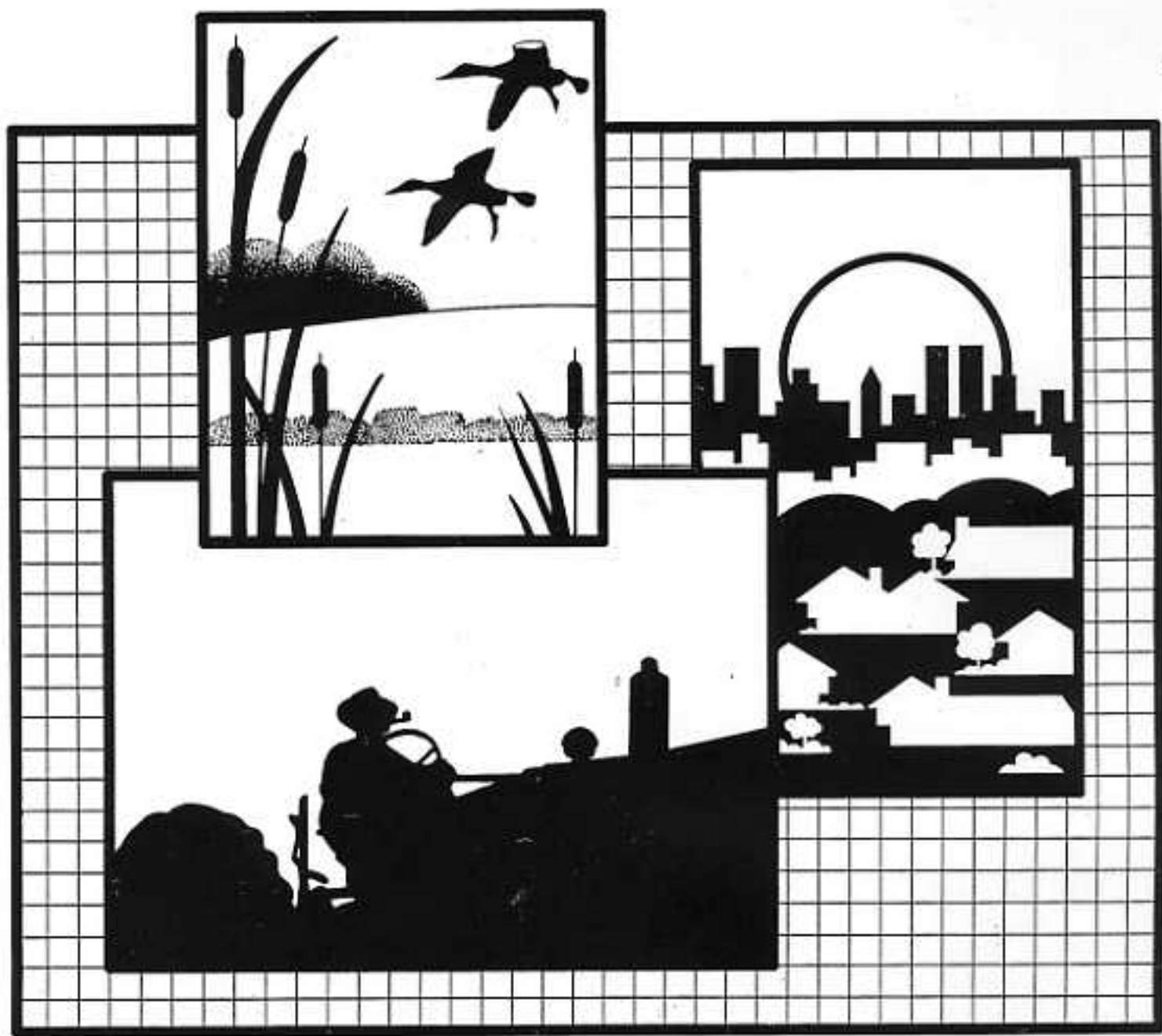


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# The Impact of Federal Programs on Wetlands

Volume I: The Lower Mississippi Alluvial Plain  
*and the*  
Prairie Pothole Region



A Report to Congress by the Secretary of the Interior  
October 1988

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## PREFACE

Wetlands are a vital element in the ecosystem, but they are disappearing and being degraded rapidly. Although there are a number of Federal programs designed to protect wetlands, other Federal programs and policies tend to encourage conversion and development of wetlands.

Thus, in 1985, as a precursor to developing greater consistency in Federal policies with respect to wetlands, Congress directed the Secretary of the Interior to conduct a study of the impact of Federal programs and subsidies on wetlands. In its guidance for the study, Congress requested a comprehensive consideration of conservation options, but urged that particular attention be given to expanding the approach embodied in the Coastal Barrier Resources Act (CBRA). Under CBRA, almost all Federal expenditures which encourage economic growth or development are unavailable for supporting new development in designated, environmentally sensitive, coastal barrier islands. Accordingly, the study identifies Federal programs which could promote the conversion or degradation of wetlands and examines ways to revise the programs to reduce or eliminate these effects.

This is the first of two reports to Congress on the impact of Federal programs on wetlands. Volume I focuses on two of the most important wetland regions in the country: the bottomland hardwoods of the Lower Mississippi Alluvial Plain (the Delta) and the Prairie Pothole Region of the Upper Midwest (the Prairies). Volume II covers all other major wetland regions in the United States: Southeastern Alaska, California's Central Valley, Florida's Everglades, Coastal Louisiana, Maryland's Eastern Shore, Coastal Michigan, Northern Michigan, the Pocosins in North Carolina, New Jersey, Puerto Rican Mangroves, the Texas Coast, and three western riparian areas (Idaho, Nevada, and New Mexico).

The report is the joint product of the Department's Office of Policy Analysis and the Fish and Wildlife Service, and was prepared under the direction of Jon H. Goldstein, Office of Policy Analysis. For their advice and counsel throughout the preparation of this report, special appreciation is due to William P. Horn, Assistant Secretary - Fish and Wildlife and Parks; Susan Recce, Deputy Assistant Secretary - Fish and Wildlife and Parks; Martin L. Smith, Director, Office of Policy Analysis; and H. Theodore Heintz, Assistant Director - Economic Analysis, Office of Policy Analysis.



Secretary of the Interior

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# EXECUTIVE SUMMARY

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## Background

### The Function of Wetlands

Wetlands produce numerous benefits for society. They are the nursery for much of life, providing habitat for many species of fish and wildlife. They play an important role in reducing flooding problems by temporarily storing large quantities of water and by slowing the velocity of flood waters. They help to maintain water quality by filtering out pollutants and sediments. They serve to control erosion by trapping soil washed from nearby farmlands. And they are a source of recreation, timber, and other natural products for commercial use. They are a vital element in the ecosystem, and they are disappearing rapidly.

### The Nature and Extent of the Losses

Approximately 215 million acres of wetlands existed in the conterminous United States at the time of the Nation's settlement. By the mid-1970's, only 99 million acres remained, 46 percent of the original wetland acreage. Between the mid-1950's and the mid-1970's about 9 million acres of wetland were lost. Annual wetland losses averaged 458,000 acres, an area about half the size of Rhode Island.

By far the most important economic sector absorbing wetlands is the agriculture sector. Agricultural development accounted for 87 percent of wetland conversions in the period the mid-50's to the mid-70's, urban development for eight percent, and other development for only five percent of the losses.

The Secretary's next report to Congress on the status and trends of wetlands will be in 1990. Although we will not know until then what the current situation is nationally, recent regional data suggest that losses remain at levels of serious concern. However, a number of programs have been instituted since the mid-70's which may have slowed the rate of loss, e.g., the Coastal Zone Management Program, the regulatory program established by section 404 of the Clean Water Act of 1972, and the Swampbuster provisions of the Food Security Act of 1985.

### The Federal Role

Although there are a number of Federal programs designed to protect wetlands, Federal policy is neither comprehensive nor consistent with respect to wetland use. Indeed, Federal policies affect wetlands in opposing ways. Some Federal policies encourage wetland conversion by reducing the cost, increasing the revenue, and/or reducing the risk of wetland development. Simultaneously, other Federal programs restrict or manage wetland use through acquisition and easement, regulation, and policy guidance.

Regulatory programs are frequently cited by conservation critics for their limitations. Among the limitations cited are: restricted jurisdiction and limited statutory authority; divergent interpretations of the statutes by the regulatory authorities; limited staffing for regulation and

enforcement; and failure to properly assess developmental impacts, especially cumulative impacts. On the other hand, developers often criticize the regulatory programs as burdensome and intrusive, for delays in permit processing, for jurisdiction by more than one agency, and for inconsistent interpretations of statutes.

Conservationists often accompany their criticisms by calls for increased Federal wetland acquisitions and easements. With the overwhelming majority of the remaining wetlands in private hands, it is unrealistic to expect acquisition and easement programs alone to solve the problem of conserving environmentally important wetlands. The cost is simply too high, given other priorities and competing budgetary interests.

## **The Purpose of This Study**

Although more vigorous regulation and increased acquisition would conserve more wetlands, these approaches could be costly. Both the Administration and Congress have shown a preference for attempting to redesign Federal programs which produce unwanted effects on wetlands before engaging in additional land acquisition or regulation to counter the programs in question. Thus, in 1985, as a precursor to developing greater consistency in Federal policies with respect to wetlands, Congress directed the Secretary of the Interior to conduct a study of the impact that Federal programs and subsidies have had and are likely to have in the future on the conversion, degradation, and conservation of wetlands in the United States.<sup>1</sup>

This is the first of two reports to Congress on the impact of these programs on wetlands. Volume I focuses on two of the most important wetland regions in the country: the bottomland hardwoods of the Lower Mississippi Alluvial Plain (the Delta) and the Prairie Pothole Region of the Upper Midwest (the Prairies). Volume II covers all other major wetland regions in the United States: Southeastern Alaska, California's Central Valley, Florida's Everglades, Coastal Louisiana, Maryland's Eastern Shore, Coastal Michigan, Northern Michigan, the Pocosins in North Carolina, New Jersey, Puerto Rican Mangroves, the Texas Coast, and three western riparian areas (Idaho, Nevada, and New Mexico).

The study has been comprehensive in its consideration of Federal programs, examining the effects of agricultural programs, water management programs (flood control, drainage, and irrigation), highway programs, land management programs (minerals development, grazing, and forestry), conservation programs, and provisions of the tax code. The study did not address regulatory programs in any detail, that work having already been conducted by the Office of Technology Assessment (OTA 1984). Since the agriculture sector absorbs the vast majority of converted wetlands, the analysis concentrated on those programs which make conversion technically and financially feasible by lowering the cost, increasing the revenue, and/or reducing the risk of conversion and development of wetlands for agriculture.

## **Federal Programs Affecting Wetlands in the Delta and the Prairies**

Federal programs may affect wetlands in two ways:

- directly through project construction; or
- indirectly by altering the financial incentives to convert wetlands (increasing revenues, reducing costs, reducing risks).

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<sup>1</sup> The mandate for this report appeared first in the FY 85 budget for the Department of the Interior, but was repeated and revised in the Emergency Wetlands Resources Act of 1986 (P.L. 99-645, section 402).

In the Prairies and the Delta agricultural conversion accounts for almost all wetland development. By increasing the profitability and reducing the risk of engaging in agriculture, Federal programs alter the incentives which farmers have to bring additional land under cultivation. Owners of wetlands may respond by draining and converting their property. The major Federal programs which have had an effect on wetlands in the Delta and the Prairies are:

- flood control and drainage programs of the U.S. Army Corps of Engineers and the Soil Conservation Service in the Delta;
- flood control, drainage, and irrigation programs of the Corps and the Bureau of Reclamation in the Prairies;
- agricultural programs and subsidies (price and income support, below market interest rate credit, crop insurance, disaster aid, and technical assistance),
- tax incentives which encourage conversion of wetlands,
- highways in the Prairies, and
- conservation programs (acquisition, easement, and oversight).

A brief description of these Federal programs appears in Appendix I-1. A more detailed description of the programs can be found in chapter 2.

## **Study Conclusions**

### **The Delta:**

#### **1. Impact of Federal flood control and drainage projects:**

- Federal flood control and drainage projects built in the Delta between 1935 and 1984 accounted for approximately 25 percent of total wetland depletion. These projects (known as the Tributary Projects) played a more important role in wetland depletion than any other factor, including the mainline levee system, increases in farm product prices, and dry weather.
- The mainline levee system (built largely before 1935) together with the natural topography also accounted for nearly 25 percent of wetland depletion in the Delta during the period 1935-1984.

#### **2. The role of agricultural economic conditions:**

- Historically, clearing of forested wetlands and conversion to agriculture has been highly profitable in the Delta.
- Basic economic conditions are no longer as favorable to bottomland development as they have been over the past two decades. Agricultural production costs have risen sharply over the past decade, and commodity prices have not kept pace. Under current, depressed market conditions the opportunities for profitable conversion and development of wetlands in the Delta are limited even with agricultural subsidies in place.

#### **3. The effect of agricultural income and price support programs:**

- Federal agricultural income and price support subsidies significantly increased the profitability and reduced the risk of conversion and agricultural development in the Delta.

#### **4. The effect of favorable tax treatment:**

- Special tax code provisions which favored conversion of wetlands to agricultural land also increased the profitability and reduced the risk associated with conversion and agricultural development in the Delta, but not by as much as agriculture programs.

**5. The combined effect of tax reform and Swampbuster:**

- The combined effect of ineligibility for agriculture programs and elimination of those tax deductions which favored conversion has a very significant impact on the incentive to convert and develop forested wetlands in the Delta: the estimated rate of return to the investment is reduced dramatically and the risk increased.

**6. Vulnerability of the wetlands:**

- Although under current (1975-1984) economic conditions bottomland development has only marginal economic feasibility, the future for these wetlands is quite uncertain and in the long run the wetlands in the Delta remain vulnerable to agricultural development whenever economic conditions yield high returns to agriculture.

## **The Prairies:**

**1. The impact of Federal agriculture programs:**

- Federal agriculture programs have significantly increased the profitability of drainage in the Prairies.
- The program that had the greatest impact on the incentive to convert wetlands in the Prairies was price and income supports.
- Other influential programs were cost sharing for drainage and the general encouragement for expansion of the agricultural sector provided by below-market rate credit.

**2. The role of general economic conditions:**

- Drainage of prairie potholes has been generally profitable, even in the absence of Government incentives. Federal agriculture programs made it more so, and at the margin induced some additional drainage.
- Economics is the most important factor influencing prairie pothole conversion, especially when all the costs and benefits to the individual, such as nuisance and avoidance costs, are included in the analysis.

**3. The effect of tax incentives:**

- Income tax provisions, such as expensing drainage costs, while important to some larger farm operations, are not generally a strong incentive to drain prairie potholes. This is probably due to historically low income tax liabilities of Prairie farmers and the small cost of drainage in the Prairies relative to the overall costs of farming.

**4. Impact of Federally aided roadways:**

- Drainage of prairie potholes has been facilitated by outlet ditches provided through construction of roads and highways.
- The installation of privately owned lines or conduits on the right-of-way of Federal-aid or direct Federal highway projects for the purpose of draining adjacent wetlands is prohibited by regulation (23 CFR 645.209I). Although the Federal Highway Administration has had regulations prohibiting encroachment since 1960, enforcement has not resulted in sufficient penalties to eliminate the use of highway ditches for drainage.

**5. Impact of water management programs:**

- Water management programs have affected a sizable number of wetlands in the Prairies. The effects have been both direct and indirect, but major impacts have come during construction of five large dams and reservoirs along the mainstem of the Missouri River during the 1950's and 1960's.

- The mainstem Missouri River projects resulted in the loss of nearly all the riparian wetlands and oxbow lakes in North and South Dakota (approximately 388,000 acres). Legislation at that time did not require mitigation, and indeed, almost none of the losses were mitigated.
  - It is expected that in the future the threats to Prairie wetlands from Federal water projects will be much reduced, because the prospects for construction of new, major water projects in the Prairies are limited, and the wetland impacts of new projects are more likely to be mitigated.
  - PL-566 stream channelization also induced considerable wetland drainage. The existence of a drainage outlet provided by a PL-566 project was a major factor influencing decisions by landowners to drain.
6. **Vulnerability of the wetlands:**
- A combination of changes in landownership and the cyclical nature of agricultural prices makes it highly likely that most unprotected wetlands will eventually be vulnerable to conversion.
7. **Prospective effectiveness of Swampbuster:**
- Swampbuster will be effective in reducing the rate of conversion and conserving wetlands in the Prairies if its provisions are vigorously enforced.
  - There are provisions in the law and regulations which permit crop production on converted wetland, and seem at variance with the underlying conservation purpose of Swampbuster.
  - Swampbuster may lead to strategic avoidance tactics, such as increased acreage of nonprogram crops, illegal drainage, or creative real estate transfers.

## **Recommendations**

When this study began, it was thought that the recommendation which would emerge from it would likely be for legislation designed along the lines of the Coastal Barrier Resources Act (CBRA). CBRA made any new development projects in designated areas on coastal barriers ineligible for most Federally financed assistance programs. Since the study was initiated, however, Congress has enacted three significant pieces of legislation which affect wetlands:

- The Food Security Act of 1985 with its conservation provisions (commonly called Swampbuster);
- The Water Resources Development Act of 1986 (WRDA) with its provisions for increased cost sharing and emphasis on the benefit principle for financing Government programs; and
- The Tax Reform Act of 1986 which eliminated those provisions of the tax code which encouraged conversion of wetlands to farmland at a time of agricultural surplus.

These new laws have the potential for solving many of the economic and environmental problems which were identified during the study. As a result, there seems little need to recommend comprehensive legislation similar to CBRA, provided existing laws are rigorously enforced and are revised as needed when gaps and inconsistencies are identified. As a first step, this will require a comprehensive review of the effectiveness of Swampbuster, the WRDA, and tax reform in conserving wetlands. The recommendations below build on the foundation established by these landmark statutes.

1. **Flood control, drainage, and other water projects:**

- a. **Require that new Federal water projects affecting wetlands be financed in accordance with the benefit principle of public finance, i.e., each beneficiary should bear the cost (including interest costs and any wetland opportunity cost) of generating his benefits.**

The Water Resources Development Act of 1986 (WRDA) constitutes a first step toward equitably allocating responsibility for financing water projects. Under the WRDA, in addition to the traditional costs of lands and rights-of-way, non-Federal sponsors of flood control and drainage projects constructed by the Corps of Engineers are responsible for:

- at least 25 percent of the construction cost, and much of this in cash;<sup>2</sup>
- all operations and maintenance expenses;
- half the cost of all development and design studies.

In addition, the WRDA prohibits the use of certain calculation techniques which have been used previously that could have resulted in artificially inflated benefit-cost ratios.

With passage of the WRDA, Congress has made substantial progress toward eliminating the subsidization of flood control, drainage, and navigation projects as well as reducing the construction of inefficient projects. However, the WRDA applies only to projects constructed by the Army Corps of Engineers. The concepts of efficiency and equitable cost sharing based on allocation of benefits are well-established. They should be extended to all new water projects affecting wetlands.

To this end, all Federal water resource development agencies are operating under a Presidential directive to seek new cost sharing arrangements with non-Federal project sponsors. The directive specifies that project beneficiaries should bear a substantial part of the costs of all project development. Pursuant to this policy, the Bureau of Reclamation has recently negotiated a 38 percent share of construction costs for the non-Federal sponsors of a water development project.

The cost shares specified in the WRDA reflect a clear goal, and both equity and efficiency will be served better if only those activities which reflect legitimate national objectives receive Federal financing, and non-Federal benefits are paid for by non-Federal sponsors.

- b. **Require that any agricultural benefits of new Federal water projects affecting wetlands be evaluated using commodity prices which reflect resource scarcity and are free of the effects of agricultural programs and subsidies.**

Traditionally, prices which include the effects of agricultural programs and subsidies have been used to evaluate the new agricultural output attributable to a water project. These artificially maintained prices consistently overvalue the agricultural output, and may have resulted in some projects being undertaken which were economically unjustifiable, but which appeared (erroneously) to be worthwhile investments.

2. **Tax code provisions favoring conversion:**

**Extend the provisions of Section 403 of the Tax Reform Act of 1986 to gains from the sale of all converted wetlands.**

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<sup>2</sup> Although many of the benefits of past projects have accrued locally, historically there have been no cash (only in-kind) contributions by the non-Federal sponsors.

As a precaution against the possible future reinstatement of differential tax treatment for capital gains, Congress singled out gains from the sale of wetlands converted for farming and specified that such gains be treated as ordinary income. The Department recommends that this provision be amended to apply to the sale of all converted wetlands, independent of the purpose for which they were converted.

**3. Federally aided highways:**

- a. Establish appropriate penalties for encroachment into drainage ditches for Federally aided roadways or Federal highways.**

Much past drainage into road ditches appears to have been in violation of Federal aid highway regulations. These ditches continue to offer an incentive to drain adjacent farmlands. At current levels of enforcement of existing regulations, wetland drainage into the rights-of-way on Federally aided roadways can be expected to continue.

Although offenders are occasionally forced to plug drains, current enforcement practices provide little disincentive to use highway ditches for wetland drainage. The enforcement/penalty system needs to be redesigned in order to discourage violators and reduce enforcement costs.

- b. Require that States and the Fish and Wildlife Service engage in pre-development consultation for highway or roadway projects receiving Federal Highway Administration funding.**

Despite the existence of a framework for early coordination, the Service sometimes has been unable (due to resource limitations) to participate fully in the planning for federally aided highways. In such cases, the Service may not get involved until after State agencies have applied to the Corps for 404 permits. Thus, opportunities have been foregone to alert State highway planners and local entities to the presence of wetlands and other environmentally sensitive resources and to advise them about avoiding adverse project effects. With participation by the Service coming late in the planning period, options for changing the design of projects have been foreclosed or limited.

The FHWA has just issued a report, identifying a variety of practices and techniques for making the early coordination process for federally aided highway projects more effective. Adoption of the procedures identified in the report will go a long way toward solving many of the inadequacies in the consultation process. Congress should encourage the States to implement the proposed procedures, and the Service will make every effort to utilize these procedures to resolve early on any differences with Federal and State highway agencies.

