could have spent much more than their annual allocation.[12/]

As of the end of 1978, contracts in Minnesota totaled 66,246 acres in 34 counties of which 17,600 acres, or 26 percent, were wetland (Table 3.8 and Figure 3.3). The highest enrollment year was 1974, when 16,311 new acres were under contract in the state.

State Programs

The Minnesota Department of Natural Resources (MDNR) has several programs designed to preserve wetlands. The "Save Minnesota Wetlands" program begun in 1951 provided for the purchase of 479,494 acres of wetland

---

11/ Minnesota is one of 15 states authorized to participate in the Water Bank Program. The other 14 are: Arkansas, California, Louisiana, Maine, Michigan, Mississippi, Montana, Nebraska, North Dakota, Oregon, South Dakota, Vermont, Washington, and Wisconsin.

12/ The Water Bank Program is allocated a total of $10 million per year to be spent in authorized states.

TABLE 3.8. Water Bank Acreage Enrolled by Year in Minnesota Counties, 1972-1978.

County	1972	1973	1974	1975	1976	1977	1978	TOTALS
Big Stone	757	859	1,036	1,022	656	824	1,213	6,367
Douglas	1,378	49	2,441	102	302	1,144	640	6,056
East Polk	1,305	1,292	751	454	165	931	827	5,725
Jackson	314	0	0	0	0	0	0	314
Kandiyohi	817	186	1,628	470	344	552	519	4,516
Lac qui Parle	204	383	0	0	0	0	275	862
Mahnomen	450	867	759	538	221	657	1,546	5,038
Meeker	1,067	0	1,497	529	190	655	651	4,589
Stevens	794	95	0	0	294	297	30	1,510
West Ottertail	1,718	434	2,883	2,075	3,311	1,946	1,269	13,636
Grant	a	30	1,599	384	112	709	309	3,143
Pope	a	0	2,500	1,078	694	921	857	6,050
Swift	a	0	147	471	198	360	90	1,266
Becker	a	a	a	a	0	586	71	657
Stearns	a	a	a	a	0	18	435	453
Swift	a	a	a	a	0	0	0	
Blue Earth	a	a	a	a	a	59	0	59
Brown	a	a	a	a	a	0	128	128
Carver	a	a	a	a	a	14	45	59
Clay	a	a	a	a	a	406	341	747
Cottonwood	a	a	a	a	a	36	175	211
Freeborn	a	a	a	a	a	151	73	224
LeSueur	a	a	a	a	a	178	400	578
Lincoln	a	a	a	a	a	0	89	89
Lyon	a	a	a	a	a	0	74	74
McLeod	a	a	a	a	a	0	399	399
Murray	a	a	a	a	a	30	0	30
Norman	a	a	a	a	a	45	140	185
Rice	a	a	a	a	a	0	586	586
Scott	a	a	a	a	a	20	473	493
Todd	a	a	a	a	a	0	380	380
Traverse	a	a	a	a	a	71	0	71
Waseca	a	a	a	a	a	0	133	133
Wright	a	a	a	a	a	0	241	241
Yellow Medicine	a	a	a	a	a	212	0	212
Nicolet	a	a	a	a	a	0	0	0
East Ottertail	a	a	a	a	a	0	0	0
	8,834	4,165	16,311	7,123	6,487	10,822	12,504	66,246

SOURCE: USDA, ASCS SC-696 Water Bank Program Status of Agreements for Minnesota Counties as of October 25, 1978.

a/ Not an eligible county that year.

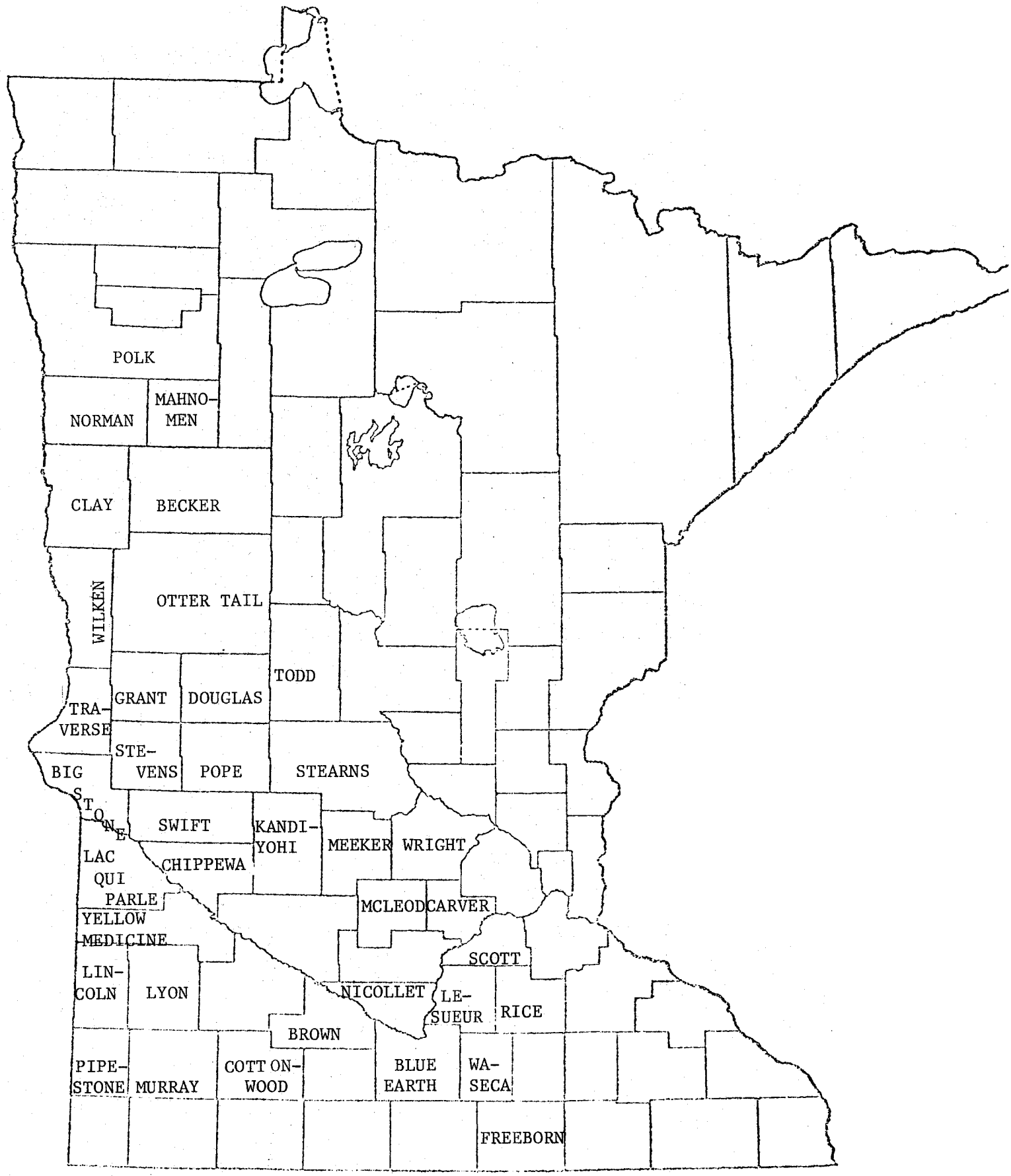

Figure 3.3. 1978 Water Bank Counties

and adjacent upland habitat across the state. These state owned areas are designated as Wildlife Management Areas (WMA's) and are generally open to public use. There are 2,671 acres, 3,943 acres, and 7,513 acres of WMA's in Grant, Douglas, and Ottertail counties, respectively.

A state Water Bank program was initiated in 1976 but as of this writing no contracts have been made. This program offers an annual payment of 5 percent of the fair market value of the wetland basin. It is a companion program with the State Public Waters Law (Minn. Stat. 105.391) which protects against unauthorized drainage of waters classified as public.[13/]

The Wildlife Habitat Improvement Program (WHIP) administered by MDNR is authorized to cost-share for establishment of habitat on private lands. Relatively new, WHIP has had very little impact on wetlands. Due to budget constraints and rigid contract provisions, future program participation may be minimal.