**4. Conservation initiatives:**

- a. To the extent permitted by budgetary constraints, encourage the development and implementation of projects for the creation, protection, and restoration of wetlands in conjunction with authorized projects for navigation, flood control, and drainage in the Lower Mississippi Valley.**

Activities of this nature have been authorized by Congress with the intention of mitigating the environmental effects of past projects and providing mitigation concurrently with construction of present projects. However, no funds have been appropriated by Congress. Higher priority could be given to these activities within existing funding levels in order not to add to the Federal deficit.

- b. Extend the mitigation requirements of the Water Resources Development Act of 1986 to all Federal projects which affect wetlands.**

Section 906 of the WRDA requires that mitigation be conducted either prior to or concurrently with construction; includes mitigation costs among those to be shared by non-Federal sponsors; authorizes mitigation for fish and wildlife damages resulting from past, present, or future projects; and requires that a mitigation plan accompany any proposal for authorization of a new project.

The WRDA applies only to projects constructed by the Corps. If mitigation is a desirable Federal objective, then it is appropriate no matter which agency undertakes the project.

- c. **To the extent permitted by budgetary constraints, take advantage of temporarily depressed prices for wetlands by accelerating planned acquisition and easements and encourage State, local, and private organizations to do the same.**

Current economic conditions in the agriculture sector have depressed the market value of some wetlands. Tax reform together with the Swampbuster sanctions have complemented this trend in land values. As a result, landowners are willing to sell their land or grant conservation easements at prices significantly below those which prevailed during recent years.

Although the Federal Government has an active acquisition/easement program, Federal resources alone are insufficient to resolve the problem of wetland conservation. Congress should seek ways of encouraging greater State, local, and private conservation efforts.

- d. **Encourage State and local agencies and private conservation organizations to participate in cost sharing for wetland restoration projects with landowners enrolled in the Conservation Reserve Program.**

The Conservation Reserve Program (CRP) provides annual rental payments to farmers who enroll their highly erodible cropland in the CRP for 10 years. The program also pays for half of the cost of conducting required conservation control measures. Many eligible properties contain existing or drained wetlands, and one of the approved conservation practices is the establishment of shallow water areas for wildlife, e.g., restoration of wetlands.

As of March, 1988, only 1,467 acres of the approximately 23 million acres enrolled in the CRP involved the establishment of shallow water areas for wildlife. There is evidence that many more CRP participants would engage in wetland restoration if they were relieved of the higher costs (relative to other conservation practices) and assured that at the end of their enrollment period their use of the wetland would not be restricted.

Estimates by the Service suggest that there are a significant number of wetland basins in the CRP and that they could be reestablished at modest cost. Iowa already has a cost-sharing program for restoring wetlands on CRP enrolled lands. Other States and private conservation organizations should be encouraged to follow their lead.

#### **5. Tailoring existing 404 regulatory program:**

**Recognize the special importance of Prairie Pothole wetlands by encouraging the Secretaries of the Army and Interior and the Administrator of EPA to closely monitor and coordinate the interagency review of this region's wetlands.**

The Corps of Engineers' program implementing section 404 of the Clean Water Act is one of the most important Federal processes for regulating activities affecting wetlands. Normally, persons seeking to conduct activities that would result in the discharge of

dredged or fill material onto wetlands must obtain a permit from the Corps. In an effort to manage the workload and administer the program, the Corps has issued several nationwide permits (general authorizations to proceed with the proposed activities without full review by the Corps or the resource agencies). One of these nationwide permits allows for filling of less than 1 acre in isolated wetlands. It also places some reporting requirements on fills of 1 to 10 acres, but these larger fills do not all receive full review by the Corps or the resource agencies. This program notwithstanding, extensive loss and degradation continue to occur to small wetlands (1-10 acres) in the Prairie Pothole Region.

Small wetlands in this region are known to be functionally important, especially to migratory and nesting waterfowl. Approximately 36 percent of all Prairie wetlands are smaller than 10 acres. By closely monitoring the interagency review of this region's wetlands, the agency heads can determine whether the regulatory program needs to be revised and greater protection extended to the small wetlands in the Prairies.

## **APPENDIX I-1: Description of Federal Programs Affecting Wetlands in the Delta and the Prairies**

The major Federal programs which have had an effect on wetlands in the Delta and the Prairies are discussed briefly below. A more detailed description of the programs can be found in chapter 2.

### **Flood Control and Drainage Programs in the Delta:**

Beginning in 1929, the Federal Government has constructed an extensive system of flood control and drainage projects (levees, floodways, channelization projects, and tributary basin modifications) in the Delta. The projects have significantly altered the hydrology of the area. The mainline levee system lies along the banks of the Mississippi River and in conjunction with its attendant floodways and channelization projects provides flood protection to approximately 15 million acres of land in the Delta. The tributary projects (along the Arkansas and Red Rivers and the tributaries of the Mississippi River, and in the Atchafalaya Basin) complement the mainline system and provide a variety of drainage and flood protection benefits to over 5 million acres of land. In the absence of these flood control and drainage projects much of the development in the Delta would be unsustainable.

Historically, financing for the projects in the Delta has been almost entirely the responsibility of Federal taxpayers.<sup>1</sup> The Water Resources Development Act of 1986 initiated cash contributions for Corps projects, however, thereby fundamentally altering the way in which local areas share in the costs of Federal water projects. This increase in local cost sharing may act as a constraint on the demand for and authorization of new projects, and reduce developmental pressure on wetlands. Financing for SCS projects can and (these days) frequently does require local cost sharing. Further, Administration policy favors increased local cost sharing in order to more equitably reflect the distribution of project benefits.

### **Flood Control, Drainage, and Irrigation Programs in the Prairies:**

During the 1950's and 1960's the Federal Government constructed five large dams and reservoirs along the mainstem of the Missouri River. Financing for the construction of these projects was almost entirely Federal, and except for the sale of hydroelectric power, operation of the facilities is heavily subsidized, too.

As the reservoirs filled, wetlands were inundated. The mainstem Missouri River projects resulted in the loss of nearly all the riparian wetlands and oxbow lakes in North and South Dakota (approximately 388,000 acres). Only very minor mitigation has occurred. Although the original project designs for the dams and reservoirs in the Prairies called for considerable irrigation (with potentially much more serious consequences for wetlands), almost none of the anticipated irrigation materialized. It is expected that in the future the threats to Prairie wetlands from Federal water projects will be much reduced, because the prospects for construction of new, major water projects in the Prairies are limited, and the wetland impacts of new projects are likely to be mitigated.

### **Agriculture Programs:**

For many years the Federal Government has intervened in the agricultural sector to support and stabilize farm income and commodity prices and to maintain consistent levels of supply. Over the last 50 years Federal agriculture policy has evolved into a mix of supply controls, production subsidies, technical assistance programs and programs to promote export expansion.

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<sup>1</sup> Cost sharing on Corps projects has been limited to contributions of lands, easements, and rights-of-way. There has been some cash cost sharing on SCS projects, however.

By raising expected profitability and reducing risk, these programs may make it advantageous for landowners to convert wetlands into cropland, and also may make lending institutions more willing to finance wetland conversions.

Section 1221 of the Food Security Act of 1985 (known as the "Swampbuster" provision) has potential implications for the future drainage and conversion of wetlands. This provision declares that any person who, in any crop year, produces an agricultural commodity on wetlands converted after Dec. 23, 1985 shall be ineligible during that crop year for most agriculture programs. If Swampbuster is vigorously enforced, the financial incentives to drain and convert wetlands provided by agricultural programs will be reduced or eliminated.

**Price and Income Support Programs:** Price supports are effected through nonrecourse commodity loans to farmers at harvest time.<sup>2</sup> The loan rates essentially establish minimum crop prices. A farmer<sup>3</sup> can place his crop in storage and receive a loan from the Government based on the established loan rate. If the market price rises above the loan rate, the farmer can sell his crop on the market and repay the loan, interest, and storage costs. If the market price does not rise above the loan rate, the farmer can opt not to repay his loan and forfeit the collateral (his crop) to the Government. Consequently, the loan rate places a floor (a price support) under the commodity price.

The technique used for supporting farm incomes is called a deficiency payment, and it constitutes a supplement to the price which a farmer received for his crop. Deficiency payments are available only for wheat, feed grains, rice, and cotton. Price supports are also available for these commodities, and both types of subsidies (price supports and deficiency payments) can be received simultaneously.

Price and income support activities currently constitute the largest portion of Federal Government expenditures in the agricultural sector. Federal outlays for commodity and related programs were \$7.3 billion in FY 1984, \$17.7 billion in FY 1985, \$25.8 billion in FY 1986, and are expected to be \$23.1 billion in FY 1987.

**Disaster Payments:** Beginning in 1973 and prior to enactment of the Federal Crop Insurance Act of 1980 (FCIA), the disaster payments program compensated eligible farmers for losses due to natural disasters. The FCIA ended the disaster assistance program for counties in which Federal Crop Insurance was available. However, the Secretary of Agriculture has the discretion to issue disaster type payments to counties if he thinks the situation warrants it. Disaster payments to an individual cannot exceed \$100,000. Prior to 1981, there were no effective limits on disaster payments.

Because it was free and reduced the risk of a disaster that could lower a farmer's net income, the disaster assistance program had the potential to affect wetlands by encouraging production in high risk areas. This potential impact was much reduced with enactment of the FCIA, and further restricted by Swampbuster, which made farmers who planted on newly converted wetlands ineligible for disaster assistance and crop insurance on all planted acreage.

**Crop Insurance:** Crop insurance reduces the risks involved in agricultural production, protecting farmers against yield losses from a variety of natural causes, including flooding, which is likely to occur on cleared bottomland areas. The Federal Crop Insurance Act of 1980 greatly expanded the Federal crop insurance program. FCIC insurance in force was approximately \$4.9 billion in 1984, and is expected to reach \$9.8 billion in 1987.

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<sup>2</sup> A nonrecourse loan is one which the farmer is not obligated to repay; he can simply forfeit the collateral (the crop).

<sup>3</sup> Technically the term is "producer" rather than "farmer," as some recipients are landowners and not farmers in the conventional sense of the term.

The Federal Government subsidizes the premiums and administrative costs of the insurance program. The acreage insured has grown each year since 1981, until the point where 41,000,000 acres are insured. Under Swampbuster farmers who plant on newly converted wetlands are ineligible for crop insurance coverage on all planted acreage.

*Low Interest Loans and Extensions of Credit:* The Federal Government has a history of involvement in supplying credit to agriculture. Loans have historically been provided at below market rates. Such loans may have reduced the costs to agricultural producers of draining and converting wetlands. Presently, loans are less likely to be provided at below market rates, and the subsidy takes a more subtle form -- making credit available to borrowers who were denied credit from commercial lenders. Provisions in the recently passed Swampbuster legislation should eliminate any impact on wetlands from such lending.

*Technical Assistance:* The Federal Government provides technical assistance, conservation planning services, and cost-sharing assistance to farmers to implement structural soil and water conservation measures. These particular conservation programs are designed to provide soil and water conservation assistance to individuals and are not oriented towards wetlands protection. Like other agricultural programs, conservation technical assistance programs have the potential to lower the costs of drainage and conversion to the individual producer. The incentive to drain and convert is provided by the free knowledge and expertise the producer has access to through these programs.

#### **Tax Incentives:**

Under prior law, tax code provisions designed to stimulate agriculture, capital investment, recreation, and timber production lowered development costs and may have increased the drainage and conversion or the modification of wetlands. Principal among these were agricultural tax code provisions which allowed deductions for land clearing and soil and water conservation expenses.<sup>4</sup> Normally, such cost would have to be capitalized into the value of the land and used to shield taxes only when the land was sold. The new tax law eliminates these wetland-specific deductions, as well as some generally applicable, preferential treatment provisions which may have encouraged the development of wetlands (e.g., capital gains taxation and the investment tax credit).

#### **Federally Aided Roadways:**

Highway programs have affected wetlands both directly during road construction and indirectly by providing a general incentive for development in an area. A persistent problem, particularly in the Upper Midwest and the Southeast, has been the unauthorized drainage of wetlands into adjacent highway rights-of-way. Although Federal regulations prohibit such encroachments, the problem persists because of the difficulty of enforcement, the political sensitivity of enforcement, and ineffectual nature of the penalties for violating the rights-of-way.

#### **Conservation Programs:**

Under the Small Wetlands Acquisition Program, the Fish and Wildlife Service (Service) can either purchase a wetland and surrounding upland area outright or enter into a perpetual easement agreement which places restrictions on the wetlands. Lease and purchase prices reflect current market conditions.

Under the Water Bank Program, wetland owners agree to protect a wetland for 10 years in exchange for a standardized (nationwide) annual payment. Land can be enrolled in both programs simultaneously, but at a reduced payment rate for Service easements.

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<sup>4</sup> Drainage, land leveling, and water removal through ditching and pumping all qualified as soil and water conservation activities.

There is some evidence that landowners enroll in the Water Bank Program when commodity prices are depressed and withdraw or do not renew their agreements when the market recovers. Swampbuster should discourage this practice, however.

In addition to these two programs, there are a number of authorities under which wetlands can be acquired for the National Wildlife Refuge System. However, the acreage protected under all these programs is small relative to the developmental pressure and the annual amount of conversion.

There are several other statutes and two executive orders that may limit the impact of projects on wetlands. However, under most of these authorities the Service has no regulatory powers, only review, comment, special study and/or reporting powers.

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## DESCRIPTION OF FEDERAL PROGRAMS AFFECTING WETLANDS

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This chapter presents descriptive information about the major Federal programs which may affect wetlands in the Prairie Pothole Region (Prairies) and the Lower Mississippi Alluvial Plain (Delta), or may have affected them in the recent past. The effects that agricultural programs, water management programs (flood control, drainage, and irrigation), highway programs, conservation programs, and provisions of the tax code have on the wetlands in these two regions is examined in chapters 3 and 4. All other major wetland regions in the United States and the Federal programs that may affect them will be examined in the second volume of this report.

These programs may affect wetlands in two ways:

- directly through project construction; or
- indirectly by altering the financial incentives to convert wetlands (increasing revenues, reducing costs, reducing risks).

By far the most important economic sector absorbing wetlands is the agriculture sector, with 87 percent of converted wetlands being devoted to agriculture nationally. In the Prairies and the Delta agricultural conversion accounts for almost all wetland development. By increasing the profitability and reducing the risk of engaging in agriculture, Federal programs alter the incentives which farmers have to bring additional land under cultivation by draining and converting wetlands.

For example, river flood control and channelization projects may make conversion of wetlands to farmland both technically and financially feasible by providing drainage opportunities and by reducing the risk of flood losses. In addition to these induced losses, such projects frequently result in direct losses of wetlands during construction. Agricultural programs, by increasing farm revenues and reducing costs and risks, may alter landowners' decisions regarding the conversion of wetlands. For example, price supports may influence output by increasing the expected market price of grain as well as reducing the risk of sharp price decreases. Tax provisions may have similar effects, although the recent tax reform eliminated several features of the code which were specifically targeted at reducing the costs of conversion. In an area such as the Delta, where drainage and conversion is relatively expensive, these previous tax provisions may have provided an important incentive for individuals considering draining and clearing a wetland area for agricultural purposes. Furthermore, until a recent 5th Circuit decision, land clearing for agricultural purposes was generally exempt from Federal regulation under Section 404 of the Clean Water Act.<sup>1</sup> Hence, prior to this decision the features in Federal programs which tend to make development of wetlands more attractive than it would have been under normal market conditions were largely unrestrained by regulation.

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<sup>1</sup> *Avoyelles Sportsmen's League v. Marsh* (715 F2d 987, 13 ELR 20942 (5th Cir. 1983)) involved a suit against several landowners who had drained and cleared a 20,000 acre bottomland hardwood tract for conversion into agricultural production without obtaining a permit under section 404 of the Clean Water Act. The Court concluded that certain activities associated with land clearing on this tract constituted a "discharge" within the meaning of the Clean Water Act. The Court also held that the landowner was not exempt from section 404, because exemptions were limited to "on going" agricultural activities. Because no farming could have taken place until after the acreage had been cleared, the court concluded that the activities in this case were not "normal farming activities".

## Water Management Programs

Among the earliest public works projects were those involving navigable waters, coastal ports, rivers, lakes and territorial seas. Over the years, Federal Government involvement has broadened substantially in water resource development to include not only navigation-related work, but also projects related to crop irrigation, municipal and industrial water supply, flood control, electric power production, and pollution control. Many of these Federal water resource development and management programs have directly affected wetlands, e.g., through inundation during the creation of reservoirs; by filling with dredge and spoil material during channelization or the construction of flood control works; by altering a region's natural hydrology with flood control and drainage facilities. Significant indirect impacts have occurred as well, e.g., by making development in surrounding areas technically feasible or by lowering the cost of such development by providing irrigation water at less than actual cost.

The effects of water resource development on wetlands occur throughout the country. The discussion of water resource programs in this report focuses on the effects of flood control and drainage programs in the Delta and the impacts of irrigation and flood control/drainage programs in the Prairies. In volume II we will discuss the Federal water resource programs which are active in other regions of the country.

The principal Federal agencies involved in water resources project development in the Delta and the Prairies are the U.S. Army Corps of Engineers, the Soil Conservation Service (U.S. Department of Agriculture), and the Bureau of Reclamation (U.S. Department of the Interior).

Corps and SCS projects are developed largely with Federal funds and limited local financial contributions. Although most of the outputs from Bureau projects are sold in order to recover costs from project customers, the pricing methods utilized result in very sizable subsidies. These will be discussed at some length below.

Historically, there have been no cash cost-sharing contributions by non-Federal sponsors of flood control and navigation projects constructed by the Corps. The cost sharing that has occurred has been almost exclusively in the form of contributions of lands, easements, and rights-of-way. By requiring cash contributions for Corps projects, the Water Resources Development Act of 1986 (WRDA) fundamentally altered the way in which local areas share in the costs of Federal water projects. For flood control the minimum local cost share is 25 percent.<sup>2</sup> The value of any lands, easements, and rights-of-way count as part of the 25 percent, but the minimum cash contribution must be equal to five percent of the construction cost. Since all lands, easements, and rights-of-way necessary for the construction of a project are the non-Federal sponsor's responsibility, it is possible for the non-Federal share to exceed 25 percent. The Act also requires 50-50 sharing of costs of studies conducted by the Corps which lead to the development of water projects, and makes the non-Federal sponsors responsible for all operations and maintenance costs. Further, the WRDA applies not just to new projects, but to previously authorized projects which are not yet under construction, as well.

The WRDA constitutes an important step toward financing water projects based on the benefit principle of public finance under which each beneficiary bears the full cost (including any environmental opportunity cost) of generating his benefits. The cost shares specified in the WRDA, however, are negotiated values, and do not reflect the actual costs of providing Federal and non-Federal benefits on a project-by-project basis.

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<sup>2</sup> The Act grants the Secretary of the Army the authority to modify the cost-sharing requirements in cases of unusual financial hardship.

The increase in the local cost-sharing requirement for Corps projects may help to protect wetlands by providing an additional constraint on the demand for and authorization of new projects.<sup>3</sup> Although there is no corresponding generic statutory language for SCS projects, *authorizing legislation for specific projects can and (more frequently these days) does require local cost sharing, and Administration policy favors increased local cost sharing in order to more equitably reflect the distribution of project benefits.* Cost sharing on Bureau projects is negotiated on a case-by-case basis. On new Bureau projects, increased cost sharing takes the form of non-Federal sponsors contributing to construction costs during construction (as opposed to historically, when reimbursement began only after construction was completed and the project was operating).

#### U.S. Army Corps of Engineers Projects:

The Corps is the principal Federal agency with responsibility for flood control and navigation projects (most of which are now multipurpose projects and include irrigation, hydroelectric power generation, municipal and industrial water supply, and recreation). In Chapter 3, this report focuses on water management programs in the lower Mississippi Valley region (the Delta). The Corps' Civil Works program in this region evolved as a multipurpose water management strategy for flood control, navigation and other purposes. Chapter 4 concentrates primarily on the wetland effects of agricultural programs in the Prairies, but water resource programs have also been active in this region and have had a substantial impact on wetlands. During the 1950's and 1960's the Corps constructed five multipurpose dams and reservoirs on the mainstem of the Missouri River, and in the process riparian wetlands were necessarily inundated.

*Delta:* There are four major types of flood control and drainage projects constructed and maintained by the Corps, all of which are found in the Delta: levees, floodways, channelization projects, and tributary basin modifications.

The central purpose of levees is to contain floodwaters. In the Delta, mainline levees follow the Mississippi River and provide flood protection to approximately 15 million acres in the Delta. In addition, levee systems constructed along major and minor tributaries of the Mississippi River, on the Red River, along the south bank of the Arkansas River, and in the Atchafalaya Basin constitute a system of some 2,000 miles of levees, floodwalls, and control structures.

Floodways divert water from the Mississippi River during times of peak floods. Channelization projects are intended to modify and stabilize rivers and streams in order to improve navigation, increase flood-carrying capacity, and maintain levees. Tributary basin modifications provide a variety of drainage and flood protection benefits for lands adjacent to tributaries.<sup>4</sup>

The first Corps projects in the Delta region were initiated in the late 1920's, and project construction reached peak levels during the 1960's. Table II-1 shows Corps tributary projects authorized and completed in the Delta during the period 1929-1984.<sup>5</sup>

Congress did not authorize any major new water resource project during the 10 year period from 1976-1986. However, work continued on previously authorized projects. Additionally, 34 Corps projects in Louisiana, 30 in Arkansas, and 18 in Mississippi have been authorized, but

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<sup>3</sup> Although the net effect is very likely to be a reduction in the wetland effects of Corps projects, the requirement for greater local cost sharing is a two-edged sword. The WRDA contains relatively strong provisions for mitigation of environmental effects. However, mitigation is also among the project costs to be shared by non-Federal sponsors. Since non-Federal sponsors generally feel that they do not benefit from mitigation activities, the increase in local cost sharing may generate increased resistance from these sponsors to mitigation initiatives.

<sup>4</sup> Recent Corps projects have focused on the provision of flood protection and drainage benefits to tributary basins. Typical modifications include the construction of levees, pumping stations, reservoirs, and dredging channels.

<sup>5</sup> The entries in Table II-1 are for Mississippi River tributary projects constructed by the Corps only. Mainline levees and SCS small watershed projects in the Delta are not included.

have not received funding. Although the Water Resources Development Act of 1986 provides for mitigation of environmental effects,<sup>6</sup> increases or changes local cost sharing, and deauthorizes \$11.3 billion worth of Corps projects, it also authorizes construction or study of 250 new projects, and its ultimate implications for wetlands is unknown. (See footnote 3.)

**TABLE II-1: CORPS OF ENGINEERS TRIBUTARY FLOOD CONTROL PROJECTS  
EIGHTY-NINE COUNTIES LOWER MISSISSIPPI ALLUVIAL PLAIN  
1929-1984<sup>a</sup>**

Year	Projects Authorized	Projects Initiated	Projects Completed	Project Construction
	(acres protected)			
1929	460,834	0	0	0
1930-1934	0	185,000	0	92,499
1935-1939	1,711,291	380,084	244,400	333,227
1940-1944	2,781,067	1,575,528	277,921	214,763
1945-1949	44,740	895,505	33,400	218,021
1950-1954	12,000	445,835	55,000	499,040
1955-1959	163,385	316,046	1,399,604	649,723
1960-1964	0	170,000	721,875	860,116
1965-1969	59,470	157,213	1,011,764	276,522
1970-1974	268,300	841,640	9,640	550,307
1975-1979	0	54,470	1,131,912	662,843
1980-1984	0	0	135,805	142,565
<b>TOTAL</b>	<b>5,501,087</b>	<b>5,021,321</b>	<b>5,021,321</b>	<b>4,499,626</b>

<sup>a</sup> The table entries are the "acreage protected" by projects. This "protected area" is defined to include the area which experiences at least some reduction in the extent and frequency of flooding as a result of project construction.

<sup>6</sup> The WRDA requires that mitigation for the fish and wildlife effects of any new water projects constructed by the Corps (including projects previously authorized, but not yet under construction) be conducted either prior to or concurrently with construction; authorizes mitigation for fish and wildlife damages resulting from past, present, or future projects; and requires that a mitigation plan accompany any proposal for authorization of a new project. Authorization to undertake an activity does not ensure that a budget request will be forthcoming (especially when the activity is not the principal mission of the agency) nor does it guarantee an appropriation by Congress with or without such a request. No request has been made for such wetland conservation activities, and no funds have been appropriated. Further, the WRDA applies only to projects constructed by the Corps, and does not cover projects undertaken by other water resource development agencies.

*Prairies:* Under the Pick-Sloan Missouri River Basin Program (authorized by the Flood Control Act of 1944), the Corps constructed and operates five large dams and reservoirs along the mainstem of the Missouri River during the 1950's and 1960's. Four of these are in South Dakota, while Garrison is in North Dakota. The Bureau manages any water distribution facilities associated with these mainstem dams and reservoirs. Tributary projects are constructed and operated by both the Corps and the Bureau.

The projects were designed and constructed for multiple purposes: flood control, irrigation, navigation, recreation, wildlife, municipal and industrial water supplies, and hydroelectric power. The share of storage capacity reserved for the various purposes can be specified in any of a number of documents: the authorizing legislation, the reports of the congressional committees, or the design memoranda. Although the managing agencies usually have some discretion over the allocation of storage capacity, the legislative history is never so vague as to provide them with unrestricted authority.

Although the original project designs for the dams and reservoirs in the Prairies called for considerable irrigation (with potentially very serious consequences for wetlands), almost none of the anticipated irrigation materialized. The storage capacity originally intended for irrigation is used largely to generate electricity. Only in the case of the Garrison Diversion Unit (GDU) is any significant amount of irrigation close to operational, and this amount is about half of what was originally authorized.<sup>7</sup> Although the storage capacity for irrigation exists, for a variety of reasons the demand for irrigation water has not been forthcoming, and very little of the distribution system has been built.<sup>8</sup>

As in the Delta, there are a number of major Corps projects in the Prairies that are authorized, but for which funds have not yet been appropriated. If these projects were constructed without mitigation, they would result in significant, direct losses of wetlands. However, for several reasons the prospects for construction of new, major water projects in the Prairies are limited: the most productive sites have already been developed, leaving (at best) modest benefit-cost ratios on any proposed projects; new projects tend to have high overall project costs; the trend toward increased local cost sharing has discouraged demand for projects; and increased public concern for the environment has slowed the development of projects. In the future, Corps projects in the Prairies are likely to be restricted to small local flood control projects.

#### **SCS Small Watershed Program:**

Funds for construction of flood control and drainage structures and systems are provided under PL-566 and through the PL-534 Flood Control Act. SCS projects, constructed under PL-566, are designed to protect, manage, improve, and develop water and land resources within watersheds up to 250,000 acres in size. PL-566 projects are analogous in purpose to projects in the Corps program but are of smaller scale. In addition, the PL-566 program may include SCS technical assistance to help farmers take advantage of the production opportunities made available by a project.

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<sup>7</sup> Originally authorized in 1965, the GDU would have irrigated 250,000 acres. Wetland losses due to construction of the project would have been about 75,000 acres, with approximately two-thirds of these due to installation of the on-farm irrigation equipment and one-third due to the delivery system. An additional 70,000 acres of wetlands on national wildlife refuges would have experienced varying degrees of degradation. Following a compromise between development and environmental interests, the project was reauthorized in 1986, and will irrigate only 130,940 acres. Gross wetland losses due to construction will be reduced to 18,000 acres, but a mitigation plan calls for replacement of most of these.

<sup>8</sup> Indeed, this is true throughout the entire Missouri River Basin. As originally designed, the Pick-Sloan project would have irrigated 3 million acres of new farm land and provided a supplemental water supply for another 700,000 acres in the ten State region. Only about one percent of this irrigation has occurred, although this will increase to about five percent with the completion of the Garrison Diversion Unit.

These SCS programs are directed at reducing farm soil erosion, protecting farmlands from floods, and improving agricultural yields through drainage and other land treatment measures. Thus, they create an opportunity and incentive for agricultural expansion and, in the process, potential conversion of wetlands.

Probably the greatest threat to wetlands from PL-566 watershed projects emanates from the construction of outlet channels into which landowners drain their wetlands. Very few such projects are being contemplated for the future.

#### **Bureau of Reclamation Program:**

Established by the Reclamation Act of 1902, the Bureau constructs, operates, and maintains multipurpose water projects in the 17 western States primarily for irrigation, hydroelectric power generation, and municipal and industrial water supply. The projects also provide flood control and recreational benefits, but these are generally not primary project purposes.

Originally funded from the sale of public lands in the West, the Bureau's program was to be self-sustaining, with project construction costs to be repaid within ten years (without interest) and reutilized to build additional projects. Additional appropriations soon expanded the program, however, and in numerous pieces of legislation, beginning in 1914, Congress has altered the nature of the repayment requirements and expanded the subsidies.

All project functions other than hydroelectric power are subsidized,<sup>9</sup> but the subsidies for irrigation are among the largest. The subsidies to irrigation come largely from two sources: 1) the interest-free repayment of capital costs and 2) the establishment of irrigators' repayment obligation based on the Bureau's estimate of their "ability to pay."<sup>10</sup> The level of the interest subsidy has grown over the years, primarily due to Congressional extensions of the repayment period and increases in the cost of borrowing by the Federal government. To a lesser degree, subsidies have occurred due to legislative changes granting moratoria on repayment and forgiving some charges. Estimates of the magnitude of the subsidy differ, but all agree that it is substantial. Much of the capital cost assignable to irrigators but not collected from them is charged to users of hydroelectric power. Power users have been subsidizing irrigation since 1939.<sup>11</sup>

*Projects in the Prairies:* The status of the Bureau's program in the Prairies parallels that of the Corps. Much of the irrigation authorized by Pick-Sloan has not occurred. A number of projects are still authorized, but since these are unlikely to be implemented without mitigation requirements, they would not be expected to result in significant damage to wetlands. In addition, the likelihood that they will receive funding has diminished in recent years.

#### **Effects of Water Management Programs on Wetlands:**

The potential effects of these projects on wetlands vary according to the type of project or activity and its geographic location, but may include direct and indirect effects on both wetland quantity and quality. Direct effects occur during project construction, operation, and maintenance. During construction some wetlands are unavoidably eliminated (drained, filled, inundated, etc.). Operating dams alters the timing and duration of stream flows, and in the process can affect wetlands. Routine maintenance of canals and waterways results in elimination of vegetation from surrounding wetland areas. Indirect effects occur because the projects alter the financial incentives to convert and develop wetlands.

<sup>9</sup> Even hydropower users may be subsidized. They pay interest at the rate legislated for the project, which historically has been less than the rate at which the Government can borrow, and they have the benefit of long repayment periods. However, since hydropower users are assigned some of the capital costs from which irrigators were relieved, these subsidies may be partially or wholly offset.

<sup>10</sup> The Bureau determines "ability-to-pay" based on a comparison of farm income under "with" and "without" project conditions, adjusted for an appropriate return to farm labor, capital, and management.

<sup>11</sup> The subsidy from power users covers only a portion of the uncollected capital cost, some capital costs having been forgiven altogether. The interest subsidy is borne by taxpayers in general.

In the Delta the direct effects are relatively minor compared to the total number of wetlands in the area that get converted. Indirect effects are more important in the Delta. Channelization and flood control projects reduce the probability of crop loss from flooding and extend the growing season by reducing early spring flooding and by increasing the hydraulic efficiency of on-farm drainage systems. Taken together these projects result in higher expected yields on cleared land, reduced yield variability, and reduced planting costs, thus favoring agricultural development.

In the Prairies the direct effects have been sizable as reservoirs have filled and wetlands have been inundated. The mainstem Missouri River projects resulted in the loss of nearly all the riparian wetlands and oxbow lakes in North and South Dakota (approximately 388,000 acres). In South Dakota none of these losses has been mitigated, and only very minor mitigation has been conducted in North Dakota. However, approximately 30,000 acres of wetlands have developed in the arms and upper ends of the North and South Dakota mainstem projects, and the rate of wetland development is expected to increase.

There are indirect effects, as well: as development occurs in formerly flood prone areas; as wetlands are drained into outlet channels; and as water supplied at less than full cost induces irrigation where it would not otherwise have occurred. The first two of these effects have been fairly significant in the Prairies. Although modern irrigation systems can be very damaging to wetlands,<sup>12</sup> thus far the indirect effects of irrigation on wetlands have been minor in the Prairies, because only a small percentage of the planned irrigation has materialized.

It is likely that the future will see increased use of voluntary water marketing, i.e., water users transferring water to higher value uses. Increasingly water will be transferred from irrigation to municipal and industrial use. To the extent that this trend cuts down on the demand for new projects, it should help to conserve wetlands. On the other hand, water reserved for wetland conservation and the mitigation of project effects is often distributed in conjunction with irrigation water, and it may be technically more difficult or more costly to distribute the water for conservation and mitigation in the absence of the irrigation water. Further, water rights for conservation often are not as secure as rights to water for commercial uses. However, given the small amount of irrigation in the Prairies, the trend toward water marketing may exert only a modest impact on wetlands in this region.

#### **Recent Changes in the Nature of the Water Programs:**

Corps, SCS, and Bureau officials are presently much more cognizant of the possibility that projects may affect land development.

*Corps:* The whole Corps program has been substantially reduced since the 1977 period, with few projects funded for construction and until 1986 no new projects were authorized for future starts. In real terms the Corps budget has declined since 1977. Now over 50 percent of that reduced budget is allocated to operation and maintenance of existing projects rather than to new construction. It is noteworthy that the Corps revised its evaluation guidelines for water projects in 1978 and again in 1980 in a manner which will make economic analysis of agricultural flood protection and drainage projects more rigorous and justification more difficult. As noted above, the Water Resources Development Act of 1986 contains some protections for wetlands and has the potential to limit significantly the construction of Corps projects which may affect wetlands.

*SCS:* The PL-566 program now places more emphasis on non-structural watershed protection measures, an emphasis which reduces the opportunities for conversion of wetlands. Nonetheless, while SCS is seeking to void funding of projects which mainly provide outlets for drainage, projects which have been authorized in the past and now are candidates for funding would, if implemented, support some drainage activity.

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<sup>12</sup> Center pivot and wheel line systems are often difficult to operate in the midst of potholes, so the wetlands are frequently drained or filled prior to installation of the equipment.

*Bureau:* Unlike the other two agencies the Bureau's construction budget has risen in recent years, and will continue to do so until the early 1990's. After that it will decline unless new projects are authorized or already authorized projects are funded. This trend reflects construction expenditures for a number of large projects, all of which should be completed by 1995. With the exception of the Garrison Diversion Unit and the WEB Pipeline (a rural, nonagricultural water supply project) none of these major projects are in the Prairies.

As with Corps and SCS projects, the non-Federal cost burden has increased recently for Bureau projects. On new projects the Bureau now requires the non-Federal sponsors to contribute 50 percent of feasibility study costs and finance up-front a portion of the construction costs for the project (as opposed to delaying reimbursement until after construction is completed and the project is operating, as was the historical practice). Further, the Bureau's approach to any new hydroelectric projects has been tightened significantly: the entire construction cost must be paid by the non-Federal sponsor during the construction period.

Recent authorizing legislation for water resource projects tends to include more requirements for conservation and mitigation than in the past, making it likely that any new authorizations and appropriations for Bureau projects also will include such requirements. However, in the implementation of these requirements the Fish and Wildlife Service continues to be concerned by the Bureau's focus on replacement of wetland acres lost. The Service contends that wetlands are not all identical and that the appropriate criterion is ecological productivity rather than area. The Bureau believes that it adequately compensates for lost wetlands.

*Evaluating agricultural benefits of water projects:* In 1987 the Administration attempted an important change in the method for evaluating the agricultural benefits of water projects. Traditionally, prices which include the effects of agricultural programs and subsidies have been used to evaluate the new agricultural output attributable to a water project. These artificially maintained prices consistently overvalued the agricultural output, and may have resulted in some projects being undertaken which were economically unjustifiable, but which appeared (erroneously) to be worthwhile investments.

This bias in the traditional procedure for evaluating water projects has been present no matter what the market conditions in the agriculture sector. It has seemed all the more pronounced, however, because that economic condition has been one of persistent agricultural surplus. Consequently, the Administration initiated an effort to remove the effects of government subsidies from the prices of surplus commodities when evaluating the benefits of water projects, and in 1987 guidelines were issued implementing the new procedures. These procedures applied broadly, even requiring that water projects which had been authorized but not yet constructed be reevaluated using the improved pricing technique.

The Administration's efforts to improve Government investment decisions about water resource development projects were thwarted, at least temporarily, when the Continuing Resolution for FY 1988 (P.L. 100-202) was amended, prohibiting Federal agencies from using the new evaluation procedures and requiring them to continue to use the traditional, biased procedure. The prohibition on using the new procedure is in effect only for FY 1988. As a result, the Administration has decided not to consider any new proposals for agricultural development projects during the remainder of FY 1988.

## **Agricultural Development and Support Programs**

For many years the Federal Government has intervened in the agricultural sector to support and stabilize farm income and commodity prices and to maintain consistent levels of supply.

Over the last 50 years Federal agriculture policy has evolved into a mix of supply controls, production subsidies, technical assistance programs and programs to promote export expansion. The Department's research for this report examined the incentives that agricultural programs have had on net farm income over time in the Prairies and Delta regions. By raising expected profitability and reducing risk, these programs may make it advantageous for farmers to convert wetlands into cropland. The price and income support programs may also make lending institutions more willing to finance wetland conversions. Federal programs which maintain or encourage expansion of the agriculture sector may also affect the quantity and quality of wetlands through increased fertilizer and pesticide runoff and deep well irrigation pumping which reduces aquifer recharge of wetland areas. The devegetation and compaction of land which occurs when new land is brought into production may also accelerate natural surface runoff and erosion, leading to increased sediment loadings in wetlands.

Section 1221 of the Food Security Act of 1985 (known as the "Swampbuster" provision) has potential implications for the future drainage and conversion of wetlands. This provision declares that any person who, in any crop year, produces an agricultural commodity on wetlands converted after Dec. 23, 1985 shall be ineligible during that crop year for most agriculture programs. If Swampbuster proves effective, the financial incentives to drain and convert wetlands provided by agricultural programs will be reduced or eliminated.

Prior to Swampbuster, some protection to wetlands was offered by Executive Order 11990. Promulgated in May, 1977, Executive Order 11990, Protection of Wetlands, mandates that each Federal agency in carrying out its individual responsibilities take action to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands. The order specifically requires that agencies avoid undertaking or assisting new construction in wetlands unless no practicable alternative exists, that all practical measures to minimize harm to wetlands are included in the action, and that agencies consider the effect of a proposed action on the survival and quality of wetlands.

The specific USDA programs discussed in this section include:

- price and income support programs
- below market interest rate credit programs
- crop insurance
- disaster aid
- technical assistance programs.

#### **Price and Income Support Programs:**

Commodity Credit Corporation (CCC) programs support and stabilize farm prices and income and maintain stable levels of supply. These goals are accomplished through CCC payments, purchases, and acreage reduction programs. Price and income support programs began with the Agricultural Adjustment Act of 1933 which introduced a number of new policies -- payments to farmers for voluntary acreage reductions, on farm storage, and marketing agreements. All subsequent farm legislation has continued to emphasize price and income supports for major crops.

*Nonrecourse Commodity Loans:* Congressionally-established loan rates provide minimum crop prices through nonrecourse loans to farmers. A nonrecourse loan is one which the farmer is not obligated to repay; he can simply forfeit the collateral (the crop). The farmer can place his crop in storage and receive a loan from the Government based on the established loan rate. If the market price rises above the loan rate, the farmer can sell his crop on the market and repay the loan, interest, and storage costs. If the market price does not rise above the loan rate, the farmer can default on the loan (without penalty) and turn the crop over to the Government. Consequently, the loan rate places a floor under the commodity price for a participant.

Nonrecourse loans continue to represent an important component of farm policy. By setting a price floor, nonrecourse loans reduce income variability and increase expected returns, and thus may provide incentives for agricultural producers to drain and convert wetlands that otherwise might not be cropped.

**Deficiency Payments:** Congressionally established target prices for certain crops enable participating farmers to receive "deficiency payments" from the CCC for eligible program commodities when commodity prices fall below the target price for specified periods of time. The legislative deficiency payment rate is the target price minus the higher of: (1) the loan rate, or (2) the national average market price for the first five months of the marketing year.<sup>13</sup> There is a \$50,000 annual limit on the payments individuals can receive under the deficiency program.<sup>14</sup> However, some farmers have reorganized their large farm operations into smaller units to evade this restriction.

Deficiency payments are based on "program yields" rather than actual yields. Program yields are established by the Agricultural Stabilization and Conservation Service (ASCS) county committees and are a function of the farm's historical yields. Deficiency payments are multiplied by a program allocation factor. In years when program expenditures are high, the Secretary of Agriculture can invoke the program allocation factor in order to reduce expenditures. The program allocation factor is legislated to be between 0.8 and 1.0, but its actual value is not known by farmers at sign-up time.

Because a participant's deficiency payment is based on production rather than income, larger farmers receive larger payments. In 1982, the largest 17 percent of participating farmers (operating farms of 500 or more acres) received 60.2 percent of the payments. The smallest fifty percent (farms less than 140 acres) received 10.2 percent of the payments.

Like nonrecourse loans, deficiency payments reduce both price and income variability and the risk of farming, and in the process may provide incentives to drain and convert wetlands to agricultural production.

**Magnitudes and Participation in Price and Income Support Programs:** Price supports (nonrecourse loans) and income supports (deficiency payments) as discussed in this report are available for wheat, feed grains, rice, and cotton. Soybean producers may receive price supports, but not income supports. The price for soybeans, the primary crop produced on cleared lands in the Delta, has rarely fallen to price support levels. Wheat, corn, and rice -- crops which are frequently rotated with soybeans -- have generally had high levels of price and income support. (In 1985 in the Delta the commodity program participation rate was over 30 percent.) Crops produced in the Prairies, such as wheat, corn, and other feed grains, have generally had high levels of price and income support.<sup>15</sup>

Price and income support activities currently constitute the largest portion of Federal Government expenditures in the agricultural sector. Federal outlays for commodity and related programs were \$7.3 billion in FY 1984, \$17.7 billion in FY 1985, \$25.8 billion in FY 1986, and

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<sup>13</sup> The national loan rate, which is used in the determination of maximum deficiency payments, may differ from the loan rate encountered by a farmer obtaining nonrecourse loans, because the latter loan rate is adjusted for regional conditions.

<sup>14</sup> The Secretary of Agriculture has the discretion to reduce the loan rate by 20 percent if economic conditions warrant it. When he exercises this authority, the deficiency payment calculation becomes more complicated. The calculation becomes two-staged, utilizing both the five-month and the twelve-month average market price, and the total payment limitation is increased to \$250,000.

<sup>15</sup> It was not possible to estimate the participation rate for the Prairies as defined in this report. Portions of the Prairies lie in the Lake, Corn Belt, and Plains regions, and participation rates for these regions for 1985 were available: Lake, 33.4 percent; Corn Belt, 35.8 percent; and Plains, 46.6 percent. These participation rates are based on the total number of acres planted, not the total number of acres eligible to participate in the program.

are expected to be \$23.1 billion in FY 1987. There were 1,851,590 farms, representing about 190 million acres, participating in Government commodity programs (corn, sorghum, barley, oats, wheat, upland cotton, and rice) in 1985. The largest number of farms (773,520) participated in corn programs and the smallest number (19,716) in rice programs.