A property tax credit plan exists in the state also. However, due to the excessive amount of administrative red tape that leads to a small financial reward, no landowner has participated in this program. The 1979 Legislature passed a bill which will reduce a landowner's property tax liability for each acre of wetland left undrained and enrolled in the new program.

Private Wetlands Preservation Programs

Ducks Unlimited (DU) is a private nonprofit organization founded in 1937 whose objective is to restore and rehabilitate prime waterfowl breeding grounds in Canada. This objective is accomplished primarily through wetland easements in the prairie pothole region of Canada. DU's efforts in the U.S. are mainly through legislative action, public relations work, and fund raising.

13/ "Public waters" were redefined by a 1979 legislative amendment as "beneficial waters."

The Minnesota Waterfowl Association was founded in 1976 to promote development of large waterfowl lakes in southern Minnesota. The association was involved in passage of the State Waterfowl Stamp Bill in 1977. The association also raises funds to promote wetlands preservation and helps facilitate wetlands purchases by the DNR.

A host of other private organizations, associations, and clubs exist that promote wildlife programs. The Nature Conservancy is a national association that has purchased several tracts of land in the state. The Fergus Falls area "Save the Wetlands Club" purchased wetlands in Ottertail county. Most private groups act as pressure groups to influence legislation, donate funds, or donate lands to the state for designation as WMA's.

In summary, incentives facing wetland owners are seen to take a wide range of options, from payments for preservation to payments for drainage of wetlands. Although ASCS cost sharing for drainage has ceased, at one time it provided a significant incentive to drain by paying approximately one-half of those costs. High crop prices, government subsidized crop prices, and the advent of bigger farm machinery have all been positive incentives to drain wetlands. On the other side, wetland easement payments as high as $480 per wetland acre (a one time lump sum) and annual Water Bank payments as high as $45 per upland acre ($5 per wetland acre) have been strong stimuli towards preservation. The wetland owner faces the decision of what to do with his wetlands given a myriad of incentives toward both preservation and drainage.

IV. LANDOWNER ATTITUDES TOWARD WETLANDS

Although economic incentives exist for either drainage or preservation of wetlands, whether or not drainage is undertaken depends partially on other noneconomic factors, such as attitude toward wetlands, age, future farming plans, etc. A personal interview survey was conducted of a sample of farm operators in Douglas, Grant, and Ottertail counties in West Central Minnesota to obtain additional information about the drainage decision-making process.[14/] The objectives of this survey were to:

[14/] Sampling procedures are outlined in Appendix C.

1) obtain information on farm operator attitudes toward wetlands,[15/] 2) collect data distinguishing participators and nonparticipators in wetlands preservation programs, and 3) obtain basic information on drainage patterns and costs. The first part of this section will discuss the characteristics of the sample population, especially as they relate to wetlands drainage and preservation. The remainder of the section presents an analysis of the relationship between respondent characteristics, and their attitudes toward wetlands. The data on drainage costs and patterns were too limited to draw more than general conclusions.

Respondent Characteristics

Most of the 137 respondents were well established farm operators having operated their present farms for 20 years or more (Table 4.1). Their farms averaged 329 acres in size with 35 percent dairy operators, 20 percent beef or hog farms, 40 percent cash crop farms, and 5 percent hobby farms.

Seventy-eight percent of the respondents said farming was their primary occupation and 69 percent said they plan to continue farming for at least the next five years. All of those not continuing with farming cited age or health as their reasons for quitting. Most (72 percent) also felt that farming in the future will be as good or better than it has been in the last five years.

Over one-third (36 percent) had purchased land to expand their farms since 1970. Furthermore, 25 percent planned to increase the amount of cropland they farm, primarily by buying or renting more land (Table 4.2).

Forty-three percent (59) of the respondents agreed they had become more supportive of efforts to preserve wetlands. Thirty-seven percent

---

[15/] See Fortney, Charles T., Robert M. Dimet, Donald R. Field, and Howard M. Sauer, 1972. Attitudes of South Dakota Farm Operators Toward Wetlands and Waterfowl Production. South Dakota State University Agricultural Experiment Station Bulletin 592 for a discussion of a similar study in South Dakota.

TABLE 4.1. Respondent Characteristics

Age		Years Operated Present Farm	
Age Category	Percent	Category	Percent
20-29	8	Less than 10 years	23
30-39	13	10 to 19 years	13
40-49	22	20 or more years	74
50-59	22		100
60-69	18		
70+	17		
	100		

Farm Size		Farm Type	
Size Category	Percent	Type	Percent
Less than 160 acres	22	Dairy	35
160 to 480 acres	64	Beef or Hog	20
481 or more acres	14	Cash Crop	40
(Mean = 329 acres)		Hobby	5
	100		100

TABLE 4.2. How Respondents Plan to Increase the Cropland They Farm

Method	Frequency of Response[a]	Percent
Buy land	22	45
Drain land	7	14
Rent land	15	31
Plow up permanent hay land	4	8
Clear woodland	1	2
	49	100

[a] More than one method could have been given by each respondent.

(51) disagreed that they had become more supportive, while 20 percent (27) had become neither more or less supportive. Those that had become more supportive felt that wildlife was an important product of wetlands (Table 4.3). Perhaps related to this is that half of the respondents were hunters, or had purchased a hunting license in at least two of the past five years. The water holding capacity of wetlands was also important to respondents.

TABLE 4.3. Reasons Given for Being Supportive or Not Supportive of Wetlands Preservation

Reason[a]	Frequency of Response[b]	Percent
Supportive		
Provide Wildlife	35	50
Groundwater recharge, prevent drought, save water, provide stock water	11	16
Natural Condition	10	14
Place to hunt	6	9
Prevent Flooding	3	4
Landscape Diversity	3	4
Soil Conservation	2	3
	70	100
Not Supportive		
A nuisance, weed problems	8	31
Dislike government control	7	28
Take cropland out of production	4	15
Have enough wetland already	3	12
Too costly to preserve	2	8
Wetlands are just wasteland	1	3
Create a fire danger	1	3
	26	100

[a]The question was open-ended allowing the respondent to provide his own answer(s).

[b]Respondents could offer more than one reason for their feelings.

Reasons for being less supportive of programs to preserve wetlands included identifying wetlands as a nuisance and creating weed problems (Table 4.3). Other respondents did not like government control associated with wetlands preservation programs or were concerned about wetlands preservation taking cropland out of production. This latter feeling may be a result of the practice of wetlands preservation agencies purchasing at least as much upland as wetland area, which they believe has to be done to provide adequate protection of the wetland.

Most of the respondents (72 percent) felt that wetland owners should be paid for preserving wetlands. The favored choices for compensation method were either a short term lease or a property tax credit (Table 4.4). When later asked whether a wetland tax credit bill in the Legislature would have any effect on their drainage decisions, 84 percent said it would. Some of the suggested methods to compensate wetlands owners are currently available through existing programs; including Water Bank, duck stamp money, a percent of crop returns (the new Water Bank compensation scheme), and a tax credit which the state of Minnesota has authorized.

One of the subgroups specifically sought out in this survey was those who had turned down either a purchase or easement offer made by the Fish and Wildlife Service. Of special interest was why these individuals refused an offer. With only seven fee refusals and eleven easement refusals included among the respondents it is somewhat difficult to establish definitive explanations for their actions. Table 4.5 shows little consensus existed as to why they refused. The perpetual lease mentioned by three easement refusers stays with the land upon transfer of ownership and may hurt resale as one respondent mentioned. Apparently a larger payment would change the minds of three easement and two fee refusers. Two easement refusers who responded that trespass was a problem with easements were apparently unaware that easement contracts allow the landowner exclusive rights to determine who may enter the property.

To investigate further what it is farm operators like and dislike about wetland preservation programs, all interviewers were asked what changes in these programs would have to be made to get them to participate.

TABLE 4.4. Responses to How Wetlands Owners Should be Paid for Preservation

Payment Method	Frequency of Response	Percent
Short term or annual lease	24	30
Property tax credit	19	24
Duck Stamp monies	8	10
Direct Payment	7	9
Government	6	8
Same way, only more	5	6
A percent of crop returns	5	6
Water Bank	3	4
Lease	2	3
	79	100

[a]The question was open-ended with the possibility of multiple responses by an individual respondent.