The price and commodity programs have the potential to affect wetlands by reducing income variability and increasing expected returns, and this may provide incentives for producers to drain and convert wetlands into agricultural lands.

#### **Supply Restriction Programs:**

Acreage reductions, set-asides, paid land diversions, and the "payment-in-kind" programs have been the primary means of restricting supply. The general goal of these policies is to reduce the number of acres planted and thus reduce crop production.<sup>16</sup> If an acreage reduction or set-aside is in effect, producers must reduce their plantings by a specified percentage of the acreage base for each enrolled commodity to be eligible for CCC loans, purchases, and payments.<sup>17</sup>

#### **Disaster Payments:**

The Agriculture Consumer Protection Act of 1973 authorized disaster payments to compensate farmers for prevented plantings and unusually low yields due to natural disasters, adverse weather, and other conditions beyond a producer's control. The program covered wheat, barley, corn, sorghum, rice and cotton.

Prior to enactment of the Federal Crop Insurance Act of 1980 (FCIA), the disaster payments program compensated eligible farmers for losses due to natural disasters. The FCIA ended the disaster assistance program for those counties in which Federal Crop Insurance was available.<sup>18</sup> However, the Secretary of Agriculture has the discretion to issue disaster type payments to counties if he thinks the situation warrants it. Disaster payments to an individual under the wheat, feed grains, upland cotton, and rice programs combined cannot exceed \$100,000. Prior to 1981, there were no effective limits on disaster payments.

Because it was free and reduced the risk of a disaster that could lower a farmer's net income, the disaster assistance program had the potential to affect wetlands by encouraging production in high risk areas. This potential impact was much reduced with enactment of the FCIA. Any residual impact was further restricted by Swampbuster, which made farmers who planted on newly converted wetlands ineligible for disaster assistance on all planted acreage.

#### **Crop Insurance:**

Federal crop insurance was established by the Federal Crop Insurance Act of 1938, but essentially operated as a pilot program for four decades. The Federal Crop Insurance Act of 1980 greatly expanded the Federal crop insurance program to make it the major policy for protection from crop failure. FCIC insurance in force was approximately \$4.9 billion in 1984, and is expected to reach \$9.8 billion in 1987.

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<sup>16</sup> The manner in which managers of the supply restriction programs respond to increases in agricultural output has implications for the benefits associated with water resource projects. Frequently, one of the benefits identified for water resource projects is increased agricultural productivity. However, if the managers of the supply restriction programs react to increases in agricultural output by increasing supply restrictions, then any new output attributable to a water project is a regional benefit, but not an addition to net national product. That is, the location of cultivation will have changed, but total output will remain constant.

<sup>17</sup> Acreage bases are established for each farm for each commodity based on the planted and considered-planted acreage of the commodity in previous years. Producers must devote a specified percent of the acreage planted for harvest to approved conservation uses.

<sup>18</sup> The FCIA also expanded coverage from six to 28 crops.

The Federal Government subsidizes the premiums and administrative costs of the insurance program. The acreage insured has grown each year since 1981, until the point where 41,000,000 acres are insured. Premium income in 1986 was \$380 million. A variety of coverage levels are available.<sup>19</sup> The higher the yield guarantee level and the higher the price election, the higher will be the premium the farmer will pay. If at harvest time, the farm yields are below the yield guarantee level, an insurance adjuster will visit the farm and determine the indemnity which the farmer is entitled to receive. Crop insurance reduces the risks involved in agricultural production, protecting farmers against yield losses from a variety of natural causes, including flooding, which is likely to occur on cleared bottomland areas. However, under Swampbuster farmers who plant on newly converted wetlands are ineligible for crop insurance coverage on all planted acreage.

## Low Interest Loans and Farm Credit

The Federal Government has a history of involvement in supplying credit to agriculture. Loans have historically been provided at below market rates by the Farm Credit System (FCS), Farmers Home Administration (FmHA), and the Commodity Credit Corporation (CCC). Below market rate loans may have reduced the costs to agricultural producers of draining and converting wetlands. Presently, loans are less likely to be provided at below market rates, and the subsidy takes a more subtle form -- making credit available to borrowers who were denied credit from commercial lenders. Provisions in the recently passed Swampbuster legislation should eliminate any impact on wetlands from such lending.

### The Farm Credit System:

The Farm Credit System (FCS) is a federally chartered cooperative owned by its farmers. Established by the Government before WWI to provide agricultural credit in rural areas, it is now made up of 37 regional banks that make farm-operating and mortgage loans through local land bank associations and production credit associations. The FCS also makes loans to farm cooperatives.<sup>20</sup> The FCS is not a Federal agency; however, it is regulated by the Farm Credit Administration. There are no restrictions on how the loaned funds are used. Common uses include purchasing real estate, buying machinery, or covering production costs.<sup>21</sup> To the extent that FCS loans are made at less than market interest rates, the subsidy comes from the owners of the cooperative, not the Federal Government.

### FmHA Loans:

The FmHA, a Federally owned major agricultural lender, is designed to be a lender of last resort, and borrowers must demonstrate that they cannot obtain credit elsewhere at terms and interest rates normally charged farmers.<sup>22</sup>

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<sup>19</sup> The farmer can choose among three levels of yield protection, 50, 65, or 75 percent of his normal yield. His normal yield is referred to as his Actual Production History (APH). If the farmer has at least 10 years of acceptable yield records, the APH will be determined by dropping the highest and lowest yield and averaging the remaining yields. If he has less than 10 years of data, the APH is calculated by a formula which blends the available farm data with county average data. (This is similar to the calculation of the ASCS program yields used for determining deficiency payments.) In addition to selecting a level of yield protection, the farmer must also choose from one of three "price elections." This will determine the price which will be used to place a monetary value on any insurable losses which occur.

<sup>20</sup> The Farm Credit System held \$68 billion (32 percent) of the total \$213 billion farm debt outstanding at the end of 1984 (OMB, FY 1987 Budget).

<sup>21</sup> Loan funds are obtained by selling bonds on the private bond market.

<sup>22</sup> The FmHA currently holds about 15 percent of the total farm debt outstanding, primarily for family farmers with limited resources (OMB, FY 1987 Budget).

Below market rate ownership and operating loans are available directly to farmers through the FmHA. The relatively low rates reduce the cost of capital and may encourage farmers to expand the size of their operations. (In the past, such expansion could have occurred through the drainage and conversion of wetlands, but if properly administered, Swampbuster should eliminate further FmHA lending for this purpose.<sup>23</sup>) The loans are made primarily to family farmers who cannot obtain private credit to finance operations or make farm improvements. In addition, the FmHA has increasingly been providing disaster emergency loans which can reduce the risk of farming in flood prone areas.

The FmHA issued regulations in 1983 (7 CFR Part 1940.301) which state that FmHA loans are not to be allowed for activities that would directly or indirectly affect wetlands, unless there is "no practical alternative". If properly implemented and enforced, Swampbuster should halt most of the lending that might affect wetlands.

Due to recent economic conditions in the agriculture sector, FmHA has acquired a significant amount of agricultural land primarily through voluntary conveyances.<sup>24</sup> FmHA's inventory of property now contains approximately 1.7 million acres of land. The inventory is expected to grow significantly during the next few years, with estimates of the ultimate size of the inventory ranging as high as 5 million acres. The size of this inventory together with the FmHA's authority to impose deed restrictions requiring the protection and/or restoration of wetlands when property in the inventory is resold presents a unique conservation opportunity. Although FmHA's principal objective is to resell these properties as quickly as possible in order to recoup its capital, FmHA has recently concluded that it has a responsibility to protect and enhance wetlands in conjunction with its property disposal process, and has entered into an agreement with the Service to do just that. Furthermore, section 616 of the Agricultural Credit Act of 1987 allows transfer of FmHA Inventory property to any State or Federal agency for conservation purposes, without reimbursement. The advantage to FmHA is the disposal of marginal land that may have been unsalable, thus eliminating future maintenance and management costs.

In addition, FmHA will soon publish regulations implementing the farm debt restructure and conservation set-aside provisions of the Food Security Act of 1985 (section 1318). This program will allow a farmer who is unable to repay his loan to have a portion of his FmHA loan cancelled in exchange for a conservation easement of at least 50 years. The percentage of the debt forgiven will be equal to the percentage of the farm acreage (secured by the loan) which is placed under easement.

## Conservation and Technical Assistance Programs

The USDA implements Federal soil and water conservation policy through the Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service (ASCS). The SCS provides technical assistance and conservation planning services to individual farmers in 3,000 local SCS conservation districts, although SCS cost sharing for projects is also available under some programs. The role of the ASCS is primarily one of providing cost-sharing assistance to farmers to implement structural soil and water conservation measures. The

<sup>23</sup> Borrowing for the purpose of converting wetlands to agriculture is more likely in the Delta than in the Prairies. In the Delta agricultural development takes the form of large plots of forested wetlands being cleared and drained, and can involve sizable amounts of capital. In the Prairies, borrowing strictly to drain and convert relatively small potholes seems less likely.

<sup>24</sup> It is not uncommon for the indebtedness on such property to exceed current land values by two- to threefold. For example, in Mississippi there are a number of instances where property having a value of \$400-600 per acre has indebtedness ranging from \$1500-2000 per acre. Much of this indebtedness stems from disaster emergency loans issued between 1982 and 1983. Even at the time of issuance, the security of the loans was questioned.

conservation programs discussed in this section are designed to provide soil and water conservation assistance to individuals and are not oriented specifically towards wetlands protection. Like other agricultural programs conservation technical assistance programs have the potential to lower the costs of drainage and conversion to the individual producer. The incentive to drain and convert is provided by the free knowledge and expertise the producer has access to through these programs.

In moderately dry farming areas such as the Prairies, ASCS funding for irrigation conservation measures, such as land leveling for irrigation, installation of reuse pits and dugouts, may indirectly affect wetlands quantity and quality. Land leveling for the purpose of center pivot irrigation increases sediment loadings in nearby wetland areas. Reuse pits and dugouts collect natural run off, preventing direct flow to wetlands and groundwater recharge of wetlands.

The particular SCS and ASCS programs and activities which have potential for affecting wetlands include:

- SCS Conservation Technical Assistance Program(CTA)
- SCS Great Plains Conservation Program (GPC)
- ASCS Agricultural Conservation Program (ACP)

#### **SCS Conservation Technical Assistance Program (CTA):**

The CTA program, the principal soil and water conservation technical assistance program of SCS, accounted for 58 percent (\$273 million) of 1983 SCS technical assistance expenditures (SCS, 1985). Prior to 1980, SCS technical assistance was provided formally through CTA on a large scale to farmers specifically for wetland drainage, often in conjunction with cost-sharing assistance through the ASCS Agriculture Conservation Program. Following issuance of Executive Order 11990 in 1977, SCS implemented regulations which officially limited SCS employees in the kinds of technical (as well as financial) assistance they could provide to farmers for activities that would result in new construction (including drainage) in wetland types 1-20 (7 CFR Part 650.26). These regulations specifically prohibit SCS from providing technical assistance for activities affecting certain wetland types, and require that SCS assistance for activities affecting other wetland types must be based on an SCS evaluation concluding that there is "no practical alternative" to the proposed activity. The regulations also specify that if specific wetland types would be drained or otherwise altered as a secondary result of a farmer's proposed action, SCS could provide technical assistance only if the farmer accepted SCS modifications to the proposed action that might avoid or mitigate wetland impacts.

Although these regulations may have greatly reduced SCS assistance for direct wetland drainage, the flexibility they provide to SCS continues to result in SCS contributions to activities directly and indirectly detrimental to wetlands. The regulations do not prohibit wetland drainage if it is a secondary result of actions whose primary purpose may be, for example, providing adequate drainage to existing cropland.<sup>25</sup> Additionally, SCS may provide technical

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<sup>25</sup> According to 7CFR 650.26(d)(5), if wetland types 1 through 20 would be drained or otherwise altered because of structural measures designed for other purposes, land users and project sponsors will be advised of alternatives that will avoid or mitigate the incidental loss of these wetlands. SCS will provide assistance only if one of the alternatives is selected for installation, or adequate mitigation is agreed to.

There are exceptions allowed to the rule (Section 650.26(e)). For example, the Chief, SCS may grant an exception where there is no practicable alternative.

With regard to the wetland types, the "least" coverage is provided to types 1 and 2 where there is more discretion. Further, since SCS and the Service use different systems for typing wetlands, discrepancies arise. In the past, problems have arisen over the identification of wetlands and the determination of adequate mitigation.

assistance for projects which do not have adverse impacts on wetlands but, nevertheless, may greatly facilitate wetland drainage by the farmer in the future. Further, Fish and Wildlife Service field offices report that despite regulations prohibiting it, SCS personnel continue to provide technical assistance on an unofficial basis to farmers wishing to drain wetlands. If SCS technical assistance will help to mitigate erosion and water quality problems, SCS may continue to assist landowners who plan to drain land regardless of whether or not they receive assistance.

#### **ASCS Agricultural Conservation Program (ACP) and SCS Great Plains Conservation Program (GPCP)**

The ACP program provides cost-sharing to farmers nationwide of up to 75 percent of the cost of constructing a variety of soil and water conservation and agricultural pollution abatement practices. There is a maximum annual payment of \$3,500 per person. These cost-shared practices can include pasture establishment, conservation tillage, use of winter cover crops, terrace installation, fencing, surface drains, sod waterways, animal waste facilities, use of vegetative barriers, and contour farming.<sup>26</sup> Most ACP assistance is provided under annual agreements. In FY 1983, approximately \$185 million was paid to about 204,000 farmers and ranchers for conservation in the 50 states, Puerto Rico, and the Virgin Islands. ACP outlays for FY 84 were \$180 million, FY 85, \$181 million, and FY 86 were \$139 million.

The SCS Great Plains program offers cost-sharing to individual farmers for soil and water conservation measures in 10 Great Plains states. Assistance provided under multi-year contracts by this program was \$21 million per year for fiscal years 1983, 1984, and 1985.

Between 1940 and 1977, cost-sharing assistance for open ditch and tile drainage under ACP was used widely for wetland drainage. It has been estimated that nearly 57 million acres of wet farmland, including many wetlands, were drained under this program (Environmental Law Institute 1985). Much of this wetland drainage occurred in the Prairies. An estimated nine out of ten wetlands in the Nebraska Rainwater Basin have been drained or filled with the Federal technical and cost-sharing assistance. Also, although many of these drainage projects were public projects, they are likely to have induced a substantial amount of additional private drainage, since construction of public drains tends to accelerate private drainage of nearby wetlands. Following issuance of Executive Order 11990, ASCS regulatory changes prohibiting the use of ACP cost-sharing for wetland drainage effectively eliminated direct wetland drainage under ACP.<sup>27</sup> However, if a farmer has already drained a wetland, and if such action has caused erosion or water quality problems, then cost sharing might be provided to help alleviate these problems.

## **Provisions of the Tax Code Affecting Wetlands**

In addition to the effects of Federal programs, tax policies may have the unintended effect of increasing the incentive to drain and convert wetlands. Tax policies designed to stimulate agriculture, capital investment, recreation, and timber production may increase drainage and conversion or the modification of wetlands. By lowering the cost of development to the taxpayer, these tax policies may reduce costs and create incentives to developed more wetlands than would have been developed in the absence of these policies.

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<sup>26</sup> Sub-surface drainage facilities are no longer cost-shared.

<sup>27</sup> Specifically, ASCS forbids cost-sharing for tile or subsurface drain pipe unless such devices are a component of another practice (e.g., strip-cropping) and the drainage is essential to the proper functioning of the conservation practice.

This section focusses primarily on the provisions of the tax code relating to both agriculture and timber which were in effect during the time the Department's research was performed and which may have affected the drainage and conversion of wetlands. Although the tax code changed substantially during the course of this study, the changes which affect wetlands generally take the form of eliminating provisions which could have encouraged conversion and development. The flexibility of the mathematical models developed by the Department together with the nature of the revisions to the tax code allow analysis of tax code implications for wetlands for both the old and newly revised codes.

The total tax expenditures for agriculture and timber are large, but it is not possible to determine the fraction of these total tax expenditures due to the development and conversion of wetlands.<sup>28</sup> The Treasury estimates total tax expenditures for agriculture to be \$1.3 billion in 1987. Total silviculture tax expenditures for 1987 due to capital gains treatment of timber income, the investment tax credit, and the seven year amortization for reforestation are estimated to be \$895 million.

#### **Agricultural Tax Code Provisions:**

Until the Tax Reform Act of 1986 there were three types of tax provisions affecting agricultural land conversion rates which reduced income tax liability: deductions, credits, and preferential taxation of capital gains. Some of these were limited to maximum amounts or by percentages of income.

Under prior law, costs for land clearing could be deducted from taxable income, subject to an upper limit of the lesser of \$5000 or 25 percent of net farm income. Expenses in excess of this allowance were added to the sale basis of the land. The Tax Reform Act of 1986 eliminated this deduction for land not now being farmed. Any clearing done as maintenance for land already in farm use continues to be deductible as an ordinary business expense. Since clearing done as maintenance is still deductible as an ordinary expense, there is potential to evade this tax provision.

Prior law allowed taxpayers to deduct certain costs incurred for the purposes of soil and water conservation that would otherwise be capitalized in the basis of the land, such as costs for drainage, land leveling and water removal through ditching and pumping. The deduction in any year was limited to 25 percent of gross farm income, but any expenses not deducted could be carried forward to subsequent years. Any deductions now taken under this provision are limited to amounts incurred in implementing an approved SCS conservation plan.

Formerly, if the land were sold within 10 years of the time the land clearing and soil and water conservation deductions were taken, then these deductions were subject to recapture rules on a sliding scale. Specifically, a portion of the gain resulting from these deductions was taxed as ordinary income rather than as capital gains income. New tax laws eliminate the land clearing deduction and any capital gains advantages for wetlands, and severely restrict the use of the soil and water conservation deduction.

#### **Forestry Tax Code Provisions:**

Similar to the agriculture tax code provisions, timber tax provisions have the potential to increase the financial incentives individuals have to drain and/or convert wetlands by reducing the costs they incur. If land is retained in forestry, costs and returns from timber production receive specialized tax treatment under the Federal tax code. Also, because most timber sales

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<sup>28</sup> Tax expenditures are revenue losses attributable to provisions of federal tax laws which allow a special exclusion or deduction from gross income or which provide a special credit, a preferential rate of tax, or a deferred liability.

qualified for capital gains treatment under prior law, the tax on a dollar income from timber sales was formerly less than the tax on a dollar of sales of agricultural output. The Tax Reform Act of 1986 retains the special tax treatment extended to silviculture by prior law with one exception: it eliminates advantages of all capital gains (including timber) for individuals. The effects of this may be to reduce the advantage of holding forest land.<sup>29</sup>

The tax code does permit the deduction from taxable income of other forest management expenses in the year they were incurred. These include real property taxes and interest paid to carry a debt on the forestland. This deduction may be taken even if there was no timber income realized in the tax year.<sup>30</sup>

#### **Other General Tax Provisions:**

Prior Federal income tax law allowed the investor to shift a portion of the costs of land development to other taxpayers. If the landowner does the development with his or her own equipment, investment tax credits and accelerated depreciation provisions could be taken on the equipment used in the development process. For example, the cost of depreciable improvements such as drain tiles could also be recovered under the tax system through accelerated depreciation. Such deductions translated into reduced taxable income and raised the after-tax rate of return on such investments. The Tax Reform Act repealed the investment tax credit and modified the depreciation schedules for agricultural structures.

Land development may also have been a means of lowering the tax rate on income to the more favorable capital gains tax rate. Returns on investment funds are generally subject to ordinary income tax rates. However, if the investment funds were devoted to purchase and development of land for agriculture, upon sale of the land the increased value of the land was subject to the more favorable capital gains tax treatment. Such attempts to convert ordinary income into capital gains may have been an integral element in "tax-loss farming" strategies. However, tax reform eliminated capital gains treatment altogether.

Under prior law, costs for land clearing and drainage equipment used in development of farmland could be deducted from gross income, as could costs for equipment necessary to conduct farming activities. This could be done in lieu of using other land conversion provisions. Deductions were based on application of the selected depreciation schedule and the ten percent investment tax credit. Depreciation on equipment to accomplish wetland conversion is still deductible under the Tax Reform Act.

Interest payments on loans used to finance conversion can be deducted from taxable income; tax reform did not change this. This provision lowers the costs of conversion, creating an incentive to develop more land than might otherwise be the case.

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<sup>29</sup> The implications for wetlands of the elimination of capital gains tax treatment for silviculture are not entirely clear. On its face, reducing a tax advantage for forestry development would seem to promote wetland conservation. But forested wetlands can sometimes be managed for forestry with less impact on wetlands than other kinds of development. If the elimination of capital gains tax treatment for forestry leads to increased sales of forested wetlands for development outside the forestry sector, less rather than more wetland conservation may ensue.

<sup>30</sup> An important deduction from income is the provision for the timber depletion allowance. The calculation of that allowance is based upon the establishment of a "unit depletion rate" which is subtracted from the unit sales price to establish the return to be subject to capital gains taxation. Establishment of the unit depletion rate occurs at the time the parcel is acquired. An appraisal is conducted to establish the number of timber units (e.g., thousand board feet, MBF) and market value of the stand standing on the tract. The market value of the tract is the basis in the trees, exclusive of the land, for tax purposes. By dividing total timber value by the number of units, a unit value is developed which is termed the unit depletion rate. Each time a unit is harvested, the depletion allowance is deducted from taxable income. Similarly, the basis left in the trees is also reduced. As long as the basis remaining in the trees is positive unit depletion deduction may continue to be taken. Since depletion reduces the basis the taxable capital stemming from sale of the tract rises. Addition to the basis in the trees is made whenever reforestation costs in excess of allowable deductions are incurred.

Finally, in Sec. 403 the Tax Reform Act specifically subjects the gains from sale of "converted wetlands" to ordinary income taxation rather than to capital gains tax treatment.<sup>31</sup> This was done as a precaution, i.e., in the event that preferential tax treatment of capital gains is reinstated in the future, such preferential treatment will not automatically be extended to wetlands converted to agriculture. However, Sec. 403 does not apply to wetlands converted for any other purpose.

## **Federal Aid Highway Program**

The Federal Aid Highway Program (FAHP) is one of the largest Federal construction grant programs. Administered by the Federal Highway Administration (FHWA), the FAHP is financed through the Highway Trust Fund (HTF). The HTF is funded through taxes on gasoline, tires, truck and trailer sales, as well as heavy vehicle user fees. The FAHP is mainly a contract authority program whose funding from the HTF is authorized by Congress for a given year. Authorized funds are apportioned by formula<sup>32</sup> to the states and can be obligated for two to four year periods. States must plan highways in accordance with the FAHP regulations to qualify for funding, but are otherwise free to determine state-wide priorities.

Highway programs have affected wetlands directly and indirectly. Direct wetland losses sometimes occur during construction. Highways may affect wetlands indirectly by providing a general incentive for development in an area. A persistent problem, particularly in the Upper Midwest and the Southeast, has been the unauthorized drainage of wetlands into adjacent highway rights-of-way.

While certain procedural safeguards to protect wetlands are built into the Federal program, the effectiveness of these has been the subject of some dispute. Principal among these have been Section 4(f) of the Department of Transportation Statute (49 USC 1653:(f)) and Section 1.23 of FHWA regulations (23 CFR 1.23). Under certain conditions Section 4(f) protects significant and publicly owned recreation areas, wildlife and waterfowl refuges and parks against new highway development. The major limitation of this section is that it does not apply to privately held lands or public lands not classified as above. Section 1.23 of FHWA regulations prohibits encroachments (like private drainage ditches) into highway rights-of-way unless the Administrator makes a public interest finding. No such finding has ever been made, but encroachments remain and continue to occur. This problem persists because of the difficulty of enforcement, the political sensitivity of enforcement, and ineffectual penalties for violating the rights-of-way.

Another problem involving the program is that the Service frequently has little or no involvement in the development of plans for federally aided roads or highways until State agencies apply to the Corps for 404 permits. Thus, opportunities are foregone to alert State highway planners to the presence of wetlands and other environmentally sensitive resources and advise them about avoiding adverse project effects. With participation by the Service coming late in the planning period, options for changing the design of projects are often foreclosed or limited.

## **Conservation Easement and Wetlands Protection Programs**

There are several Federal programs that are used to protect wetlands. One of the major preservation programs is the FWS's Small Wetlands Acquisition Program (SWAP), which focuses on waterfowl habitat in the Prairies. Under this program the FWS can either purchase a wetland and surrounding upland area outright, or enter into a perpetual easement agreement.

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<sup>31</sup> Converted wetland is defined as land drained for purpose of agricultural production.

<sup>32</sup> The formulas vary depending on the type of road (interstate, primary, secondary) but in general are based on population and some measure of road mileage.

which places restrictions on the wetlands. In the case of an outright fee purchase, the FWS buys the land at the current market value. This valuation is performed by examining recent land sales where land sold contained wetlands. When purchasing a wetlands area, the FWS seeks to obtain a ratio of 2:1 upland to wetland.

In the case of an easement purchase, the landowner gives up rights and responsibilities to drain, fill, burn, or level the wetland. All other ownership rights and responsibilities remain. Uplands are not restricted with a FWS lease as in the purchase. Easement payments are made on a one time, lump sum basis, with the payment varying according to land values in the immediate area and the development potential of the wetlands.

A second important preservation program is administered through the ASCS's Federal Water Bank Program (WBP). Under this program, wetland owners enter an agreement with the ASCS promising not to drain, burn, fill, level, or use the wetland for a 10 year period. In exchange, the landowner receives an annual payment designed to reflect local real estate values. If the land is also under a FWS agreement, the annual payment is reduced by 20 percent. When accepting an area into the program, ASCS tries to maintain a 3:1 or 4:1 ratio of uplands to wetlands.

Although the SWAP and WBP are similar, they do provide different types and degrees of protection. WBP agreements extend protection to and require conservation measures on adjacent upland habitat. FWS easements cover only wetlands. Under FWS easements, landowners may graze, hay, or crop the wetland basin when it is naturally dry enough. These practices are not allowed under the WBP. FWS easements are permanent, however. WBP agreements afford only ten years of protection, and there is some evidence that landowners enroll in the program when commodity prices are depressed and do not renew their agreements when the market recovers.

During FY 85 the FWS purchased 1,250 acres and brought under easement or lease an additional 11,755 acres of waterfowl production areas (Annual Report of Lands Under Control of US FWS 10/30/85 and 10/30/84). Water Bank has a nationwide appropriation of approximately \$8 million per year, much of which is committed to the Prairies. This funding level allows about 160,000 wetland acres and 350,000 adjacent upland acres to be enrolled in the program at any one time. Thus, the acreage protected by Water Bank is small relative to the developmental pressure and the annual amount of conversion.

There are several other statutes and other measures that may limit the impact of projects on wetlands:

- The Fish and Wildlife Coordination Act (16 U.S.C. 661, et seq.) requires consideration of impacts on habitat and mitigation of impacts on wetlands for most Federal water resource projects. While this Act comes into play with Federal dam construction and related flood control structures, the sponsoring agency is only mandated to consider FWS recommendations on mitigation. Further, mitigation is not a panacea. The techniques for creating and restoring wetlands are still experimental. Monitoring to determine the success of any mitigation efforts is very limited. Finally, if good faith mitigation efforts have not been successful, it is not clear from the statutes who, if anyone, is responsible for correcting the defects.

- The National Environmental Policy Act of 1969 (42 U.S.C. 4321-61) requires the preparation of an environmental impact statement for all major Federal actions significantly affecting the environment, and many Corps public works projects fit into this requirement.
- The Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-87) protects designated wild and scenic rivers segments from dam and other development, although it does not protect the entire river unless such protection is specified in the separate Congressional designation.

Appendix II-1 provides a more detailed discussion of the authorities available to the Service for protecting wetlands.

## APPENDIX II-1: Major Legislative and Administrative Authorities for Fish and Wildlife Service Wetlands Protection Activities

The primary authorities that the Fish and Wildlife Service (Service) works under to protect wetland resources, as well as other fish and wildlife resource values, include the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j), Fish and Wildlife Coordination Act (16 U.S.C. 661-666c), Migratory Bird Treaty Act (16 U.S.C. 703-711), Endangered Species Act (16 U.S.C. 1531-1543), National Environmental Policy Act (42 U.S.C. 4321-4347), Section 404 of the Clean Water Act of 1977 (91 Stat. 1566 and 33 U.S.C. 1344; 86 Stat. 884), River and Harbor Act (33 U.S.C. 403), Coastal Zone Management Act (16 U.S.C. 1451-1464), Coastal Barrier Resources Act of 1982 (16 U.S.C. 3501-3509), Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1009), Federal Power Act (16 U.S.C. 791a-825r), Food Security Act of 1985, Emergency Wetlands Resources Act of 1986, and Executive Orders 11990 and 11988.

Under all but three of these authorities, the Service has only review, comment, special study and/or reporting powers. The exceptions are the Migratory Bird Treaty Act and Endangered Species Act, where the Service has regulatory authority, and the Fish and Wildlife Act of 1956, where the Service has responsibility for developing policy and procedures relating to fish and wildlife.

The acquisition of lands (either through purchase or donation), especially wetlands, for inclusion in the National Wildlife Refuge System is authorized by legislation such as the Migratory Bird Conservation Act (16 U.S.C. 715-715d), Endangered Species Act, Fish and Wildlife Act of 1956 and Fish and Wildlife Coordination Act. Funding for acquisition of refuge lands (including waterfowl production areas) is authorized by the Migratory Bird Hunting and Conservation Stamp Act (16 U.S.C. 718-718h), Wetlands Loan Act (16 U.S.C. 715), and Land and Water Conservation Fund Act of 1965 (16 U.S.C. 460).

### Legislative Authorities

The *Fish and Wildlife Act* of 1956 authorizes the development and distribution of fish and wildlife information to the public, Congress and the President, and the development of policies and procedures that are necessary and desirable to carry out the laws relating to fish and wildlife. This act gives broad authority to the Secretary of the Interior (Secretary) to take such steps as "may be required for the development, advancement, management, conservation and protection" of fish and wildlife resources. The Secretary, in a required annual report to Congress, may make recommendations for additional legislation. The strength of this authority is that it provides the Service, through the Department of the Interior (Department), with an avenue for developing new policy and making recommendations for new legislation that could be used to improve Federal wetland protection alternatives.

The *Fish and Wildlife Coordination Act* (Coordination Act) authorizes the Service to investigate and report on Federal water resource development projects and non-Federal actions requiring a Federal permit or license.<sup>1</sup> This Act specifies that fish and wildlife conservation shall receive equal consideration with other project purposes. This authority requires that a Federal agency consult with the Service and State fish and wildlife agency concerning the effects on fish and wildlife resources of a Federal water resource development project or non-Federal water development project requiring a permit or license. Federal agencies authorized to construct or operate water resource projects (primarily the Corps of Engineers and the Bureau of Reclamation) or approve permits and licenses for non-federal projects (primarily the Corps and the

<sup>1</sup> The Tennessee Valley Authority is specifically exempted under this act.

Federal Energy Regulatory Commission) are required to give full consideration to the Coordination Act report and recommendations of the Secretary. However, action agencies may make determinations that do not result in adoption of the Service's recommendations. Also, Congress may not authorize certain project features benefiting fish and wildlife resources. Consequently, wetland resources may not receive full protection for all project, permit, or license actions.

The *Migratory Bird Treaty Act* (Treaty Act) authorizes the Service to preserve, distribute, introduce and restore migratory and gamebird populations. This authority gives the Service, through the Secretary, broad Federal responsibility including regulatory authority to protect migratory birds. The U.S. has negotiated migratory bird treaties with Japan and the Union of Soviet Socialist Republics that contain provisions committing the parties to protect migratory bird habitats. However, these treaties by themselves do not provide the legal authority to implement these agreements, because they are not self-executing. Authority for implementing the treaties is limited to the provisions of the Treaty Act and, in the case of the Soviet treaty, section 3(h)(2) and (3) of the Fish and Wildlife Improvement Act of 1978, 16 U.S.C. 712, and the Migratory Bird Conservation Act, 16 U.S.C. 715-715r. The Treaty Act focuses primarily on preventing the unlawful taking, killing or possession of migratory birds, and does not contain habitat provisions that provide the Department with explicit authority to protect wetland habitats crucial to migratory birds. Most recently concern over the applicability of the criminal sanctions in the Treaty Act to Federal employees was a factor in the decision to close the Kesterson National Wildlife Refuge because of bird losses associated with contaminated agricultural drainage water.

The principal purposes of the *Endangered Species Act* are the conservation of threatened and endangered species and the ecosystems on which they depend. This is one of the stronger authorities the Service works under to protect fish and wildlife resources, including wetland habitats for listed species. The Service has regulatory authority to prohibit unauthorized taking and possession of endangered species. Section 7 of the Act requires Federal agencies to utilize their authorities to carry out programs for the conservation of endangered and threatened species. Section 7 also requires Federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of its designated critical habitat, and to consult with the Service in carrying out this responsibility.

The *National Environmental Policy Act* (NEPA) requires that the responsible Federal official for a major Federal action shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or expertise with respect to any environmental impact involved. NEPA requires that Federal agencies provide detailed environmental statements on the environment of, the expected environmental impacts of, and the alternatives to a proposed action. NEPA documents make the positive and negative aspects of a proposed action available for public and agency scrutiny and comment. However, agencies having authority to implement or approve projects need not adopt Service recommendations to protect wetland resources or mitigate adverse impacts stemming from a proposed project.

*Section 404 of the Clean Water Act* of 1977 authorizes the Corps to issue permits for the discharge of dredged or fill material into waters of the United States. Dredging activities without the associated placement of fill, vegetative clearing and several specifically exempted activities, as provided for in Section 404(f), are not covered under this authority. The Service provides comments and recommendations on Section 404 public notices under the authority of the Coordination Act. The Corps' Section 404 program is the only Federal program influencing the use of wetland resources in many areas of the country. The Section 404 program provides the Service with broad opportunities to protect wetland resources through consultation with the Corps during the review of permits. A primary purpose of this authority is to protect, restore and/or improve the quality of our Nation's water resources, especially by protecting wetlands and associated resources.

Section 404 of the Act appears to provide considerable protection to nationwide aquatic and wetland resources. However, for several reasons the level of protection is limited. The Act restricts the type of activities that can be regulated to the discharge onto wetlands of dredged or fill material. Wetlands can be altered in many other ways, e.g., excavation, drainage, clearing, or flooding. The result of restricting regulation to the discharge of dredged or fill material is to leave about 80% of the Nation's wetland losses uncovered by the Section 404 program (Congressional Research Service 1982). In addition to the legislative constraints on 404, the program's effectiveness is also influenced by the magnitude of the regulatory problem relative to the Corps' resources and the manner in which some Corps districts implement the Act (e.g., low priority given to monitoring and enforcement). Problems associated with the Corps' Section 404 program have been addressed at hearings held by the Senate Subcommittee on Environmental Pollution. The November, 1985, 404(q) Memorandum of Agreement between the Department of the Army and the Department of the Interior has resulted in more cordial relations between the Corps and the Service, but it is unclear whether the procedural changes effected by the MOA will increase the protection of wetlands.

*Section 10 of the River and Harbor Act* prohibits the unauthorized obstruction or the alteration of navigable waters by fills or construction of outfalls, piers, levees, etc. or work such as dredging without a permit from the Corps. Under the authority of the Coordination Act, the Service comments on public notices circulated by the Corps for such activities. The Section 10 authority is generally limited to coastal navigable waters and inland waterways, i.e., waters in which the transport of commerce occurs or occurred historically. The Service is generally satisfied with the level of protection afforded wetlands associated with navigable waters under this authority.

The *Coastal Zone Management Act* declares a national interest in the effective management, beneficial use, protection and development of the coastal zone. This act makes Federal funds available to encourage States to develop comprehensive management programs, in cooperation with Federal and local governments. State participation is voluntary. The Secretary of Commerce is required to obtain and give adequate consideration to the Service's views about fish and wildlife resources before approval of State Coastal Zone Management Plans. Opportunities for wetland protection are limited to the narrow, but ecologically important coastal zone. This Act fosters coordinated land and water use planning in the coastal zone to protect important coastal resource values. Overall, this effort has resulted in increased protection of coastal wetland resources.

The *Coastal Barrier Resources Act* established a network of 186 units within 15 states along the Atlantic and Gulf coasts, within which most Federal expenditures are no longer available. There are certain exceptions to the general prohibition. However, even in the case of the exceptions Federal agencies must consult with the Service and allow the Service the opportunity for written comment concerning fish and wildlife resource impacts associated with coastal barrier development prior to making Federal funds or financial assistance available.

The *Watershed Protection and Flood Prevention Act* authorizes the Service to make surveys and investigations and prepare a report for the conservation of wildlife resources on Soil Conservation Service small watershed projects. The Secretary of Agriculture is required to obtain the views and recommendations of the Department/Service prior to authorizing a project. This authority provides the Service with an opportunity to make recommendations to protect wetlands at proposed small watershed project sites. Wetland protection under this authority would increase if the Soil Conservation Service, as part of their wetland protection policy, used the Service's 1979 wetland classification system for making wetland determinations. The Soil Conservation Service currently utilizes Circular 39, an obsolete Service wetland classification system, for making wetland determinations.

The *Federal Power Act*, as amended, provides for cooperation between the Federal Energy Regulatory Commission and other Federal agencies in the investigation of proposed power projects, and for other agencies to provide information to the Commission upon request. Section 4(e) of the Act requires acceptance of the Secretary of the Interior's mandatory terms and conditions to protect any Federal reservation<sup>2</sup> occupied by a project; Section 18 requires acceptance of the Secretary's fishway prescriptions; and Section 30(c) requires acceptance of the Service's terms and conditions for exemptions from licensing.

In 1986 the Federal Power Act was amended by the *Electric Consumers Protection Act (ECPA)*. The ECPA provides that the Federal Energy Regulatory Commission (Commission) give equal consideration to the protection, mitigation of damage to, and enhancement of fish and wildlife. It further requires that each license issued by the Commission include conditions for the protection, mitigation, and enhancement of fish and wildlife resources based on recommendations provided by the Fish and Wildlife Service pursuant to the Fish and Wildlife Coordination Act. Under the amendments to the Act, the Commission is not required to include the Service's recommendations if it determines they are inconsistent with the purposes and requirements of the Act or other applicable law. Consequently, wetland resources may not receive adequate protection for all license actions.

The *Food Security Act* of 1985 (Farm Bill) encourages removal of fragile lands from production and provides various opportunities for wetland habitat protection and restoration while reducing Federal subsidy costs. A special wetland conservation provision, commonly called Swampbuster, removes some of the incentives for developing wetlands by eliminating most agricultural subsidies to persons who produce commodities on wetlands converted after enactment. Under the Farm Debt Restructure provision, wetlands on private lands may be set aside and managed for fish and wildlife resources for at least 50 years, in exchange for debt relief to the landowner. Wetlands interspersed with highly erodible lands may be set aside for a period of 10 years under the Conservation Reserve Program. States and conservation organizations may obtain easements on wetlands and other habitats on Farmers Home Administration (FmHA) inventory lands (foreclosed lands) prior to resale under Section 1314 of the Farm Bill. The Service is continuing to work with the Department of Agriculture on implementation of provisions of the Farm Bill in order to increase opportunities for wetland protection and enhancement.

The *Emergency Wetlands Resources Act* (Wetlands Act) was enacted in 1986 to promote the Conservation of our Nation's wetlands in order to maintain the public benefits they provide. The intent was to intensify cooperative and acquisition efforts among private interests and local, State and Federal governments for the protection, management and conservation of wetlands. The Wetlands Act contains a broad variety of measures available to the Department to promote wetland conservation and to offset or prevent wetland losses. These include new options for generating revenues for acquisition and protection of wetlands, establishing a National Wetlands Priority Conservation Plan for wetland acquisition, requiring that Statewide Comprehensive Outdoor Recreation Plans specifically address wetlands, completing the mapping of the Nation's wetlands, and studying the effects of Federal programs on wetlands.

## Administrative Authorities

*Executive Order 11990 - Protection of Wetlands.* This Executive Order directs each Federal agency to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values in carrying out agency responsibilities.

<sup>2</sup> Reservations include such lands as Indian reservations, wildlife refuges, reclamation projects, acquired lands held for public purposes, and public lands withdrawn, reserved or withheld from private appropriation and disposal.

*Executive Order 11988 - Floodplain Management.* This executive order directs Federal agencies to take floodplain management into account when formulating or evaluating water or land use plans. The Floodplain Management Executive Order is applicable because of the strong interrelationship between wetlands and floodplains.

An executive order represents administrative policy and does not have the force of law that comes with delegation of authority by Congress. In particular, there is no right of private action (judicial recourse) under an executive order. These executive orders reinforce legislative authorities by directing Federal agencies to exercise leadership and take action to avoid, to the extent possible, the long-and short-term adverse impacts associated with the occupancy and modification of wetlands and floodplains. The purpose of the executive orders is to reduce the loss of life and property due to floods and to diminish environmental damage due to imprudent planning and development. Most Federal agencies have promulgated regulations implementing these executive orders.<sup>3</sup> No quantified information is available to indicate how effective these executive orders have been in reducing wetland losses.

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<sup>3</sup> Although there is no right of private action under an executive order, usually judicial recourse is available if an agency has promulgated regulations to implement an executive order.

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## CONVERSION OF FORESTED WETLANDS OF THE MISSISSIPPI DELTA

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The 5.2 million acre bottomland hardwood forest of the Lower Mississippi Alluvial Plain, commonly called the Delta, contains many of the remaining prime bottomland hardwood sites in the United States. The Delta extends 600 miles from the confluence of the Mississippi and Ohio Rivers at Cairo, Illinois to New Orleans, and encompasses a total of 26 million acres in seven states. These bottomland hardwoods are among the Nation's most important wetlands. They are prime overwintering grounds for many North American waterfowl, including 2.5 million of the 3 million mallards of the Mississippi Flyway, nearly all of the 4 million wood ducks and many other migratory birds. Numerous finfishes depend on the flooded hardwoods for spawning and nursery grounds. These wetlands support many other species of wildlife, including deer, squirrel, raccoon, mink, beaver, fox and rabbit. They also play a vital role in reducing flooding problems by temporarily storing large quantities of water and by slowing the velocity of flood waters. In the process, these wetlands remove chemicals such as fertilizers and pesticides from the water, trap soil eroding from nearby farmlands, and recharge ground water supplies.