TABLE 4.5. Reason for Refusing FWS Offers for Fee and Easement Contracts

Reason[a]	Frequency[b] Easement	Fee
Perpetual lease	3	-
Payment too low	3	2
Trespass	2	0
Contract restrictions	1	0
Weed problems	0	1
Would hurt resale	1	-
Need to relocate	0	1
Did not want to participate	2	0
	12	4

[a]The question was open-ended with the possibility of multiple responses by an individual respondent.
[b]Not all program refusers replied to this portion of the question, and some gave more than one answer.

The response given most often was for more information on the programs (Table 4.6). The next two most frequent responses follow what was said by those who had refused offers, that is, that the payment should be higher (19 percent) and that leases should be shorter (17 percent). Easing restrictions on easement lands was also cited as an area for improvement.

Thirty-five percent of the respondents with wetland on their farm said there was a dollar value at which they would sell or take easement on their wetlands. Fifteen respondents quoted a price at which they would sell, with the average price being $583 per acre. Eleven quoted a price at which they would sell an easement, with the average being $271 per acre. Overall, respondents indicated that the average price of cropland in their area was $736 per acre. Thus, it appears those who would sell their wetlands would accept approximately 80 percent of cropland value, while easement sellers would settle for 37 percent of cropland value. These values are naturally much more site specific than they are shown here, but give a general feeling for how some of the respondents value their wetlands.

TABLE 4.6. Suggested Ways to Improve Wetland Preservation Programs

Change[a]	Frequency of Response	Percent
More information	17	29
Higher payments	11	19
Shorter leases	10	17
Fewer easement restrictions	8	14
Purchase only wet area	5	8
Just use lowland areas	2	3
No tax on wetland	2	3
Less government control	2	3
Deny public access	1	2
Pay for wetland improvements on private land	1	2
	59	100

[a]The question was open-ended with the possibility of multiple responses by an individual respondent.

Provisions of FWS wetlands easements carry over to the new owner when land is transferred. It is thought that this affects the potential resale value of the land and thus is a disincentive to participation. To obtain further information on this subject, a question was asked about the existence of easements on land purchased. Eight of fourteen respondents who had bought land under one of these programs said they knew about it at the time they had bought. Contrary to popular belief, these eight also said that this did not affect the price they paid for the land. People who buy land with a Water Bank contract on it may continue the contract at their option.

Another often voiced complaint about wetland programs is that the lands are not managed to control weeds adequately or that they create other problems for adjacent landowners. One-half of the respondents said their neighbors had sold wetlands to the state or federal governments. Of these, only 13 percent said that wetlands owned by the government caused them problems. Here again, weeds were cited as the most frequent source of trouble (Table 4.7). Four respondents mentioned problems caused by hunters.

Respondents whose neighbors had sold easements or had participated in the ASCS Water Bank were asked if this had caused them any problems. Of the 54 respondents (39 percent) who knew of their neighbor's participation in one or both of these programs only four had problems because of it.

TABLE 4.7. Problems of Respondents Living Near Government Wetlands

Problem[a]	Frequency of Response[b]	Percent
Weeds	9	40
Hunters trespassing	4	18
Wildlife damage or nuisance	3	14
Lost lease on land sold to FWS	2	9
Raised taxes, fire damage, restrict drainage, Raised land price	4	19
	22	100

[a]The question was open-ended with the possibility of multiple responses by an individual respondent.

[b]Some respondents did not answer, and some gave more than one response to the question.

Two cited weeds as a problem, which under these programs are the farm operator's responsibility. One respondent complained that it took land out of production, and the other said it blocked his development plans. Apparently, the programs where the landowner retains ownership rights are believed not to cause as many problems as when the wetlands are bought outright by a government agency.

Drainage is oftentimes a source of discord between neighbors. Of the 70 respondents who were aware of drainage done by neighbors only 14 said there had been any problems caused by it. The majority of these (11 of 14) claimed their neighbors drained water on them. One respondent asserted his neighbor's drainage had caused pollution. Another was disturbed that he had been assessed for a local drain.

Thirty-six of the respondents (28 percent) with wetlands on their farm said they would like to drain some of them. Most of the wetland they wanted to drain (66 percent) was permanent wetland surrounded by cropland, while 24 percent was temporary wetland surrounded by cropland.[16/] The primary reason to drain was to increase the amount of cropland (Table 4.8). Closely associated with this were 26 percent who wanted to get better use of their fields, or eliminate a nuisance. Drainage would allow two farm operators to irrigate. Another two wanted to improve pasture land by drainage.

When asked why they had not already drained these areas the responses varied from cost (34 percent) to that they had tried to drain it but were unsuccessful (5 percent) (Table 4.9). Six respondents cited legal restrictions had blocked their drainage plans. These could have either been FWS easement restrictions or difficulty in obtaining legal right to an outlet.

16/ A temporary wetland was defined as one that is usually dry by the end of the planting period. It may be too wet to seed one or two years out of ten. A permanent wetland was defined as one that is usually wet throughout the year. It may be several feet deep and contain cattails or other emergent vegetation. It may be cropped one year in ten, but could be hayed, at least around the edges, more often.

TABLE 4.8. Reason for Wishing to Drain Wetlands

Reason[a]	Frequency of Response	Percent
Increase or improve cropland	25	60
Better use of field	11	26
Improve pasture	2	5
Allow irrigation	2	5
Increase native hayland	1	2
Eliminate nuisance birds	1	2
	42	100

[a]The question was open-ended with the possibility of multiple responses by an individual respondent.

TABLE 4.9. Reasons for Not Draining Wetland Respondents Wanted to Drain

Reason[a]	Frequency of Response	Percent
Drainage cost too high	13	34
Just have not got around to it	8	21
Legal restriction	6	16
Neighbor wil not separate	4	11
No reasonable outlet	3	8
Tried but unsuccessful	2	5
Recently purchased farm	2	5
	38	100

[a]The question was open-ended with the possibility of multiple responses by an individual respondent.

Many of those wishing to drain said they would raise corn (38 percent) on the drained wetland (Table 4.10). The yields they expected to get on drained wetland were usually higher than the yields they reported getting currently on their cropland, with the exception of hay and flax. Expected higher yields on drained areas are perhaps the result of experience, as one-half of those who had drained claimed their yields were higher on drained areas than on adjacent cropland. Forty percent said the yields were the same and only eight percent reported lower yields on drained areas.

TABLE 4.10. Crops and Expected Yields on Potentially Drainable Wetlands

Crop	Frequency of Response	Percent	Expected Yield Per Acre
Corn	16	38	92.5 bushels
Rotation	12	29	-
Oats	7	17	70 bushels
Wheat	2	5	37.5 bushels
Alfalfa	1	2	4 tons
Soybeans	1	2	30 bushels
Pasture	1	2	-
Potatoes	1	2	300 pounds
Flax	1	2	20 bushels
	42	100	

Open ditch drainage would be used by 57 percent (20 respondents) of those who would like to drain. The others would use either underground tile (34 percent, 12 respondents) or another method (9 percent, 3 respondents) such as a pump or a combination of the three. Nearly all (94 percent) of the 36 respondents who would like to drain said they would hire it done. Only two would do the work themselves, one with his own equipment and the other with rented equipment.

All farm operators interviewed were asked if their drainage intentions had been affected by elimination of ASCS cost-sharing for drainage. Eight percent (11 respondents) responded that it had affected their plans. Only one of the 35 who would like to drain said it did not affect his plans. It is obvious from this response that ASCS cost-sharing of 50 per-

cent of drainage costs (see section III) was a strong incentive to drain wetland.

A little over half (54 percent) of those who would like to drain thought the government should aid them, either with financial or technical help. Only 19 percent of those who did not wish to drain thought the government should provide aid.

The results of drainage do not always meet the farm operator's expectation. However, of the 58 respondents (35 percent) who had drained wetlands only 16 (28 percent) had any problems farming these areas. The most frequent problem cited was farming the drained area in wet years (Table 4.11). Another significant problem encountered was a poorly done job of drainage.