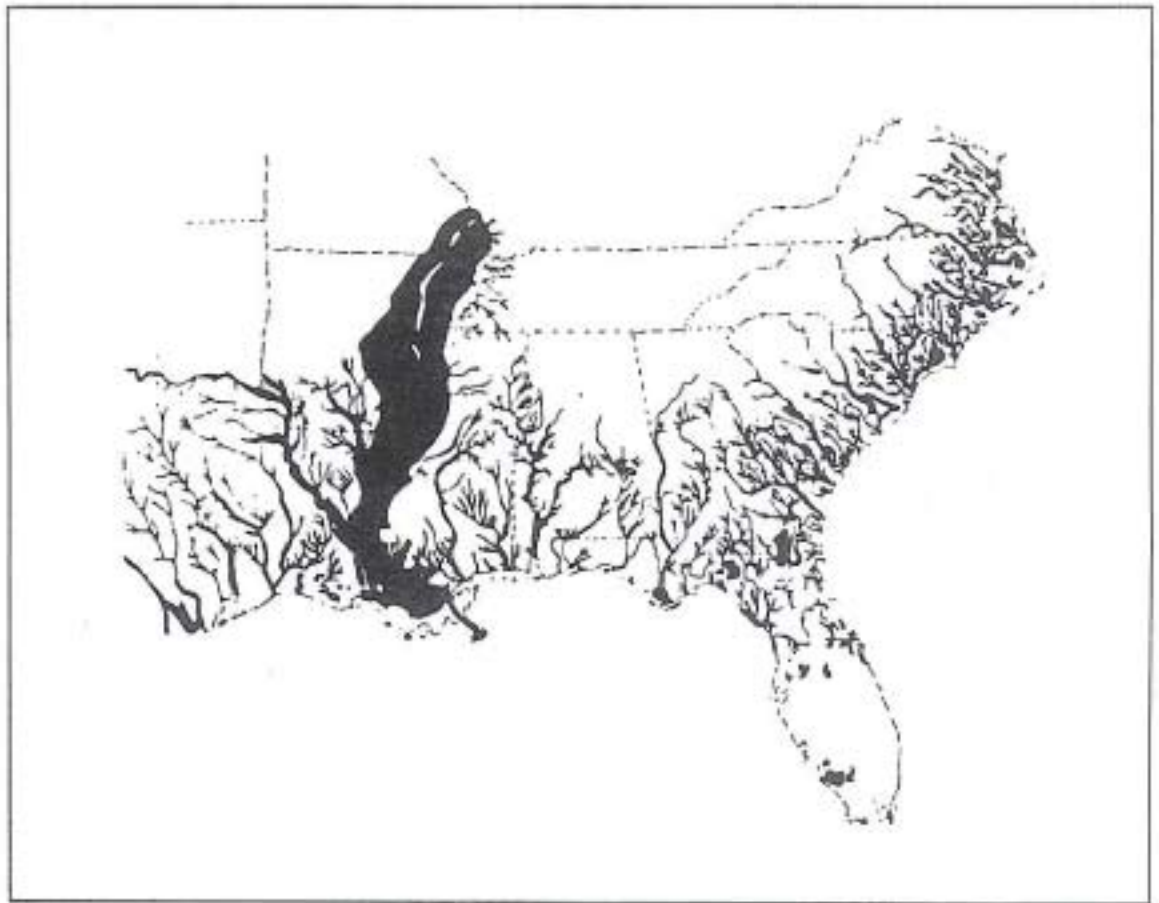
In addition to being one of the most important wetland resource in the U.S., the Delta is also one of the most seriously depleted and threatened. While nationwide wetland losses have reached the order of 50 percent, in the bottomland hardwood region of the lower Mississippi some 80 percent of the original wetlands have been lost. Originally, the Delta included nearly 24 million acres of bottomland hardwood forested wetlands. By 1937, however, only 11.8 million acres (about 50 percent) remained. Since that time, another 6.5 million acres of hardwood forests in the Delta have been cleared. Today, there are less than 5.2 million acres left, approximately 20 percent of the original acreage.

During the post-war period, wetland losses have occurred in the Delta at three times the national average rate. An estimated 2 percent of the remaining bottomland forests are lost annually. A 1982 study by the National Research Council predicted that the most extensive losses of wetlands in the nation through the remainder of the century will be within this same region, with another 1.5 million acres being lost by 1995.

This chapter examines the causes of the rapid rate of wetland depletion in the Delta, and estimates the extent to which Federal programs have played a role in that depletion.

### **The History of Development in the Delta and the Federal Involvement**

Historically, most lands in the Delta were subject to frequent flooding from the Mississippi River and the Alluvial Valley tributaries. This frequent flooding together with the naturally poor drainage characteristics of the relatively flat alluvial soils subject to an average rainfall in excess of 50 inches per year combined to produce land with a high soil moisture content. These conditions are tolerable only by hydrophytic vegetation, the vegetation typical of bottomland hardwood ecosystems. Owners of these wetlands can harvest timber without substantially altering the nature of the land, but the frequent floods and high soil moisture create conditions hostile to agricultural development. Sustained cultivation of this area is impossible without the provision of flood control and drainage.



**FIGURE III-1: THE DELTA AND THE RIVERS AND SWAMPS OF THE SOUTHEASTERN UNITED STATES**

The history of change and development in the Delta has been marked by the construction of numerous flood control, drainage, and small watershed projects and the clearing and draining of substantial acreage for agriculture. Regional settlement began with passage of the Swamp Lands Acts of 1849 and 1850, under which Federal ownership of over 20 million acres of swamp lands was deeded to the States. These acts provided for the States to sell the lands and use the proceeds for reclamation. Extensive settlement ensued, along with widespread but generally uncoordinated local drainage projects. Long term flood protection failed to materialize.

Prompted by major floods in 1912, 1913, 1916, and especially 1927, Congress passed the Flood Control Act of 1928, initiating a direct Federal role in flood control in the Delta. The objective of the 1928 Act was to protect existing development in the Delta from catastrophic flooding. Specifically, the Act authorized construction of the Mississippi River and Tributaries Project (MR&T) by the Corps of Engineers. The Flood Control Act of 1944 added authority for construction of drainage projects, and brought a shift in the emphasis of the Federal program from one of catastrophic flood protection to one of tributary flood control and drainage for the purpose of agricultural expansion and intensification. The SCS became directly involved in the development of flood control and drainage projects in the Delta when Congress passed P.L. 566, the Watershed Protection and Flood Prevention Act of 1954. The objective of P.L.566 reflected the changed Federal role: promoting agricultural intensification in the Delta, including both improved yields on existing farmland and clearing of forested wetlands.

With these three acts, the Federal Government assumed the primary responsibility for flood control and drainage in the Delta. It has exercised this responsibility through the civil works program of the Corps and to a lesser extent through the P.L. 566 program of the SCS. Protection from Mississippi River flooding has been provided by the Mainstem Features of the MR&T Project, consisting primarily of the mainline levees and channel improvements. Tributary flood control and drainage has been conducted through numerous Corps projects, referred to collectively as the Tributary Features of the MR&T Project. The SCS projects have been smaller in scale, and designed to augment the flood control and drainage benefits provided by the larger system of Corps projects. Concomitant with the implementation of these Federal programs, there has been extensive clearing, leaving less than half of the forested acreage from 1937 standing today.

Ninety-six percent of the cleared land has been devoted to agriculture. Until the mid-1950's, cotton and corn were the primary crops raised on former bottomland forests, but since then, soybeans have been the dominant crop. In 1977, cropland acreage in soybeans amounted to more than the combined acreage of the four other principal crops - cotton, wheat, rice and corn. Soybeans have major advantages over the other crops: (1) they have a shorter growing season, so they can be planted in areas that are flooded until late June, and (2) they can be planted in a variety of soil conditions. Other crops, like cotton, require better drained soils than soybeans or rice. Heavy foreign demand helped make soybeans the most lucrative cash crop. Although the demand for exports has subsided somewhat, soybeans remain the most profitable crop. Traditionally, natural stands of bottomland hardwood forests were cut for timber, and recently, in an effort to increase timber production, cottonwood and other silviculture plantations have been established to a limited extent. However, the economics of hardwood production is such that forestry has a difficult time competing with agriculture on lands where farm crops can be cultivated.

In addition to the flood control and drainage programs, the profitability of agriculture has been influenced by agriculture programs and tax code provisions. There is a broad range of Federal programs designed to assist farmers by raising incomes, lowering costs, or reducing risks. Notable among these are the price support, loan and storage programs; below market rate loans; technical assistance; and crop and disaster insurance. In addition to the programs operated by the USDA, certain provisions of the tax code have served to shift some of the costs of converting wetlands for agricultural purposes to the general taxpayer.

The fact that a variety of Federal programs operated during a period in which there were significant losses in the bottomland hardwoods is insufficient evidence to conclude that these programs were responsible for the clearing and conversion of the wetlands or that they will continue to effect such change in the future. There are numerous forces, both governmental and nongovernmental, operating in the Delta which can affect the decisions which landowners make about the use of wetlands. Although the general consensus among authors of previous studies of this issue is that the Federal flood control and drainage projects were the dominant factor inducing conversion of the wetlands, agreement among the authors is not unanimous. Some researchers have argued that although the flood control projects were installed during the same 50-year period that development encroached most heavily on the hardwoods, most of this development would have occurred anyway, prompted by favorable economic conditions in the form of rising real agricultural prices. Similarly, the degree to which agricultural price and income support programs have influenced the clearing has been called into question: soybeans have been the dominant crop in the bottomlands since the mid-50's, but few soybean farmers have participated in the price support program, because the market price for soybeans has exceeded the support price. Previous empirical research on wetland conversion has been limited, however, and not of a caliber to provide reliable estimates of the magnitude and relative import of the various factors involved. Nonetheless, the history of development in the region suggests that the programs cited (flood control, drainage, and small watershed projects; agricultural assistance; and tax incentives) are the prime candidates to consider in determining the extent of Federal influence on wetland conversion.

## The Conceptual Framework for the Conversion Decision

The decision to convert wetlands into farmland is essentially an investment decision by the landowner in an attempt to maximize his long-term economic return from the activities conducted on the land. In its natural state, the land can be managed for its timber value and, in some instances, can be leased for recreational hunting. Cleared, leveled, and drained, the land can be cultivated. The decision to incur the conversion costs depends upon the expected earnings from the alternative uses of the land.

A landowner seeking to increase his income from the land would compare the net income expected over the years from conversion with the net income expected from timber production and hunting. In making this comparison, he would recognize the effects of interest payments that he could make or receive, expressing the comparison in terms of present value.<sup>1</sup> The greater the net gain from the conversion, the more likely it will be that landowners will make conversion investments.

A mathematical way to express the gain from conversion is the following equation:

$$G = -K + \sum_{t=1}^Y (P_t Q_t - C_t - T_t)(1+r)^{-t} + V(1+r)^{-Y} \quad (3.1)$$

where  $G$  = the net income gain if the land is converted;

$K$  = cost of conversion;

$Y$  = landowner's planning horizon in years;

$P_t$  = expected crop prices;

$Q_t$  = expected production of crops;

$C_t$  = expected agricultural production costs;

$T_t$  = expected value of foregone timber production and leasing of environmental amenities (primarily hunting); and

$V$  = difference in sale value between agricultural land and forested wetland in year  $Y$ .

Equation 3.1 compares the investment cost with the present value of the net returns from i) cultivating the land less ii) the present value of the foregone income from timbering and any recreational amenities plus iii) the present value of the differential land values at the time of sale.

Because agriculture is risky, landowners may not be willing to undertake a conversion investment that is expected merely to break even. Because of the possibility of incurring losses either in the conversion investment or in the costs of putting in a crop, such risk-averse landowners would require that the gains exceed a threshold amount, often referred to as a risk premium.

Federal programs and policies can alter the variables in the land-conversion decision in a number of significant ways: they can increase the expected net income from alternative uses of the land, lower the risk premium, reduce the cost of conversion, and change land values. In particular, by reducing the incidence of flooding and changing the hydrologic characteristics of the land, Federal flood control and drainage projects can increase the probability of successful crop production (increase the expected value of  $P_t Q_t$ ) and reduce the risk premium. These projects make the land drier and lengthen the growing season; as a result, yields ( $Q_t$ ) tend to

<sup>1</sup> When the interest rate is  $r$ , the present value of an amount ( $P$ ) which is to be paid a number of years ( $t$ ) in the future is  $(P)/(1+r)^t$ .

increase and a more lucrative crop mix can be cultivated. Taken together, these effects increase the value of farmland in the protected area (thereby increasing V). Further, the drier conditions may make it cheaper to clear and level the land, and may allow the landowner to get by with a less elaborate drainage system (both of which would reduce K). All these effects tend to improve the gains from converting forested wetlands to agricultural land. Finally, it is worth recalling that the flood control and drainage projects are largely Federally funded, and hence, any benefits to landowners are gained through a subsidy.

The agricultural assistance programs have similar effects. The price and income support and crop insurance programs tend to increase farm revenues and reduce risk. The technical assistance programs can reduce production and conversion costs and perhaps improve yields. And, at least historically, below market rate loans have been available for planting, harvesting, and capital improvements. Until the Swampbuster provisions of the Food Security Act of 1985 were enacted, all of these effects increased the incentive to convert forested wetlands.

The direction of the impact of tax code provisions is not quite so clear.<sup>2</sup> Prior to tax reform in 1986, the tax code provided for expensing of some conversion costs, costs which normally one would expect would have to be capitalized in the land basis. These expensing provisions reduce the cost of conversion to landowners. However, there are some provisions of the tax code which enhance the value of forestry uses. The net effect of these two sets of provisions on the land-conversion decision is not immediately apparent.

Finally, the wetland conservation programs operated by the FWS and the ASCS can increase the opportunity cost (increase T<sub>1</sub>) and reduce the rate of return associated with converting wetlands.

Thus, it is apparent that Federal programs have had and, in many cases, still have the potential to significantly affect land conversion in the Delta. The degree to which they have actually affected conversion is the subject of the rest of this chapter.

## The Methodology for Estimating the Impact of Federal Programs

The Department used two distinct approaches to estimate the impact of Federal programs on the conversion of forested wetlands in the Delta: (1) an econometric model and (2) a cash-flow simulation model.

An econometric model is a mathematical way to determine and express the extent to which each of a variety of possible causes affects the variable of interest, e.g., how flood control affects conversion of wetlands. An econometric model uses statistical techniques to determine the extent to which variations in the data measuring the potential causes are correlated with variations in the data measuring the effect. In this case, a model was developed to test the statistical relationship between changes in the acreage of forested wetlands in the Delta during the 50-year period 1935-1984 and the various conditions, policies and programs that, in concept, may have affected decisions to convert wetlands (Stavins 1986a). The econometric model was structured within the context of the preceding discussion of rational landowner behavior. That is, the model was designed to reflect the assumption that landowners attempt to maximize the expected return from their land and that the decision to clear the land is influenced by those variables which affect the rate of return from alternative uses of the land.

This was an ambitious effort. No previous research of these dimensions had been conducted of the factors affecting depletion of the bottomland hardwoods. The study was made possible by the existence of rich data sets, published by the U.S. Forest Service, the U.S. Department of Commerce, and State Crop and Livestock Reporting Services. These data provided estimates of changes in forested acreage, at the county level, in 36 Delta counties, at five-year intervals, over the 50-year period.

<sup>2</sup> Taxes have been omitted from equation (1) in order to keep the presentation simple.

The econometric model was designed to examine the impact which only one of the Federal programs of interest had on conversion of the hardwoods: Federal flood control and drainage projects. The model could have been structured to permit an examination of the impact of individual agriculture programs, conservation programs, and tax code provisions, as well. However, a preferable approach was available to estimate the effects which these Federal programs had on wetlands in the Delta. A farm-level, cash-flow model was developed which simulates the rate of return associated with converting bottomland hardwoods to farmland under specified public policies (Kramer and Shabman 1986). The model has the flexibility to test the impact which changes in the design of these public policies have on the profitability of conversion. Simulations were conducted for four different situations, reflecting differing ownership patterns, crop mixes, and soil characteristics in the Delta. Interpretation of the simulation results was supplemented and enhanced by an analysis of data describing the ownership of bottomland forests and Delta cropland. Different owners face different constraints and have different motivations for developing bottomland forests. Therefore, in a given policy and economic climate the likelihood that land will be converted depends on the characteristics of the landowners.

In the following sections of this chapter, both approaches are discussed in more detail together with the results of the analyses.

## Econometric Model of Forested Wetland Conversion

The model of forested wetland conversion is based on a land-conversion relationship similar in concept to equation 3.1 above. The full model, complete with mathematical detail, is described in Appendix III-1. Only an explanatory discussion is given here.

The land-conversion equation shows how the percentage change in the forested acreage which occurred in each county during each five-year interval is explained by the data measuring the relevant climatic, hydrologic, and economic variables. Statistical techniques were used to derive the coefficients for each of the explanatory variables from the data. Once the coefficients of the equation were determined, the equation was used to assess the impact of changes in each explanatory variable on changes in forested wetlands.

The explanatory variables in the land-conversion equation include:

- the economic variables which affect net agricultural revenue (prices, yields, acreages, and production costs for four crops -- soybeans, cotton, rice, and corn);
- the economic variables which affect forestry net revenue (prices, volumes, growth rates, and yields of sawlogs and pulpwood);
- the amount of land protected by Federal flood protection and drainage projects built between 1935 and 1984 (essentially the Tributary Features of the MR&T and SCS small watershed projects);
- variables measuring the extent of natural flood protection and drainage, the protection provided by the mainline levee system, and weather conditions (precipitation, solar radiation, and flood stages of the Mississippi River); and
- the costs of converting forested wetlands to farmland.

The econometric model was used to assess the relative importance of the various factors which affected wetland conversion in the Delta during the study period, 1935-1984. In order to interpret the statistical results properly, it is important to keep in mind that the model has not been structured haphazardly. That is, it is not simply a correlation of 1) those variables which

are likely candidates for influencing depletion with 2) the observed changes in the forested wetlands. The model has been structured to reflect the underlying economic theory<sup>3</sup> and to test the validity of the following sequence of reasoning:

- that Federal flood control and drainage projects reduce the probability of flooding and make drainage of wetlands technically more feasible;
- that as a result of these changed hydrologic conditions, the likelihood of success in producing crops on converted wetlands increases;
- that as a consequence of this, the expected income from such land in agriculture increases relative to its income as forested wetland; and
- that the extent of wetland conversion depends upon the expected economic return from conversion.

This chain of reasoning describes a causal linkage through which the construction of Federal projects might systematically lead to increased conversion of wetlands to alternative uses. The model was developed to test the validity of the hypothesized sequence of events. In the next two sections the specific hypotheses which were tested are presented and the data used to estimate the model are discussed.

## Hypotheses Tested with the Econometric Model

The principal questions addressed with the econometric model were:

- Did Federal flood protection and drainage projects systematically increase the rate of conversion of forested wetlands to agricultural cropland in the Delta during the period 1935-1984?
- If these Federal projects encouraged conversion of forested wetlands to agricultural uses, what was the magnitude of this impact? In other words, what share of the total depletion of forested wetlands in the Delta during the study period can be attributed to the construction and operation of Federal flood control and drainage projects?
- What share of the total depletion of these forested wetlands can be attributed to other economic, hydrologic, and climatic factors? Of paramount interest here is the share of total depletion that can be attributed exclusively to increasing real agricultural prices.

## The Nature of the Data Used to Estimate the Econometric Model

A very substantial body of data was used to develop the econometric model. A detailed discussion of all the data can be found in the background study (Stavins 1986a). However, an explanation of the nature and sources of data on the most important variables provides some insight into the extent and completeness of the research.

*Study Area and Sample Time Frame:* The sample area was limited to portions of the Alluvial Plain within three states: Arkansas, Louisiana and Mississippi. These three states account for approximately 90 percent of the total area of the Delta, and roughly 90 percent of the Federal projects constructed during the sample time period (1935-1984) occurred within them. Data on forested acreage were available for the entire Delta, but because other data were incomplete, the study area was reduced to 36 counties which lie wholly within the Delta (the floodplain) in the three major states (Table III-1 and Figure III-2). These 36 counties comprise 13 million acres, about 54 percent of the total area of the Delta. The Department believes that the study results were neither biased nor compromised in any way by restricting the study area, and further, that the study results are applicable to the entire Delta.

<sup>3</sup> For the discussion of the underlying economic theory, see the section entitled "The Conceptual Framework for the Conversion Decision."

**Forested Acreage:** The U.S. Forest Service (USFS) periodically measures land-use at sample sites, and estimates the share of the land which is forested in each surveyed county.<sup>4</sup> The USFS inventory is conducted approximately every 10 years, and the data published regularly in the USFS series of Survey Reports and Resource Bulletins. The very close relationship between changes in forested acreage per county and changes in agricultural acreage per county was utilized to develop estimates of forested acreage per county at five-year intervals over the 50-year study period. The path over time of the total forested acreage and the agricultural acreage for the four major crops for all 36 counties is given in Table III-2 and Figure III-3. The sources for the five-year agricultural data series were the U.S. Department of Commerce and State Crop and Livestock Reporting Services.

**Agricultural Revenue and Costs:** Agricultural revenue per acre for each county during each time period is one of the principal explanatory variables in the model. It takes account of prices, yields, and acreages for each crop. Table III-3 gives the annual acreage for each of the four major crops in the 36 counties. The sources for these data were the U.S. Census of Agriculture, State Crop and Livestock Reporting Services, numerous journal articles, and private communications with experienced researchers.

Agricultural production costs for each crop for each time period were estimated as averages of the costs reported in numerous State documents. The production cost variable accounts for both variable and fixed costs.

**Forestry Revenue:** Data for net forestry revenue per acre for each county during each time period came from State Forestry Commissions, the USDA, and numerous journal articles.

**TABLE III-1:** **STUDY AREA**  
**THIRTY-SIX INTERIOR COUNTIES**  
**LOWER MISSISSIPPI ALLUVIAL PLAIN**

<b>ARKANSAS</b>	<b>LOUISIANA</b>	<b>MISSISSIPPI</b>
Chicot	Concordia	Bolivar
Clay	East Carroll	Coahoma
Craighead	Franklin	Humphreys
Crittenden	Iberville	Issaquena
Cross	Madison	Leflore
Desha	Pointe Coupee	Quitman
Greene	Richland	Sharkey
Lee	St. Charles	Sunflower
Mississippi	St. James	Tunica
Phillips	St. John/Bapt.	Washington
Poinsett	Tensas	
St. Francis	West Baton Rouge	
Woodruff	West Carroll	

<sup>4</sup> Total forested acreage is used in this study, not bottomland hardwood wetland acreage. The two are very close in magnitude and highly correlated.



*Impact of Federal Flood Protection and Drainage Projects Constructed Between 1935 and 1984 (the Tributary Projects):* The "acreage protected" by projects was used as the primary measure of project impact. This "protected area" is defined to include the area which experiences at least some reduction in the extent and frequency of flooding as a result of project construction. The protected area is a proxy for a more complete measure of area affected plus the effectiveness of protection, i.e., the change in the probability of flooding in a particular area. Data to develop this latter measure for each county are not available.

The data for area protected by U.S. Army Corps of Engineers projects came from Corps documents and personal communications with Corps officials. SCS officials provided the corresponding information on SCS projects.

As discussed previously, the variables which account for the impact of these Federal projects are cumulative variables. They account for the *current* flood protection and drainage benefits provided by all *past* construction. They were structured in this way, because it is possible that current clearing might be influenced not just by construction of Federal projects in the present period, but by projects which were constructed in previous periods, as well. Thus, the model was designed to account for both current and delayed impacts of flood control and drainage projects.

The projects constructed between 1935 and 1984 are essentially the Tributary Features of the MR&T and the SCS small watershed projects. Hereinafter these will be collectively referred to as the tributary projects.<sup>3</sup> The model distinguishes between the tributary projects and the mainline levee system, and accounts for their effects separately. (See below.)

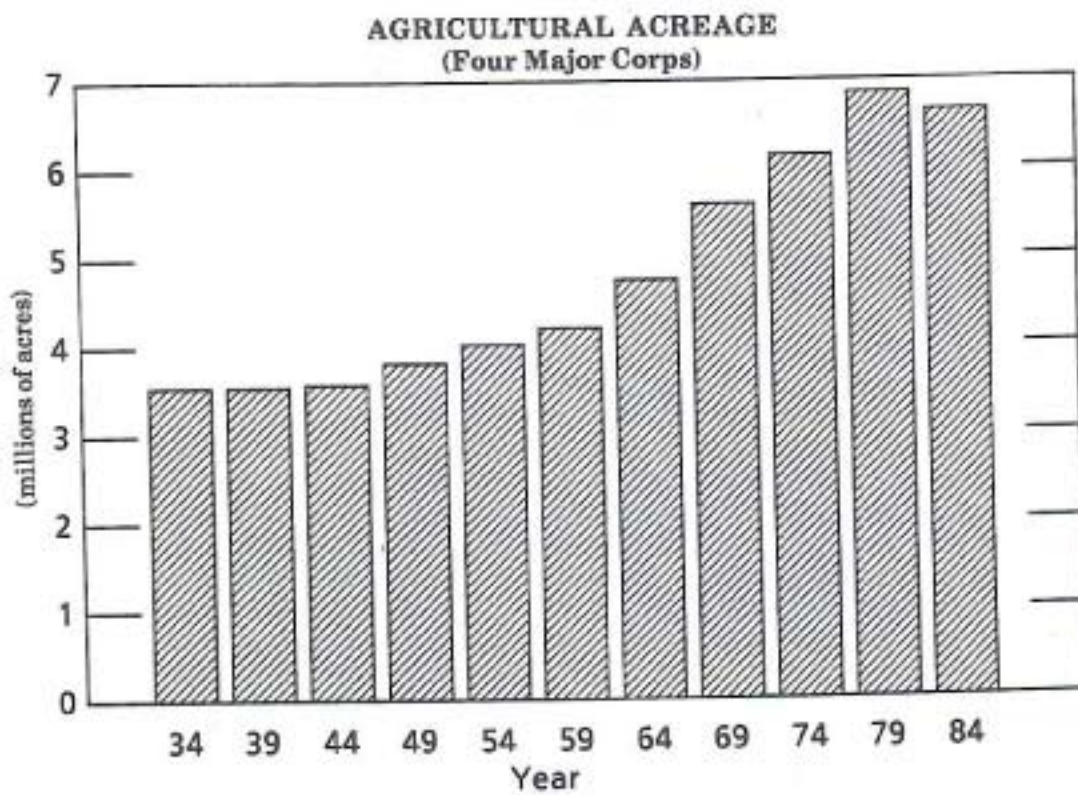
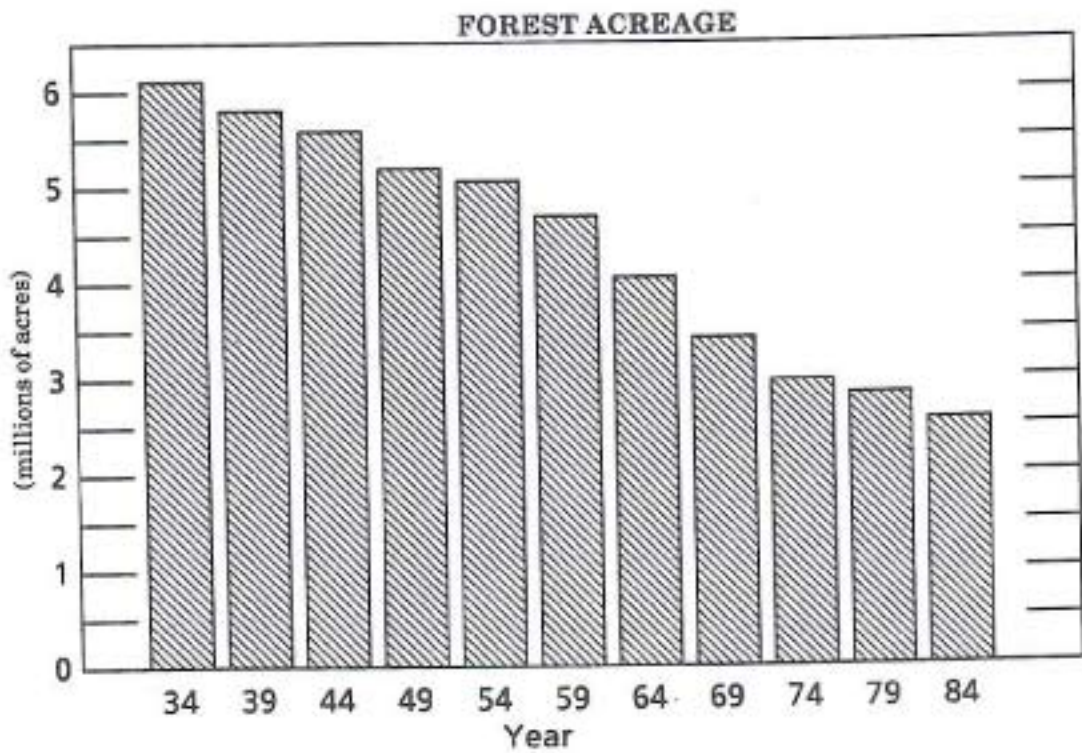
*Natural Flood Protection and Drainage:* A variable was used in the model which gives the percentage of a county's land area which is protected from flooding by the natural topography of the land. The values for this variable were derived from data in the 1982 Natural Resources

**TABLE III-2: FOREST AND AGRICULTURAL ACREAGE  
THIRTY-SIX INTERIOR COUNTIES  
LOWER MISSISSIPPI ALLUVIAL PLAIN  
1934 - 1984**

Year	Forest acreage	Acreage of four major crops
	(1,000 acres)	
1934	6,274	3,661
1939	5,970	3,648
1944	5,730	3,688
1949	5,341	3,934
1954	5,201	4,156
1959	4,826	4,329
1964	4,170	4,894
1969	3,506	5,758
1974	3,063	6,311
1979	2,927	7,015
1984	2,638	6,808

<sup>3</sup> An inconsequential amount of construction was conducted on the tributary projects prior to 1935.

FIGURE III-3: FORESTED AND AGRICULTURE ACREAGE  
THIRTY-SIX STUDY AREA COUNTIES, 1934-1984



Inventory (NRI), which was conducted by the SCS. The NRI data yields estimates of the average natural probability of flooding by county for each of the 36 counties in the study.

*Mainline Levees:* The mainline levee system lies along the banks of the Mississippi River, and is designed to protect against a catastrophic flood.<sup>6</sup> The system, authorized in 1928, has not been breached since 1937, and hence was virtually complete from the start of the study period. For statistical reasons, the impact which the mainline levee system had on the wetlands could not be separated from that exerted by the natural lay of the land. Thus, their combined impact was estimated using one variable (natural topography and the mainline levee system). (See Appendix III-1 for further explanation.) As indicated above, the model does distinguish between the impact of this combined variable (topography and the mainline levees) and that of the tributary projects.

**TABLE III-3: TOTAL ANNUAL HARVESTED AREA OF MAJOR CROPS  
THIRTY-SIX INTERIOR COUNTIES  
LOWER MISSISSIPPI ALLUVIAL PLAIN  
1929 - 1984**

Year	Soybeans	Cotton	Rice	Corn
	(1,000 acres)			
1929	9	2,541	34	780
1934	28	2,438	33	1,161
1939	63	1,947	40	1,597
1944	168	2,009	79	1,431
1949	307	2,472	141	1,013
1954	661	2,502	282	710
1959	1,627	1,932	306	463
1964	2,695	1,755	231	212
1969	3,739	1,683	263	71
1974	4,077	1,839	362	32
1979	4,707	1,632	652	22
1984	4,733	1,205	845	25

<sup>6</sup> Technically, the system is designed to convey "the standard project flood" safely to the Gulf of Mexico. The standard project flood is a hypothetical flood produced as a result of the largest storms considered to have a reasonable chance of occurring. While a frequency of occurrence is not normally assigned to the standard project flood, it is assumed to be larger than the 100 year frequency flood.

*Weather Conditions:* Weather conditions appear in the land-conversion equation, and affect the probability that the land in a particular county is suitable for cultivation during a given time period. The Palmer Hydrological Drought Index (PHDI) was used as a measure of weather conditions. The National Climatic Data Center estimates the PHDI, based on local precipitation, evapotranspiration, runoff, recharge, and soil water loss. The PHDI reflects soil moisture content.

*Conversion Cost:* The cost of conversion of forested wetlands to agricultural cropland was developed from limited published data and numerous personal communications. Because geographic differences in the cost of conversion are partly a function of soil moisture, the variable used in the model to account for the cost of conversion utilizes the PHDI. Soil moisture has the effect of increasing conversion costs, due to the difficulty of moving heavy machinery onto the land and the difficulty of achieving satisfactory burns of felled timber and brush.

## Results of the Econometric Analysis

This section presents the results of the statistical estimation of the model and the tests of the hypotheses. The results confirm the view that Federal flood control and drainage projects were a major factor inducing conversion of the forested wetlands. The general nature of the statistical results is discussed first, including their statistical reliability which is a primary indication of the degree to which one can have confidence in the results. Following this, we discuss the extent to which the various economic, hydrologic, and climatic factors affected conversion, with emphasis on the magnitude and relative importance of agricultural prices and Federal projects.

### The Nature and Reliability of the Statistical Results:

Coefficients for 15 different variations of the land-conversion equation were estimated. (The statistical results for the most important versions of the model are reported in Appendix Table III-1.) These alternative versions of the model were developed in order to determine the validity of the model and to facilitate testing of different hypotheses.

The results from estimating these 15 different forms of the model strongly support the basic validity of the model. They demonstrate that 1) the model includes the appropriate variables and 2) the concept that conversion of the forested wetlands is primarily a function of the expected profits associated with investing in clearing the trees, draining and leveling the land, and cultivating crops is supported by the data. The particular statistical evidence which validates the model is:

- In all versions of the model, each of the economic, hydrologic, and climatic variables affected conversion of the wetlands in the direction indicated by the basic concept.<sup>7</sup> More specifically, conversion was encouraged by: construction of flood control and drainage projects; increases in agricultural revenues; and reductions in the cost of conversion due largely to drier weather. Conversion was slowed by: increases in the natural risks of flooding; increases in the profitability of silviculture; increases in agricultural production costs; and excessively wet regional weather and high flood stages on the Mississippi River (both of which depressed crop yields).

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<sup>7</sup> There was only one exception to this, but it was for a variable whose coefficient was never statistically significant. Even for this variable the direction was reversed only once in all 15 versions of the model.

- The statistical reliability of the estimated values (as measured by standard statistical methods) was consistently very high, and for the two variables of greatest interest for purposes of public policy (Federal projects and agricultural revenues), the statistical confidence was extremely high in all 15 versions of the model.<sup>8</sup>
- The basic results did not change appreciably with different versions of the model. In slightly more technical terms, neither the magnitude of the estimated values for the coefficients nor their statistical reliability were sensitive to modifications in the specification of the model.

Taken together, these statistical results lend a great deal of credence to the view that the model is properly structured to reflect a valid, underlying economic theory. It is very improbable that one would consistently obtain such statistically reliable results, stable signs (i.e., the statistically derived relationships always acted in the direction consistent with the theory), and unvarying magnitudes for the estimated values of the coefficients, if the model were just a haphazard collection of factors which might be related to depletion of the wetlands.

#### **Flood Control and Drainage Projects as a Cause of Conversion:**

The principal conclusions which emerge from this stage of the statistical analysis are:

- Substantial wetlands conversion would have occurred in the Delta as a result of favorable economic returns to agriculture relative to forestry, even if no Federal flood control and drainage projects had been undertaken between 1935 and 1984.
- Construction of Federal flood control and drainage projects caused a higher rate of conversion of forested wetlands to agricultural cropland.
- The tributary projects had this impact because they increased the suitability of the land for agricultural uses, and hence the profitability of investing in conversion and agricultural development.

The conclusion that the statistical results show that the flood control and drainage projects *caused* increased depletion of the wetlands is a strong conclusion and should not be made without substantial and convincing evidence. No one believes that conversion of the forests to agriculture and construction of the projects are unrelated and just happened to occur simultaneously. But there are two theories of the sequence of development. The first is that the projects protected the lands from flooding and made conversion both technically feasible and, in conjunction with other forces, economically attractive. The second is that the projects were authorized and constructed in order to protect agricultural development which had already occurred, i.e., the conversion caused the construction of the projects. There are two aspects of the statistical analysis which support the first theory.

The first aspect has just been discussed above. The statistical results confirm the basic validity of the model and its underlying theory that people clear and convert the wetlands, because it is in their best economic interest, and that interest is affected by projects which protect the land from the risks of inundation.

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<sup>8</sup> For the statistically minded, the confidence level for the coefficients on agricultural revenues and on Federal projects always exceeded the 95 percent level. The coefficient reflecting the joint impact of the natural lay of the land and the mainline levee system always had statistical significance in excess of 90 percent, and in 6 of the 15 variations was significant at a level greater than 95 percent. The parameter reflecting the impact of conversion costs had a 95 percent level of confidence in 13 versions of the model. And the coefficient which indicated the constraining influence of timbering revenues on conversion was significant at a level greater than 90 percent ten times and for 5 of these at a level greater than 95 percent.

At least as important as the validity of the basic structure of the model, however, is the nature of the variables which are used to reflect the benefits of Federal flood protection and drainage projects. These variables are cumulative variables, that is, in each time period they account for the extent of flood protection and drainage benefits provided by all past construction. That the construction of all previous flood control and drainage projects is statistically related to the extent of clearing in each period has been irrefutably demonstrated by the statistical analysis. The statistical relationship is overwhelming; it is consistently strong in all versions of the model, with a confidence level always in excess of 95 percent.

Thus, it is virtually certain, statistically speaking, that there is a relationship between the extent of wetlands conversion and past flood control and drainage projects. The remaining issue is cause. The statistical model shows that a substantial share of the wetlands conversions is correlated with the amount of previous flood protection and drainage projects. In order for the argument to be true that this share of agricultural development preceded the flood control and drainage projects and caused their construction, it would have to be the case that clearing in each period caused past construction. A present event cannot cause a previous event. Thus, the portion of wetlands clearing correlated with previous Federal projects was the result rather than the cause of those projects.

It is worth noting that the statistical model does not show that all land conversion was caused by previous projects, only a substantial share. Nor does the model address what caused Federal flood control and drainage projects to be constructed. In fact, there are a number of cause-and-effect sequences that are consistent with the model results:

- Some land conversion occurs because, even without Federal projects, agriculture is more profitable than forestry. Subsequent flood damages to crops on such converted land is used to justify flood protection and drainage projects. These projects make additional wetlands more attractive for agriculture, prompting additional conversion.
- Some land conversion occurs because agriculture appears to be more profitable than forestry. Flood damages to crops on such lands threaten to cause abandonment of agriculture, but Federal projects subsequently reduce damages, allowing agriculture to continue and reducing the reversion of the land to forested wetland.
- Some landowners anticipate the benefits of proposed Federal projects, and convert wetlands that would not otherwise be economical to convert. Flood damages to such lands contribute to the justification for the Federal projects which, when built, reduce reversion and induce further conversion.
- Some landowners observe that historically, some Federal projects have been built to protect lands which, following conversion, suffered flood damages. In the expectation that they too will be rescued, these landowners convert their land to agriculture. Again, flood damages to such lands contribute to the justification for Federal projects which, when built, reduce reversion and induce further conversion.<sup>9</sup>

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<sup>9</sup> A striking example of a Federal project undertaken to rescue development is the Yazoo Area Pumps Project in Mississippi. Originally authorized in 1941, the project was designed to function with a natural flood storage reservoir, consisting of approximately 135,000 acres of forested wetlands. The assumption by the Corps was that this very flood-prone area would not be developed for agriculture. The pump portion of the project was designed to provide flood protection only to elevations above the natural storage area. The Federal government did not purchase the forested wetlands, however, and in the 1960's and 1970's agricultural development encroached into the area intended for storage of flood waters. As a result, the project was redesigned, and in 1982 was recommended for construction at a considerably higher capital cost. As reevaluated, approximately 79 percent of the project benefits accrued not to flood damage reduction by a natural storage area, but to agricultural expansion and intensification within the area formerly intended for storage. Clearing of 30,000 acres of forested wetlands was projected in addition to the acreage already converted to agriculture.

It is undoubtedly true that some construction occurs in response to landowner pressure for projects to be built to protect their cleared land. But, the statistical analysis strongly suggests that a significant amount of the clearing and conversion did not precede the construction of the projects and the flood protection and drainage benefits that they provided.

Although the Department believes that the statistical evidence demonstrates that the sequence of development frequently runs from the provision of flood control and drainage to the clearing and conversion of the wetlands, it does not matter in terms of the larger issue of the effect of the Federal programs on wetlands and land use whether the sequence of conversion is reversed (as it has been on occasion). Sustained cultivation of this region is possible only with the large-scale hydrologic alterations provided by the Federal flood control/drainage program.<sup>10</sup> Attempts to cultivate the region in the absence of such facilities have failed in the past, resulting in cleared areas reverting to hardwoods. Thus, even when the sequence of development runs in the opposite direction, the Federal projects are still instrumental in maintaining much of the current land-use pattern and sustaining agriculture in the Delta. In the long run, without the change in the hydrology provided by the mainline levees and tributary projects, agriculture is not profitable and the region would be largely wetlands.<sup>11</sup>

## **The Magnitude of the Impact of the Major Economic, Hydrologic, and Climatic Factors on Forested Wetland Depletion**

The previous section confirmed that Federal flood control and drainage projects were a major factor inducing conversion of forested wetlands in the Delta. This section addresses the magnitude of the impact which the major economic, hydrologic, and climatic factors had on depletion of the forested wetlands in the 36-county study area of the Delta during the period 1935-1984. Specifically, this section presents the estimates of the impacts of five variables: the tributary projects; topography and the mainline levees; forestry revenue; conversion costs; and agricultural prices.

In estimating the magnitudes of the impacts of the first four variables, a number of calculations, called sensitivity analyses, were performed with the model. (For reasons discussed shortly, the role played by agricultural prices required a different type of analysis.) To determine how "sensitive" depletion of the wetlands is to a change in the value of a particular variable, say the cost of conversion, one makes two calculations:

- the extent of the depletion of forested wetlands using the historic or observed values for the cost of conversion, and
- the extent of depletion using assumed values for the cost of conversion, e.g., values which are 10 percent smaller than the historic values.

In the example given, only conversion costs would change; all other economic, hydrologic, and climatic variables would retain their historic values. The difference between the two estimated levels of depletion is due to the 10 percent reduction in conversion costs. By changing only the cost of conversion, we have isolated its impact on depletion of the wetlands.

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<sup>10</sup> On high, natural levees, sustained cultivation is possible even in the absence of flood control.

<sup>11</sup> One of the most succinct cases for this conclusion is provided by Col. Gerald Galloway, former District Engineer for the Vicksburg District of the Corps of Engineers in his analysis of the Corps program in the Yazoo Basin portion of the Delta. Gerald E. Galloway, *Ex Post Evaluation of Regional Water Resources Development: The Case of the Yazoo-Mississippi Delta*, Ft. Belvoir, Virginia, Institute for Water Resources, U.S. Army Corps of Engineers, Oct., 1980.

For purposes of this study, we are interested in the *total* impact that each of the various factors had on depletion of the wetlands in the 36-county region during the entire period 1935-1984. In order to calculate the total impact of a variable on the wetlands over the entire 50-year period, one first calculates the extent of depletion given the observed values of the variables, and then repeats the calculation, setting the variable of interest equal to zero. If we did this for flood control and drainage projects, for instance, the difference between the two calculated levels of depletion would be the number of acres of forested wetlands that were converted in the 36-county study area between 1935 and 1984 as a result of the construction of all the Federal projects during the 50-year period. In what follows, we shall call the calculation using the observed values of the variables the "historic-loss" calculation and the calculation using the zero level for the variable of interest the "simulated-loss" calculation, with the difference being the estimated impact of the variable during the 50-year period.

#### Impact of the Tributary Projects:

Table III-4 gives the estimated impact of Federal flood control and drainage projects on depletion of the forested wetlands in the 36-county region of the Delta between 1935 and 1984. For several versions of the model, the table gives both the total 50-year impacts and the impacts in each five-year period. The estimated impacts vary somewhat, depending upon which version of the model is used to make the calculations. This is so because the estimated coefficients, although quite similar, are not identical in each version of the model.

The total estimated impact of the tributary projects on forested wetland depletion over the entire 50-year period amounts to a loss of approximately 700,000 to 750,000 acres.<sup>12</sup> (The values in Table III-4 range from 647,000 to 884,000 acres, with an average of 769,000.) In other words, taking into account all factors which affected individual landowners' decisions to convert wetlands, the statistical evidence indicates that if there had been no Federal flood control and drainage projects constructed in the Delta since 1935, about three-quarters of a million fewer acres of forested wetlands would have been converted in the 36 counties. This impact accounts for about 25 percent of all the wetlands lost.<sup>13</sup>

It is important to distinguish between "the reduction in the number of acres of forested wetlands which would have been *converted* in the absence of the projects" and "the increase in the number of acres of forested wetlands which would have been *standing* in the 36-county region in the absence of the projects." The model predicts conversion; it cannot account for *abandonment* of farms and subsequent *reforestation* which would have resulted if the projects had not been constructed. Consequently, 750,000 acres should be viewed as a lower bound for the increased number of acres of forested wetlands that the 36-county region would have experienced in the absence of the projects. In other words, the impact of the projects on the region's forested acreage is likely to exceed the amount of depletion due to the projects.