Another source of discontent between land owners and public officials is the alleged high amount of tax paid on wetlands. Only 15 percent of the respondents could cite a dollar value at which their wetlands were appraised. This value ranged from $.50 to $200. The vast majority said they did not know the value at which their wetlands were appraised (Table 4.12). Nine percent believed they were valued the same as the

TABLE 4.11. Problems Farming Drained Wetlands

Problem	Frequency of Response[a]	Percent
Farming in wet years	11	61
Poor drainage job	4	21
Raised water level in another slough	1	6
System is old	1	6
Pasture was poor	1	6
	18	100

[a]The question was open-ended with the possibility of multiple responses by an individual respondent.

rest of their land.[17/]

TABLE 4.12. Value Respondents Felt Their Wetlands Were Appraised For

Value	Frequency of Response	Percent
Gave a value from $50 to $200	20	15 %
Didn't know	100	73 %
The same as rest	12	9 %
Less than cropland	2	1 %
As wasteland	2	1 %
50% of cropland	1	1 %
	137	100 %

Attitude Assessment

In addition to the frequency counts of responses to survey questions as discussed above, the information was further analyzed by use of statistical tests and measures of association between selected variables. To complete this analysis an attitude index was constructed to measure a respondent's pro or anti feelings toward wetlands.

17/ Wetland that is usually too wet to farm nine out of ten years is classified as wasteland for taxation purposes. Other wetland would not normally be differentiated from the land it is found in, with considerations made for extreme conditions such as an abundance of temporary wetlands. Most wetland (wasteland) in the three study area counties is appraised at $20 or $25 per acre, with some at $15. The actual value is mainly a function of location within the county. Taxes assessed on wetland depend on what township it is in (as do taxes on all land), whether homestead rates apply, and other taxation anomalies. The range of taxes assessed is approximately 30 cents to 50 cents per acre. (Eugene Davenport, Ottertail County Auditor, interview, July 20, 1979).

Respondents were asked to indicate whether they agree with, disagree with, or were indifferent or didn't know about the following set of statements concerning wetlands:

		Agree	Don't Know or Indifferent	Disagree
(a)	You are concerned about the loss of wetlands	0	1	2
(b)	Wetlands recharge groundwater	0	1	2
(c)	Wetlands are a nuisance to farmers	2	1	0
(d)	Wetlands are part of our natural landscape	0	1	2
(e)	Wetlands create flooding problems	2	1	0
(f)	Wetlands provide wildlife habitat	0	1	2
(g)	Wetlands are a place to hunt	0	1	2
(h)	Wetlands provide hay	0	1	2
(i)	Wetlands attract nuisance wildlife (e.g. blackbirds)	2	1	0
(j)	Wetlands are of value to the public	0	1	2
(k)	Wetlands trap run-off water	0	1	2
(l)	All wetlands in cropland should be drained	2	1	0
(m)	Wetlands are an eyesore in cropland	2	1	0
(n)	Wetlands create noxious weed problems	2	1	0
(o)	Over time have you become more supportive of efforts to preserve wetlands?	0	1	2

Their responses were given values ranging from 0 to 2. For instance, if a respondent agreed with statement (a) he was given a zero value for that statement, zeros were meant to represent positive attitudes toward wetland preservation and two's negative attitudes toward preservation. In other words, if an individual had a zero total on statements a through o he was considered extremely preservation oriented. And conversely if he scored 26 he was considered strongly pro-drainage. These total scores were then grouped into three attitude groups as follows:

	Total Score	Freq. of Responses	Percent
Attitude Group 1 (pro-preservation)	0 to 5	41	30
Attitude Group 2 (middle-of-the-road)	7 to 11	46	34
Attitude Group 3 (pro-drainage)	12 to 26	50	36
		137	100

The first comparison will be between the attitude index and selected variables. Other evaluations will be made on farm size, farm type, and participation in wetlands programs. Farm size was categorized into three groups as follows:

Farm Size Group	Acres	Frequency of Response	Percent
1	Less than 160	30	22
2	160 to 480	87	64
3	More than 480	19	14
		136	100

The average farm size in the sample was 329 acres or approximately a half section.[18/]

Farm operations were grouped into four farm types according to the following classification:

Farm Type Group	Characteristics	Frequency of Response	Percent
Hog or beef	Any number of hogs or beef	27	20
Cash crop	No hogs, beef, or dairy and more than 80 acres	55	40
Dairy	Any number of dairy cows	47	35
Hobby	If none of the above	7	5
		137	100

Participation in wetlands programs was categorized according to the following schedule:

18/ Land was originally platted in square mile sections in this part of the country. Each section contains 640 acres and is generally subdivided into quarter sections of 160 acres, with further subdivisions in quarter or half increments.

Participation Group	Characteristics	Frequency of Response	Percent
Participators	Participated in FWS Fee, Easement, or ASCS Water Bank	70	51
Refusals	Refused FWS Fee or Easement Offer	14	10
Nonparticipators	Neither Participators nor Refusers	53	39
		137	100

Two sets of the above participation groups were tested against selected variables for association. One set was comprised of participators and refusals. The other set included participators and nonparticipators.

TABLE 4.13. Statistical Relationships Between Attitude and Selected Variables[a]

Variable	Gamma Value[b]	Chi-square Statistic Significance level[c]
MORECROP	.33	.03
LIKEDR	.48	,01
ASCSSTOP	.63	.03
GOVAID	.40	.01
HUNTLIC	-.27	.10
ANYPROB	.76	.00
FARMTYPE	-.18	.09
PART-I (participants)	-.32	.09
PART-II (refusers)	.65	.00
COMMIT	.44	.01
TAXBILL	-.53	.02

[a]Variable descriptions are presented in Appendix D. Also listed are variables with little or no association with attitude.

[b]The coefficient Gamma is distribution free, measures the degree of association between two variables, and has a range of -1 to +1. A -1 or +1 coefficient indicates that paired observations of the 2 variables in question are all consistent (i.e. all move together or all move in opposite direction). Values in-between indicate less than complete consistency. For more detailed information see David, James A. Elementary Survey Analysis, Prentice-Hall, 1971

[c]The statistic Chi-square measures the discrepancy between observed frequencies and the corresponding expected frequencies. The probability level reported is the probability of obtaining by chance an observed chi-square value as great as what was observed.

Association of Attitude with Selected Variables. Several variables were found to have little association with attitude, at least as expressed by a low absolute value of gamma and by an insignificant chi-square. These variables are described in the list of variables in Appendix D but are not discussed here.

A small number of selected variables were found to be associated with attitude[19/] both in terms of degree of association (gamma) and statistical significance (chi-square). In interpreting these measures, statistical significance is considered to be of primary importance. That is, a large positive or negative gamma value is considered important only if the relationship is also statistically significant.[20/] The hypothesis that there is no relationship between attitude and selected variables can be rejected in several cases.

Those planning to expand their cropland acreage (MORECROP) were more pro-drainage than those who were not planning to expand. The relationship between the desire to increase the amount of cropland and a positive attitude towards drainage was significant at the .03 level with a gamma of .33 (Table 4.13).[21/] Fourteen percent of those who were planning to expand were going to use drainage as an option as was shown in Table 4.2 above.

The fact that a farm operator would like to drain (LIKEDR) was strongly associated with attitude (gamma = .48) as expected.

Those indicating termination of ASCS cost-sharing for drainage (ASCSSTOP) had an affect on drainage plans were pro-drainage as indicated by the positive Gamma. Although many respondents favored no government aid to farmers wishing to drain (GOVAID), those who were in favor of government aid were pro-drainage.

The respondents who were hunters (HUNTLIC) were preservation oriented, while those who were not hunters were in favor of drainage.

19/ Trivial associations are not discussed.

20/ A significance level of .10 was arbitrarily selected as the cut-off point.

21/ Positive values of Gamma are associated with pro-drainage attitudes, whereas negative values indicate pro-preservation attitudes.

There was a strong association (gamma = .76) between attitude and having problems as a result of a neighbor's wetland being sold to the state or federal government (NSOLD). Those who cited problems had pro-drainage attitudes, while those without problems showed only a slight tendency to be preservation oriented.

Farm type was significant at the .09 level when tested against attitude. Dairy farmers tended to have attitude indexes toward pro-drainage. Beef or hog raisers were slightly in favor of preservation. Attitudes of both hobby and cash crop farmers were fairly evenly distributed from preservation to drainage oriented.

In order to test whether participation in wetlands programs is strictly due to economic incentives, participation was tested against attitude. Whether or not a respondent had participated in a wetlands program (PART-I) and attitudes were related at the .09 level with a gamma equal to -.32. This implies that participants, as well as being lured by economic incentives, have attitudes that favor preservation.

This is even more strongly brought out when participants and refusals (PART-II) are tested against attitude. In this case gamma equals .65 and is significant at the .00 level. In other words, those who refused to participate in wetlands programs when presented with an offer had attitudes in favor of drainage and away from preservation.

Farm operators whose primary occupation was farming, who intend to continue farming for at least 5 years, and who plan to expand their cropland were assumed to have a strong commitment to farming. Testing this commitment (COMMIT) with attitude resulted in a gamma of .44 and a significant chi-square at the .01 level. Strongly committed farm operators were thus inclined to favor drainage over preservation of wetlands.

A bill proposed in the 1979 Minnesota Legislature would provide property tax credits for wetland acreage preserved during the tax year. Respondents who replied that this bill would affect their drainage decision (TAXBILL) were less drainage oriented than those who said it would not affect their decision. The strongly pro-drainage individual would be less likely to be affected by this economic incentive than would the person who is somewhat less drainage oriented in his attitude.

In summary, attitude was seen to be associated with variables representing farm expansion (MORECROP, LIKEDR, COMMIT), economic incentives (ASCSSTOP, GOVAID, TAXBILL), experience with neighbors selling wetlands (ANYPROB), type of farm operation (FARMTYPE), whether the farm operator was a hunter (HUNTLIC), and participation in wetlands programs (PART-I, PART-II). Variables that one might expect to have been associated with attitude but were not include percent of farm that is wetland, farm size, and expected productivity of drained wetland. One conclusion that can be drawn is that attitudes of landowners are important considerations when developing wetland preservation programs. Wetlands are drained or preserved on the basis of more than just economics.

Association of Farm Size with Selected Variables. The relationship between farm size and several other variables was tested. Little or no relationship was found with most variables. Variables with an association with farm size were have drained (HVDR), age (AGE), had bought land since 1970 (PURCHAS), neighbors have drained (NDRAIN),[22/] neighbors have sold wetlands to state or federal government (NSOLD), farm type (FARM TYPE), and commitment to farming (COMMIT) (Table 4.14). Most of these are trivial relationships showing that operators of larger farms had drained wetlands, were committed to farming, had purchased land since 1970, and were younger than operators of smaller farms.

Among several other nonsignificant variables was the attitude index. Knowing the size of an individual's farm operation will provide little if any help in determining his attitude toward wetlands and subsequently the likelihood of his participation in wetlands preservation programs.

Associations of Farm Type with Selected Variables. Farm type was associated with more variables than was farm size, but again several of

---

[22/] That a significant inverse relationship would be found between farm size and having neighbors who had drained wetlands (gamma = -.25, .00 level) or sold wetlands (gamma = -.25, .02 level) is unexplained.

TABLE 4.14 Statistical Relationships Between Farm Size and Selected Variables[a]

Variable	Gamma Value[b]	Chi-square Statistic Significance level[c]
HVDR	.48	.01
AGE	-.07	.06
PURCHAS	.68	.00
NDRAIN	-.25	.00
NSOLD	-.25	.02
COMMIT	.22	.08
FARMTYPE	.22	.00

[a]Variable descriptions are presented in Appendix D. Also listed are variables with little or no association with farm size.

[b]See note b to Table 4.13.

[c]See note c to Table 4.13.

TABLE 4.15. Statistical Relationship between Farm Type and Selected Variables[a]

Variable	Gamma Value	Chi-square Statistic Significance Level[c]
FARMSIZE	.34	.00
OPFARM	-.05	.00
AGE	.39	.01
CONTFARM	.28	.00
MORECROP	.12	.04
ATTITUDE	.22	.08
PAYOWNER	-.18	.06
COUNTY	-.04	.00
NDRAIN	-.20	.00
PART-I	.56	.00

[a]Variable descriptions are presented in Appendix D. Also listed are variables with little or no association with farm type.

[b]See note b to Table 4.13.

[c]See note c to Table 4.13.

these relationships were trivial. Of little significance to this study was that farm type was statistically associated with farm size (FARMSIZE), years operated present farm (OPFARM), age, plan to continue farming (CONTFARM), and county (Table 4.15).

Whether or not neighbors had drained (NDRAIN) showed up as significant (gamma = -.20, .00 level) when tested against farm type. This may be related to the association of farm type with attitude (gamma - .22, .08 level) as discussed above.

The association of farm type with plans to expand cropland (MORECROP) shows that dairy farmers were more inclined toward expansion than the other farm types. Cash crop farms were least expansion oriented. These two observations may be indicative of recent economic returns for these different farm types. This may also explain the association of farm type and attitude.

The relationship between farm type and whether or not the government should pay owners of wetlands for preserving them (PAYOWNER) resulted from dairy operators being weakly in favor of this while cash crop operators were very strongly in favor.

Participation in wetlands programs (PART-I) was strongly associated with farm type (gamma = .56, .00 level). Hobby and beef/hog farms were evenly divided between participators and nonparticipators, while dairy farmers tended to be nonparticipators and cash crop farmers participators. Ruling out sampling techniques as the cause of this association, a possible explanation may be independence of dairy operators as expressed by their negative attitude toward wetland owners being paid for preservation. As pointed out above, dairy operators' attitudes tended toward drainage, which may also imply expansion plans.

The identity and distribution of farm types in an area may provide an indication of the success or failure of wetlands programs in that area. Dairy farmers' attitudes were the most drainage oriented, and they had the lowest participation level. This indicates wetlands preservation programs may not be very successful in dairying regions. Cash crop farmers' attitudes were evenly distributed across the index, while their participation was highest of any group. Wetlands programs have obviously been

successful with this type of farm. Beef/hog operators were preservation oriented in their attitude and evenly divided between participation and nonparticipation. This type of farm along with hobby farms may be fruitful ground for wetlands preservation programs modified to eliminate some of the problems discussed earlier.

Association of Participation in Wetlands Programs and Selected Variables. Participation in wetlands programs was checked against selected variables to determine if there were any significant differences between participators and nonparticipators or between participators and those who refused an offer. The association between whether a farm operator had participated or not (PART-I) with farm type and attitude was discussed above.

Respondent's age was associated with PART-I, with a gamma equal to .42 significant at the .03 level (Table 4.16). This would imply that participators are older than nonparticipators and that wetlands programs may be an alternative means of income, or way to dispose of part of their farm as they approach retirement.

There was a strong negative association with continuing farming (CONTFARM) and participation (gamma = .77). This is in line with the association with age, in that those who plan to continue farming would naturally be the younger farmers. Likewise those who do not plan to continue are more likely to participate in wetlands programs.

A relationship was found between participation (PART-I) and whether or not the individual would sell wetlands or easement not to drain (WOULDSEL). This reinforces the validity of the test and also says that present participators are not dissatisfied with the programs and may participate further.

The association between would like to drain (LIKEDR) and participation (gamma = -.38, .09 level) indicates that those who want to drain are not as likely to participate in wetlands preservation programs. This same observation was made between attitude and participation and attitude and LIKEDR.

TABLE 4.16 Statistical Relationship Between Participation in Wetlands Programs and Selected Variables[a]

Variable	Gamma Value[b]	Chi-square Statistic Significance Level[c]
PART-I (Participate (1), Nonparticipate (0))		
AGE	.42	.03
CONTFARM	-.77	.00
WOULDSEL	.32	.09
LIKEDR	-.38	.09
FARMTYPE	.56	.00
ATTITUDE	-.32	.09
PART-II (Participate (1), Refuse (2))		
WOULDSEL	-.63	.08
ANYPROB	.75	.03
ATTITUDE	.65	.00

[a]Variable descriptions are presented in Appendix D. Also listed are variables with little or no association with participation.

[b]See note b to Table 4.13.

[c]See note c to Table 4.13.

Using those who refused an offer and participators (PART-II) in a test against other variables revealed refusers' stronger tendency away from preservation. In this case, WOULDSEL had a strong negative association (gamma = -.63) with PART-II, indicating refusers were less likely to sell than participators.

Whether or not neighbors selling wetlands had caused any problems (ANYPROB) was strongly associated with participation (PART-II) (Table 4.16). If a respondent felt that living close to government owned wetland areas had caused him problems he was not likely to participate in wetland programs himself.

Participation in wetland programs is related to a number of farmer characteristics. Perhaps of greatest importance is the attitude of farm operators. This attitude is a result of a lifetime of personal experiences.

Problems with neighbors selling wetlands to the government was seen to have an effect on participation and also to be associated with attitude. Looking into the nature of these problems and their resolution more deeply than was done above could be an important first step in achieving a wetlands preservation program acceptable to a broader public.

V. CONCLUSIONS AND POLICY IMPLICATIONS

Incentives to drain wetlands were originally established to stimulate agricultural production and economic growth in rural areas. However, in section II it was shown that the optimal quantity of wetlands drained privately, even without drainage incentive programs, exceeds that from society's point of view because the landowner ignores natural wetland values for which he does not possess ownership rights. Over the last several decades, as the value of wetlands has become increasingly recognized, incentives have been offered by public agencies to slow the rate of drainage. Thus, the landowner is "pulled" in both drainage and preservation directions.

The incentives for drainage and preservation change each year due to variation in the profitability of farming and due to changes made in policies and programs reflecting the mood of policy-makers. The increase in agricultural product prices and the increase in land values the last several years have increased the incentive to drain wetlands. On the other hand, drainage subsidies have been reduced and preservation incentives raised during this same period. ACP sharing of the costs of drainage, which was as high as 50 percent in earlier years, was phased out in 1978 on wetlands of types 3, 4, and 5. Fee simple purchases of wetlands in the study area were made at an average per acre value of $637 in 1977, up from $104 per acre in 1970. Easement acquisitions, which were made in the $25-$30 per acre range in the early 1970's averaged $320 per acre in 1977 and $260 per acre in 1978. Annual payments under the Water Bank program established in 1970 were in the $10-$17 per acre range the first year of the program, and in 1978 were in the $6-$45 per

acre range. A new payment method is expected to raise this payment further in 1979.

The effectiveness of the effort to preserve wetlands is often measured by the rate at which landowners participate in the preservation incentive programs. However, the critical issue from the standpoint of economic efficiency is the determination of the optimal rate of drainage and the preservation incentive needed to achieve that rate. There are several problems in attempting to attain a theoretical optimum of drainage and preservation. First, valuation of the amenities produced by wetlands in their natural state is incomplete, even in a qualitative sense. This precludes estimation of the marginal social cost of wetland drainage, a key element in determining the optimal quantity of drainage and preservation (Figure 2.2). Second, the private benefit to wetland drainage, while quantifiable through use of farm budget analyses, is site specific. This makes quantification of the private net benefits from drainage difficult. Third, owners of wetlands are not motivated solely by economic incentives and may not respond even though the "right" economic incentive is presented.

Although this study did not include an analysis of the value of wetlands, nor an analysis of private benefits to drainage, some rough data is available from the survey of landowners that sheds light on the private incentive to drain wetlands. Based upon respondents estimates, cropland values currently average $736 per acre in the study area, whereas those willing to sell wetlands would do so at an average of $583 per acre. While the portion of the total sample providing information on values was small, and the data should be used cautiously, this would leave $153 per acre for draining the wetland if purchased with that purpose in mind. Respondents indicated drainage costs ranged from $250-$371 per acre for tile systems, and $21-$400 for open ditch systems. Evidently, it is only the less costly open ditch systems that might provide cost-effective drainage, even before considering the natural values of wetlands lost when they are drained. Several survey respondents indicated they had wetlands they wanted to drain, but explained they had not already done so because of the high cost of drainage. These results reinforce Goldstein's conclusions. Again, the rough nature of this data is emphasized.

While evidence is available showing that drainage may not be economically justifiable on the average, landowners continue to drain wetlands. Thus, it is not sufficient to estimate the optimal drainage rate or to merely know what incentive payment "should" induce landowners to preserve their wetlands. Rather, to fully implement the preservation program, information is also needed on what non-economic factors affect landowners' drainage and preservation decisions. Information obtained in this study suggests that a major reason for landowner nonparticipation in wetlands preservation is lack of information about the existence of preservation programs, the level of incentive payments, the methods used to tax existing wetland acreage, and the actual property tax burden borne by their wetland acreage. Landowners that were informed about the preservation programs suggested that the level of payments needs to be increased and that leases be shorter. Implementation of these suggestions would swing the balance toward preservation and away from drainage.

Fee simple purchases of wetlands by the Fish and Wildlife Service were often blamed for weed control problems, and perhaps in combination with other factors, lead to a general dislike for governmental control of wetlands. Acquisition of easements, where management of the land remains with the landowner, did not appear to be as objectionable to nearby landowners. Programs were also criticized for taking too much upland, a factor evidently related to the amount of adjacent upland acquired when wetlands are purchased. If this policy is a threat to the success of the preservation effort, it may be worthwhile to consider the advantages and disadvantages of reducing the amount of upland purchased. These factors suggest that revised management policies and better management of acquired wetlands would improve the success of preservation efforts.

The landowner survey conducted in this study also showed that owner attitude toward drainage and preservation per se is critical to making drainage decisions. Such attitudes, having been formed over the entire lifetimes of owners, cannot be changed easily - toward either preservation or drainage. To minimize attitude problems, ongoing analysis of attitudes and attitude determining factors could prove useful in improving the success of preservation efforts. Preservation efforts can focus somewhat

on factors that determine attitude - such as good management (e.g. weed control), but otherwise the major adjustment that might be made is to concentrate preservation efforts where drainage pressure is least, i.e. in those areas where agriculture is marginal. This would generally be where farmers are less interested in expanding their operations through drainage of wetlands. The location of these areas would change over time depending on the relative profitability of various agricultural enterprises. The survey in this study showed dairy farmers currently being more expansion oriented than other farmers and hence less interested in preserving wetlands.

In summary, it would appear that the success of wetland preservation efforts could be improved in several ways: (1) by making a greater effort to provide additional information to the public about preservation program features and incentives, (2) by increasing the incentives to preserve wetlands, (3) by changing the attitude of the public toward governmental involvement through increasing emphasis upon proper management of government-acquired wetlands, and (4) by concentrating preservation efforts in those geographical areas where attitudes are least pro-drainage. Analyses of these alternatives and the development of a strategy that would eliminate the most critical bottlenecks would likely yield large returns.

References

Anthony, Willis E. 1974. "Basic Economics of Farm Drainage," Minnesota Agricultural Economist, No. 568, University of Minnesota.

ASCS. 1961. Conservation Reserve Program of the Soil Bank: 1960 Statistical Summary. USDA, Washington, D.C.

Bockstael, N. E. and K. E. McConnell. 1978. "The Estimation and Use of the Household Production Function for Wildlife Recreation," unpublished working paper, Department of Resource Economics, University of Rhode Island, Kingston.

Brown, Gardner, John Charbonneau and Michael Hay. 1978. "The Value of Wildlife Estimated by the Hedonic Approach," U.S. Fish and Wildlife Service Working Paper No. 6.

Crissey, Walter F. 1969. "Prairie Potholes from a Continental Viewpoint," Saskatoon Wetlands Seminar. Ottawa, Ontario: Canadian Wildlife Service Department of Indian Affairs and Northern Development Report Series No. 6, pp. 161-171.

Davis, Robert K. 1963. "The Value of Outdoor Recreation: An Economic Study of the Maine Woods," unpublished Ph.D. thesis, Harvard University.

Erickson, Ronald E. 1975. "Effects of P.L. 566 Stream Channelization on Wetlands in the Prairie Pothole Region," unpublished M.S. thesis, South Dakota State University.

Goldstein, Jon H. 1971. Competition for Wetlands in the Midwest: An Economic Analysis. Washington, D.C.: Resources for the Future, Inc.

Haddock, J. Larry and Lawrence W. DeBates. 1969. Report on Drainage Trends in the Prairie Pothole Region of Minnesota, North Dakota, and South Dakota, U.S. Department of the Interior, Fish and Wildlife Service, Minneapolis.

Hammack, Judd and Gardner Brown. 1974. Waterfowl and Wetlands: Toward Bio-Economic Analysis, Baltimore: The Johns Hopkins Press.

Harrison, Bill. U.S. Fish and Wildlife Service, Ft. Snelling, Realty Division, personal communication, February 26, 1979.

Jaworski, Eugene and C. Nicholas Raphael. 1978. Fish, Wildlife, and Recreational Values of Michigan's Coastal Wetlands. Michigan Department of Natural Resources, Lansing.

Johnson, D. Gale. 1963. "Efficiency and Welfare Implications of United States Agricultural Policy," Journal of Farm Economics, 45(2), pp. 331-342.

Krutilla, John V. and Anthony C. Fisher. 1975. The Economics of Natural Environments: Studies in the Valuation of Commodity and Amenity Resources, Baltimore, The Johns Hopkins Press.

Lancaster, K. 1966. "A New Approach to Consumer Theory," Journal of Political Economy, 74 (April 1966), pp. 132-155.

Leitch, Jay A. and Donald F. Scott. 1977. Economic Impact of Flooding on Agricultural Production in Northeast Central North Dakota. Agricultural Economics Report No. 120, North Dakota State University, Fargo.

Mann, Grady E. 1955. Wetlands Inventory of Minnesota, U.S. Department of the Interior. Office of River Basin Studies, Minneapolis, Minnesota.

Nelson, Harvey K. 1979. Regional Director, US FWS, Great Lakes Region, presentation to Association of Minnesota Counties on August 10, 1979 at Alexandria, Minnesota.

Nord, Warren H., Charles D. Evans, and Grady E. Mann. 1952. Ducks or Drainage: A Study of the Prairie Pothole Region of Minnesota and the Dakotas. U.S. Department of the Interior, Office of River Basin Studies, Minneapolis, Minnesota.

Randall, Alan and David S. Brookshire. 1978. "Public Policy, Public Goods, and Contingent Valuation Mechanisms," Staff Paper 68, Department of Agricultural Economics, University of Kentucky, Lexington.

Shaw, S. P. and C. G. Fredine. 1971. Wetlands of the United States, Their Extent and Their Value to Waterfowl and Other Wildlife. Washington, D.C.: U.S. Fish and Wildlife Service Circular 39.

Wallace, Norel. 1975. "1974 Western Minnesota Wetlands Inventory," U.S. Department of the Interior, Fish and Wildlife Service, Fergus Falls, Minnesota.

APPENDICES

APPENDIX A

History of the Wetlands Easement Evaluation Process[1/]

The U.S. Fish and Wildlife Service may well be one of the largest easement acquiring agencies in the Nation. During the past 17 years approximately 16,900 wetlands easements have been acquired in the states of North Dakota, South Dakota, Montana, and Minnesota.

Prior to 1962, all wetlands easements acquired by the U.S. Fish and Wildlife Service were for 20 years. Easement offers were based on paying the owner a net profit of 50 cents (minimum lease value) per acre per year, plus 25 cents per acre per year to compensate for taxes. The 75 cents was capitalized for 20 years at 6 percent, or $8.60 per acre value. This was a preliminary value which was usually decreased "according to what price the owners would require in order to grant the easement," or about $6.50 per acre.

Then, in February 1962, the valuation of easements was computed on a lump-sum payment of capitalized annual rents, and efforts were made to purchase 30-year and perpetual easements. Twice the amount of the 30-year easement was offered for the perpetual agreement. In September of that year, instructions containing a more detailed analysis of the easement payment were sent to the field. Wetland type, drainability, size of ownership, and percentage of fee value became new considerations in the computations of easement payments. This procedure continued until about January 1963. At that time, appraisers were instructed to conduct before-and-after appraisals to serve as basic data for an easy calculation chart which was to evolve. Assembly, compilation, and analysis of field data on before-and-after appraisals which would be used for supporting data for the calculation chart continued until mid-1963.

[1/] This summary is quoted from: Hartman, Paul. 1975. Easement Evaluation Wetlands Acquisition Program, U.S. Fish and Wildlife Service, Denver, Colorado.

The first easement calculation chart was implemented in June 1963. It was based on the analysis of a considerable amount of data from individual easement appraisals and was recognized as a defensible easement value for most easements on properties having a fee sale value of less than $100 per acre. Properties valued in excess of $100 per acre still required a complete before-and-after appraisal. Accompanying the chart was a list of factors for determining drainability. This chart proved somewhat successful. However, it should again be noted that the chart itself was based to a significant degree upon successful negotiative experiences. In October 1963, the chart was expanded on a straight line basis to include lands with fee values up to $300 per acre. At this time, certain basic premises were changed. Based on actual field experience, it was concluded that all wetlands were drainable, and easement offers were computed accordingly. The effect of this change was to increase offers averaging 40-50 percent, but sometimes doubling or tripling them. Again, it was the success of acquiring easements that necessitated these changes.

The 1963 easement calculation chart endured until late 1968, when it was realized that it no longer fit the agricultural economy and did not attract an adequate level of easement acceptance at the higher value range. As early as this date, it was recognized that our easement analysis was not competitive with other economic uses on higher valued lands, particularly in the Devils Lake area. Service personnel working in the area at that time were in disagreement with some of the basic premises used in the derivation of the 1963 chart, particularly with reference to the capitalization rate. It was their contention that the capitalization rate used in the 1963 chart did not reflect market conditions in 1968. Although other basic data for the 1963 chart were revised at this time, no attempt was made to extract a new capitalization rate from the market.

Shortly after the implementation of the 1969 chart, drastic changes began taking place in the agricultural industry in the Dakotas. Farm commodity surpluses began to dwindle; wheat allotments were cancelled; costs of fertilizer and machinery soared; and above all, by 1973-74 the price of wheat leaped to a high of $6.00/bushel for hard spring wheat and $8.00/bushel for durum wheat. Land price increases followed almost

immediately, and much marginal agricultural land was converted from pasture to cropland. Needless to say, drainage of wetlands on existing cropland was intensified, but more so on recently converted lands. These and other changes again eliminated the competitiveness of the easement with alternative economic uses. Easement acquisition success dropped from a normal rate of 30-40 percent to a current low of 7-10 percent, with virtually no success on lands with a fee value in excess of $350 per acre.

APPENDIX B

ASCS BACKGROUND INFORMATION

BI No. 12

United States Department of Agriculture

Agricultural Stabilization and Conservation Service

OCTOBER 1978

WATER BANK PROGRAM

PROGRAM OBJECTIVES

The Water Bank Program is designed to:

1. preserve and improve habitat for important nesting and breeding areas of migratory waterfowl, and for other wildlife resources;

2. preserve and improve wetlands, and conserve surface waters;

3. reduce runoff, soil, water, and wind erosion, and stream sedimentation;

4. contribute to flood control, better water quality, and improve subsurface moisture;

5. reduce acres of new land coming into production and retire lands now in agricultural production to accomplish the purposes of the Water Bank Program;

6. enhance the natural beauty of the landscape, and

7. promote comprehensive and total water management planning.

LEGISLATIVE AUTHORITY AND ADMINISTRATION

The program is authorized by the Water Bank Act (Public Law 91-559 (84 Stat. 1468, 16 U.S.C. 1301)) approved by Congress on December 19, 1970.

Farmer-elected Agricultural Stabilization and Conservation county committees administer the program. Planning and technical services are provided by the Soil Conservation Service.

1978 WBP COUNTIES AND PAYMENT RATES

Counties	Rate 1	Rate 2	Rate 3	Rate 4
Becker	$25.00	$17.50	$12.50	$6.00
Big Stone	30.00	21.00	15.00	6.00
Blue Earth	45.00	31.50	22.50	6.00
Brown	45.00	31.50	22.50	6.00
Carver	40.00	28.00	20.00	6.00
Clay	25.00	17.50	12.50	6.00
Cottonwood	45.00	31.50	22.50	6.00
Douglas	25.00	17.50	12.50	6.00
Freeborn	45.00	31.50	22.50	6.00
Grant	30.00	21.00	15.00	6.00
Kandiyohi	40.00	28.00	20.00	6.00
Lac qui Parle	40.00	28.00	20.00	6.00
LeSueur	45.00	31.50	22.50	6.00
Lincoln	35.00	24.50	17.50	6.00
Lyon	40.00	28.00	20.00	6.00
Mahnomen	25.00	17.50	12.50	6.00
McLeod	40.00	28.00	20.00	6.00
Meeker	40.00	28.00	20.00	6.00
Murray	40.00	28.00	20.00	6.00
Nicollet	45.00	31.50	22.50	6.00
Norman	25.00	17.50	12.50	6.00
E. Otter Tail	25.00	17.50	12.50	6.00
W. Otter Tail	25.00	17.50	12.50	6.00
E. Polk	25.00	17.50	12.50	6.00
Pope	30.00	21.00	15.00	6.00
Rice	45.00	31.50	22.50	6.00
Scott	40.00	28.00	20.00	6.00
Stearns	35.00	24.50	17.50	6.00
Stevens	35.00	24.50	17.50	6.00
Swift	40.00	28.00	20.00	6.00
Todd	25.00	17.50	12.50	6.00
Traverse	30.00	21.00	15.00	6.00
Waseca	45.00	31.50	22.50	6.00
Wright	40.00	28.00	20.00	6.00
Yellow Medicine	40.00	28.00	20.00	6.00

Rate 1 is for cropland SCS Classes I, II, and III. Rate 2 is cropland Class IV. Rate 3 is grassland and all other eligible land including types 1 and 2 wetlands. Rate 4 is for woodland.

SCS technicians will delineate the above capabilities on a map and return it to ASCS for calculation of acreage and total payment for the designated acreage.

APPENDIX C

Survey Sample Selection

Landowners in Douglas, Grant, and Ottertail Counties who were members of one of the following six subgroups were selected to be interviewed:

	Subgroup	Population	Enumerator List	Sample	Percent of Population Sampled
1.	Those who had sold land to the FWS	397	68	25	6.3%
2.	Those who had refused offers to buy from the FWS	72	15	7	9.7%
3.	Those who had sold wetland easements to the FWS	353	100	31	8.8%
4.	Those who had refused to sell wetland easements to the FWS	35	9	11	31.4%
5.	Those who had participated in ASCS Water Bank	429	49	31	7.2%
6.	Landowners at random	7,600	63	53	0.7%
			304	137	

Names of individuals in subgroups 1 through 4 were obtained from Fish and Wildlife Service files. County Atlases and telephone books were then searched for the present location of these individuals. Those who could not be located, had left the area, or were obviously not farm operators (i.e. owned by a business or government), were omitted from the sample. A listing of all those who appeared to be still residing in the area, along with their farmstead location, was provided to each of four enumerators.

Names of Water Bank participators (subgroup 5) were obtained from county ASCS files and located in a similar manner as mentioned above.

The random subgroup was selected by personnel at the Fergus Falls Area Wetland Office of the Fish and Wildlife Service.[1/] Their procedure was as follows: (1) Designate quarter numbering 1 through 4 within square by blind pencil drops within the square and simultaneous drops on random number table and using only digits 1, 2, 3, and 4 until 4 quarters are filled. (2) Determine direction of reading where 1= up, 2=down, 3=left, and 4=right, by pencil point encounter. (3) Column on table selected by pencil point and next digit in direction of read. (4) Row on table selected by pencil point and next digit in direction of read. (5) Read from predetermined intersection and in direction of read until 01 through 98 is encountered. This shall be township selection. (6) Repeat procedures (1) through (4) with the limit of continued reading until 01 through 36 is encountered. This shall be section selection. (7) Repeat procedures (1) through (6) for next random quarter selection.

Enumerators were given the lists of names and farmstead locations along with an arbitrarily chosen minimum sample number in each subgroup. They were to obtain at least the minimum in each group before interviewing more than the minimum in any other group. Enumerators were further instructed to interview the farm operator currently residing on the identified farmstead if the named individual had moved. This was done since all but subgroups 2 and 4 were as much related to the farm as to the operator himself.

[1/] The Fish and Wildlife Service had developed this procedure for their own use and agreed to draw a sample for this survey.

Field work was hampered by the usual problems of people not at home or having moved, and some problems with out-of-date identification on name and farmstead location lists. Some periods of inclement weather and poor spring road conditions also posed a problem. The four enumerators were able to make initial contact with every location on their lists. In most instances two tries were made at each location before the desired minimum number of respondents was achieved in each group. Unfortunately, due to time and income constraints, only the minimum acceptable number of responses was collected.

APPENDIX D

Variable Descriptions

Variable Name	Description	Value[a/]
AGE		Above (1) or below (0) average
ANYPROB	Neighbors selling wetlands caused problems.	Yes (1), No (0)
ASCSSTOP	Stoppage of SCS cost-sharing for drainage affected drainage plans.	Yes (1), No (0)
COMMIT	Commitment to farming.	If OCC=1, CONTFARM=1, and MORECROP=1 (1). If not (0)
CONTFARM	Whether or not respondent plans to continue farming, at least for the next five years.	Yes (1), No (0)
DRPROD	Respondent's estimated productivity on already drained wetland.	Lower (1), Same (2), or Higher (3) than adjacent upland.
EPROB	If neighbor's participation in FWS easement or ASCS Water Bank caused any problems.	Yes (1), No (0)
FARMDP	If any problem farming drained wetland.	Yes (1), No (0)
FARMSIZE	Total farm acreage.	Less than 160 (1) 160-480 (2) More than 480 (3)
FARMTYPE	Type of farm operation.	Hobby (0) Dairy (1) Beef or Hog (2) Cash Crop (3)
FUTURE	Farming will be as good or better than it has been in the last 5 years.	Yes (1), No (0)
GOVAID	The government should aid farmers who want to drain wetlands.	Yes (1), No (0)

Variable Name	Description	Value
HUNTLIC	Number of years hunting license bought in last 5 yrs.	Less than 2 (0) 2 thru 5 (1)
LIKEDR	Like to drain some existing wetlands.	Yes (1), No (0)
MORECROP	Intend to increase amount of cropland.	Yes (1), No (0)
NDRAIN	Neighbors have drained wetlands.	Yes (1), No (0)
NEASM	Neighbors participated in FWS easement or ASCS Water Bank	Yes (1), No (0)
NSOLD	Neighbors sold land/wetland to state or federal government.	Yes (1), No (0)
OCC	Primary occupation is farming.	Yes (1), No (0)
OPFARM	Years operated present farm.	1 thru 9 (1) 10 thru 19 (2) 20 thru 29 (3) 30 thru 39 (4) 40 and above (5)
PART-I	Participation in wetlands programs	Yes (1) Refused (0)
PART-II	Participation in wetlands programs	Yes (1) No (2)
PAYOWNER	Owners of wetlands should be paid for preserving them.	Yes (1), No (0)
PCTWET	Percent of total land owned that is wetland.	Above (1) or Below (0) average
PCTWETC	Percent of cropland owned that is wetland.	Above (1) or Below (0) average
PURCHAS	Have purchased land to expand farm since 1970.	Yes (1), No (0)
TAXBILL	Taxbill to reduce property taxes for each acre of wetlands would affect drainage decision.	Yes (1), No (0)
TAXDED	Drainage costs being tax deductible affected decision to drain or not.	Yes (1), No (0)
WOULDSEL	There is a dollar value at which respondent would sell or take easement not to drain wetlands.	Yes (1), No (0)

[a]Different categories than those shown were also tested against the selected variables with no apparent improvement in measures of association.