The estimated depletion impacts are remarkably close to those estimated by Col. Gerald E. Galloway, Jr., District Engineer for the Vicksburg District Corps of Engineers from 1974-1977 (Galloway 1980). Using a geographic analysis approach, Galloway estimated the extent of forest clearing and agricultural development in the Yazoo-Mississippi Delta in the 50-year period 1920-1970, assuming three different levels of development for the Federal flood control system:

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<sup>12</sup> An effort was made to distinguish between the impacts of Federal projects constructed by the Corps of Engineers and the SCS. Because the estimated parameter values for the separate Corps and SCS variables proved statistically equivalent, the analysis was conducted with one variable, representing the combined impact of Corps and SCS projects.

<sup>13</sup> The estimated impact of Federal projects on forested wetland depletion is an average over a 50-year period. Future projects may have a more pronounced impact on the remaining forested wetlands. In an effort to intensify agriculture on previously cleared wetlands, the more recent projects are directed at protecting against more frequent floods, e.g., the 1-3 year frequency flood as opposed to the 3-10 year event. Because new projects provide this greater degree of protection, they may exert more influence on future conversion.

no projects whatsoever; mainline levees only; and the actual system of mainline and tributary levees. (The Federal projects which we have been examining are tributary projects.) Galloway estimated that the tributary levees were responsible for 21-27 percent of the forest clearing. Given the markedly different analytic techniques, the closeness of the estimated impacts tends to increase one's confidence in their accuracy.

Since the tributary projects constructed between 1935 and 1984 account for 25 percent of the conversion, it goes without saying that other forces acting in the Delta are responsible for the other 75 percent of the depletion of the wetlands. The extent to which other economic, hydrologic, and climatic variables affected depletion is addressed in the next two sections.

**Relative Impact of Major Economic, Hydrologic, and Climatic Factors:**

For four versions of the model, Table III-5 presents the estimated impacts on depletion for all the factors of interest except agricultural prices. For two reasons, the analytic technique used

**TABLE III-4: THE IMPACT OF FEDERAL FLOOD CONTROL PROJECTS ON FORESTED WETLAND DEPLETION IN THIRTY-SIX COUNTIES OF THE MISSISSIPPI ALLUVIAL PLAIN, 1935-1984**

Five-Year Period	Forested Wetland Depletion Due to the Tributary Projects					
	(I) <sup>a</sup>	(V)	(IV)	(IX)	(I & XVI)	(IX & XVI)
				(1,000 acres)		
1935-1939	2 <sup>b</sup>	2	2	1	3	2
1940-1944	11	8	8	5	11	6
1945-1949	12	9	10	6	12	7
1950-1954	14	11	12	7	19	11
1955-1959	66	55	58	46	69	50
1960-1964	128	108	110	86	112	80
1965-1969	167	147	143	120	161	119
1970-1974	170	146	150	126	178	135
1975-1979	169	151	150	136	182	151
1980-1984	<u>142</u>	<u>127</u>	<u>125</u>	<u>113</u>	<u>137</u>	<u>111</u>
50-Yr Total <sup>c</sup>	882	764	768	647	884	671

<sup>a</sup> Roman numerals refer to different version of the model. See Stavins 1986a and 1986b for details. XVI in conjunction with another number means that calculated yields from the yield equation were used rather than historic yields.

<sup>b</sup> All figures represent depletions, i.e., loss of forested wetlands.

<sup>c</sup> Columns may not add due to rounding.

here (setting a variable of interest equal to zero for the simulated-loss calculation) is inappropriate for examining the role which agricultural prices played in depletion of the wetlands. First, if crop prices were zero, there would be no incentive to convert wetlands to agriculture. Indeed, land that had already been cleared would revert back to forested wetlands. More importantly, how many more wetlands there would be in the absence of an agriculture sector is not really the issue: the issue is what influence rising real agricultural prices had on conversion during the period 1935-1984. This question is addressed in the next section.

Of the factors considered, the tributary projects had the largest impact on the conversion of forested wetlands to cropland. Referring to the table, the tributary projects reduced the forested wetlands in the 36-county region by 647,000 to 882,000 acres during the 50-year study period. The joint effect of the natural topography and the mainline levee system was only slightly less than this, resulting in estimated clearing of between 579,000 and 814,000 acres.<sup>14</sup> Net revenues from forestry exerted only a modest restraint on clearing, while the combined effect of conversion costs and wet weather had a sizable impact. Not surprisingly, the tributary projects and the protection provided by the mainline levee system in conjunction with the natural lay of the land were the dominant forces responsible for the conversion of the wetlands.

It is important to note a limitation in the use of the estimated impacts in Table III-5. Because of the manner in which the calculations were made, one cannot add two impacts together to obtain an estimate of the *joint impact* of two factors. To determine such a joint impact, the "simulated-loss" calculation would have to be redone, setting *both* variables of interest at zero. Further, making an estimate of the combined impact for some variables may exceed the predictive capacities of the model. For example, it does not make any more sense to conduct a calculation with no mainline levees and no construction of tributary projects from 1935-1984 than it does to set crop prices at zero. As Galloway notes, almost the entire region would ultimately revert to wetlands without the hydrologic changes produced by the flood protection (Galloway 1980).<sup>15</sup>

#### Impact of Agricultural Prices:

The literature search conducted for this study revealed the general consensus that the Federal flood control and drainage projects were the dominant factor inducing conversion of the

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<sup>14</sup> The nature of the data prevented distinguishing the impact of the natural topography from that of the mainline levees. (See Appendix III-1 for a detailed discussion.) Although statistically the impacts of these two variables cannot be separated, the prevailing opinion of most experts on the Delta (Galloway among them) is that: 1) the natural topography alone does not provide much flood protection and 2) in the absence of the mainline levee system sustained cultivation of the Delta is impossible. If correct, these views imply respectively that: 1) the estimated impacts from the variable "Topography and Mainline Levees" is due largely to the mainlines, and 2) the Service's estimate of the wetland-clearing impact of the mainlines is conservative and constitutes a lower bound on this effect.

Subtle variations in the seemingly flat Delta topography certainly offer significant advantages in terms of better natural drainage and reduced susceptibility to tributary flooding. Although such areas were generally not immune from Mississippi River flooding, they were among the first lands cleared. Indeed, at the time of the 1927 flood almost half of the Delta had been cleared. However, virtually all students of the Delta believe that this clearing and development was induced at least in part by state and local flood control efforts.

Galloway is among those who attribute very little importance to topography alone as a flood protection feature. He contends that in the absence of the rebuilding and expansion of the mainlines, the dominating hydrologic influence of the Mississippi River would have led to the ultimate reversion of most of the Delta to bottomland hardwood forest. (See footnote 15.)

<sup>15</sup> Although Galloway's focus is the Yazoo-Mississippi Delta, the environmental similarities between the Yazoo and the entire Delta are such that his conclusions are likely to extend to the Delta as a whole. Galloway contends that by the time of the 1927 flood, the local jurisdictions were financially exhausted by their efforts to control the Mississippi River flooding and demoralized by their lack of consistent success. In the absence of the Federal program initiated in 1928, clearing would have abated and ultimately almost all of the Yazoo (between 95 and 97 percent according to Galloway) would have reverted to bottomland hardwood forests.

wetlands. Agreement among previous researchers was not unanimous, however. Some researchers argued that although the tributary projects were installed during the same 50-year period that development encroached most heavily on the hardwoods, most of this development would have occurred anyway, prompted by favorable economic conditions in the form of rising real agricultural prices. Thus, the issue is: if *no* tributary flood control and drainage projects had been constructed in the Delta between 1935 and 1984, would nearly as much clearing have occurred anyway during this period due to the inducements provided by relatively high farm product prices?

In order to address this question, the approach used earlier to estimate impacts on the wetlands had to be modified slightly. Historical-loss and simulated-loss calculations are still utilized, however. The impact which rising real farm prices had on the wetlands is given by the difference between:

- 1) the depletion which would have occurred if there had been no tributary projects constructed between 1935 and 1984, but all other variables, including crop prices, were kept at their historic levels, and
- 2) the depletion which would have occurred if there had been no tributary projects constructed during the period, all variables other than crop prices were kept at their historic levels, but crop prices were set at their 1935 levels (in real terms), instead of being allowed to rise as they did historically.

**TABLE III-5: DEPLETION OF FORESTED WETLANDS DUE TO MAJOR ECONOMIC, HYDROLOGIC, AND CLIMATIC VARIABLES, MISSISSIPPI ALLUVIAL PLAIN, 1935-1984<sup>a</sup>**

Variable	Impacts on Forested Wetlands			
	(I) <sup>b</sup>	(V)	(IV)	(IX)
	(1,000 acres)			
Tributary Projects	-882	-764	-768	-647
Topography and Main-line Levees	-814	-724	-654	-579
Net Forestry Revenue	31	36	19	29
Conversion Costs	573	521	435	435

<sup>a</sup> The indicated impacts are the total effects which each variable had on the wetlands during the 50-year study period. A negative impact means that the variable caused depletion, while a positive impact indicates that the variable acted to restrain depletion. The impacts for each variable are equal to the (total 50-year) difference between the "historic-loss" calculation of changes in forested wetlands and the "simulated-loss" calculation, where the latter is calculated by setting the indicated variable equal to zero for all years.

<sup>b</sup> Roman numerals refer to different versions of the model. See Stavins 1986a and 1986b for details.

The results are given in Table III-6. If there had been no tributary projects built between 1935 and 1984, there would still have been an estimated 2.8 million acres of wetland conversion in the 36 Delta counties (column 4). This is a sizable amount of depletion, but it is considerably less...647,000 acres less...than the 3.5 million acres of conversion that occurred with the projects in place (column 3). Further, the 2.8 million acres of clearing that would have occurred in the absence of the tributary projects cannot be attributed entirely to agricultural prices. It is due to the combined effects of historical (rising) agricultural prices and all other economic, climatic, and hydrologic factors (including flood protection provided by the mainline levee system).

The amount of depletion due to rising agricultural prices is estimated to be 367,000 acres (column 7). Thus, rising agricultural prices accounted for about half as much conversion in the 50-year period as the tributary projects, and they would not have induced nearly as much agricultural development in the absence of the tributary flood control projects as occurred with the projects.<sup>16</sup>

**TABLE III-6: FORESTED WETLAND DEPLETION DUE TO TRIBUTARY FLOOD CONTROL PROJECTS AND AGRICULTURAL PRODUCT PRICES, 1935-1984**

Five-Year Period	Actual Forested Wetland Loss	Simulated-Loss Calculation			Impacts Due to	
		Historic-Loss Calculation	No Tributary Projects and Rising Ag Prices	No Tributary Projects and 1934 Ag Prices	Tributary Projects	Rising Ag Prices
(1)	(2)	(3)	(4)	(5)	(6) = (3)-(4)	(7) = (4)-(5)
(1,000 acres)						
1935-1939	304	276	274 <sup>a</sup>	274 <sup>b</sup>	1 <sup>c</sup>	0 <sup>c</sup>
1940-1944	240	216	211	165	5	46
1945-1949	390	371	365	304	6	61
1950-1954	140	132	125	69	7	56
1955-1959	375	350	305	253	46	52
1960-1964	656	617	531	480	86	50
1965-1969	664	607	486	460	120	25
1970-1974	443	459	333	302	126	31
1975-1979	136	152	16	-11	136	26
1980-1984	<u>290</u>	<u>280</u>	<u>167</u>	<u>148</u>	<u>113</u>	<u>19</u>
50-Yr Loss	3,638	3,460	2,813	2,444		
50-Yr Impact					647	367

<sup>a</sup> Simulated loss of forested wetlands in the 36 Delta counties, with artificial flood-protection and drainage provision held constant at their 1934 levels; all other variables, including agricultural product prices, are at their historical levels.

<sup>b</sup> Simulated loss of forested wetlands in the 36 Delta counties, with agricultural product prices and artificial flood protection held at their 1934 levels; all other variables are at their historical levels.

<sup>c</sup> Difference may not add due to rounding.

<sup>16</sup> For purposes of simplicity only the results of the analysis on agricultural prices from version IX of the model are reported. The relative impacts of Federal projects and agricultural prices are similar for all versions of the model. Indeed, because version IX does not account for the yield-intensification effects of Federal flood control and drainage projects, the amount of depletion due to the projects is underestimated.

By referring to Table III-5, column IX, one can see the impact of rising agricultural prices relative to all other economic, hydrologic, and climatic variables.<sup>17</sup> Agricultural prices ranked below the tributary projects, the natural lay of the land and mainline levees, and conversion costs in influencing changes in the wetlands.

## Summary and Conclusions of the Econometric Analysis

An econometric model was used to examine the effect of Federal flood control and drainage projects on the conversion of forested wetlands in the Delta between 1935 and 1984. The analysis provided strong statistical evidence that such projects caused a substantially higher rate of wetland conversion than would have occurred in their absence. The actual depletion of forested wetlands in the 36-county sample area over the 50-year study period totalled approximately 3.6 million acres. Under various versions of the Department's econometric model, estimated depletion ranged from 2.6 to 3.5 million acres (Table III-7). The principal conclusions are:

- During the period 1935-1984, tributary flood control and drainage projects played a more important role in wetland depletion in the Delta than any other factor, although natural hydrologic conditions, the mainline levee system, conversion costs, dry weather, and increases in real agricultural product prices were also important.
- Depletion attributable exclusively to the influence of tributary flood control and drainage projects built between 1935 and 1984 amounted to approximately 750,000 acres or about 25 percent of total depletion (Table III-7). The effect of the mainline levees acting in concert with natural topography was slightly less (approximately 690,000 acres).
- The effect of rising farm product prices on wetland conversion ranked below the effects of all other economic, hydrologic, and climatic factors except net revenue from forestry. In particular, rising farm product prices induced about half as much clearing as tributary flood control and drainage projects.

## Farm-Level Simulation Model: Analysis of Impact of Agriculture Programs, Conservation Programs, and Tax Code Provisions on the Conversion Decision

In order to investigate the potential impact which Federal agriculture programs, conservation programs, and tax code provisions have on the decision to convert bottomland hardwoods to agriculture, a farm-level, cash-flow model was developed which simulates both the economic return and the risk associated with conversion and development under specific public policies (Kramer and Shabman 1986). The conceptual foundation for the model and this analysis was presented at the beginning of the chapter.

Reviewing briefly, the simulation model views the decision to convert wetlands into farmland as an investment decision by the landowner in an attempt to maximize his long-term economic return and/or reduce his economic risk from the activities conducted on the land. In its natural state, the land can be managed for its timber value and, in some instances, can be leased for recreational hunting. Cleared, leveled, and drained, the land can be cultivated. The decision to incur the conversion costs depends upon the expected earnings and the potential risk from the alternative uses of the land. Federal programs and policies can increase the expected net income from alternative uses of the land, lower the risk premium, reduce the cost of conversion, and change land values.<sup>18</sup>

<sup>17</sup> Only model IX was used to estimate the impact of rising agricultural prices. See footnote 16.

<sup>18</sup> For a more detailed treatment of how Federal programs can alter the conversion decision, see the section early in this chapter entitled "The Conceptual Framework for the Conversion Decision."

At a given level of risk, a landowner seeking to increase his income from the land would compare the net income expected over the years from conversion with the net income expected from timber production and hunting leases. The greater the net gain from the conversion, the more likely it will be that landowners will make conversion investments.

The model simulates the operation of a representative farm over a 13 year period (1985-1997), taking into account: crop yields and distributions; commodity prices; farm operating costs; and the benefits from participation in Federal programs.<sup>19</sup> It compares the net income from farming with the foregone income from hunting leases and timbering, and calculates the economic return to the investment in conversion generated by this difference, as well as the change in risk.

The model calculates statistics which can be used to assess both the economic feasibility of conversion (the rate of return to the investment, the change in net present value of the property as a result of the investment, and the accompanying coefficients of variation, which are measures of risk) and the financial feasibility of conversion (whether the cash-flow is sufficient to service any loan incurred to finance the investment). There are no critical values for the measures of economic feasibility below which conversion will not take place. Rather, the calculated values simply provide an indication of the magnitude of the incentive to convert. If the net present value (NPV) of the investment is greater than zero, there is some incentive to convert; the larger the NPV, the greater the incentive. Similarly for the rate of return, although it is reasonable to assume that if the return to conversion does not exceed the historic returns to investments in agricultural production, the incentive to convert is not strong. Since

TABLE III-7: THE IMPACT OF TRIBUTARY PROJECTS  
ON FORESTED WETLAND DEPLETION IN THIRTY-SIX COUNTIES  
OF THE MISSISSIPPI ALLUVIAL PLAIN, 1935-1984  
SUMMARY OF RESULTS

	(I) <sup>a</sup>	(V)	(IV)	(IX)	(I & XVI)	(IX & XVI)
	(1,000 acres)					
Depletion	2,631	3,109	2,952	3,460	2,655	3,467
Depletion Due to Tributary Projects	882	764	768	647	884	672
Share of Depletion Due to Tributary Projects	33.5%	24.6%	26.0%	18.7%	33.3%	19.4%

<sup>a</sup> Roman numerals refer to different versions of the model. See Stavins 1986a and 1986b for details.

<sup>19</sup> Previous research suggests that a 1000 acre operation tends to be the most efficient size farm in the Delta and that clearing is usually conducted to achieve approximately this operating size. Thus, the analysis is conducted throughout for a cost structure of an efficient, 1000 acre farm. Because of the way that the simulation model is structured, it does not matter whether the landowner is starting with a tract of, say, 750 acres and considering expansion to 1000 acres, or whether he is beginning with 1000 forested acres and is considering conversion and development of the entire parcel. The analysis and results are identical.

there are studies which suggest that this historic return is in the neighborhood of five percent, five percent is used as the discount rate for calculating NPVs and as a point of reference throughout the study. Finally, the larger the coefficient of variation (cv) associated with any of the measures of economic feasibility, the more risky the investment.

Even if an investment is economically promising and is expected to generate an attractive rate of return over its lifetime, it still may not be financially feasible. If there are periods over the lifetime of the investment when the cash flow is insufficient to meet fixed financial obligations, creditors may foreclose on the property. When an investment in bottomland conversion and farming is financed, there will be fixed annual repayment requirements associated with the loan. The farm must earn sufficient income annually to meet operating expenses and still have enough left over to service the debt. A risk-averse investor will not borrow the capital necessary for bottomland development unless there is only a small likelihood that he will be forced to default on the loan. The simulation model calculates the probability that a representative farm operating under specified conditions (including certain Federal programs) will suffer a negative net cash flow.<sup>20</sup>

The simulation model is not designed to predict future rates of clearing and development of bottomland hardwoods in different policy settings. Rather it is designed to estimate the magnitude of the incentive for development under hypothetical conditions, notably the availability of various Federal programs. The assessment of the potential effects of Federal programs on the conversion decision is conducted in much the same way as the sensitivity analysis of the impact of Federal flood control projects was conducted earlier in this chapter. The model is run, and values for the economic and financial feasibility statistics are calculated with a particular set of Federal programs in place. Then the model is run again with one of the programs eliminated, and new values are calculated for the economic and financial feasibility variables. The differences in the values of these statistics measure the potential effect of the program of interest on the incentive to convert.

## The Nature of the Data Used in the Simulation Model

Data for the farm simulation model consist of farm and timberland prices, land clearing and development costs, agricultural production data (crop yields, commodity prices, and production costs), Federal program benefits and tax code provisions, and estimates of timbering and hunting lease revenues. A detailed discussion of all the data, data sources, and how they are utilized by the model can be found in the background study (Kramer and Shabman 1986). Only a brief discussion of the most important variables and data is given here.

*Case Study Counties:* Simulations were conducted for representative model farms in four counties in the Delta, selected to reflect a mix of ownership, cropping patterns, and geographic differences (yields, soils, etc.). Pointsett County was selected to represent soybean-rice-cotton counties in Arkansas; Lee County and Catahoula Parish, to represent soybean dominated counties in Arkansas and Louisiana, respectively; and Bolivar County, to represent mixed farming counties in Mississippi. Although the cropping patterns differ among the case study counties, like the Delta as a whole, all four counties have a substantial majority of their crop

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<sup>20</sup> The model assumes that 70 percent of the cost of land acquisition and development is financed. Financial feasibility is tested only for the first year of operation of the representative farms. Given the way the model is structured, if financial feasibility is violated in year one, it will be violated in all other years. Although it is unlikely, it is possible that a project could be financially feasible in year one, but not in other years. See Kramer and Shabman 1986 for a more detailed discussion.

acreage devoted to soybeans. Selected counties had to contain significant quantities of forested wetlands. No case study analysis was conducted for sugarcane counties, because sugarcane is produced on higher elevation rather than on converted wetlands. The sources for these data on cropping patterns and wetland acreages were State Crop and Livestock Reporting Services and MacDonald et al., 1977. The Department believes that the case study counties reliably reflect conditions in the Delta as a whole and that the results of the simulation analysis are applicable throughout the Delta.<sup>21</sup>

**Simulation Period:** The model simulates the operation of a representative farm over a 13 year period (1985-1997). The model farm is assumed to be sold at the end of the simulation period. All analysis is conducted in 1985 dollars.

**Land Purchase, Clearing, and Development Costs:** Farmland prices were based on the opinion of local real estate experts. Timberland prices were derived from the farmland prices by subtracting land development costs and adding the value of standing timber.

There are no precise estimates for clearing costs in the Delta. Data from North Carolina was used, where the clearing practices and soil conditions are similar. Unpublished USDA data were used to estimate drainage costs.<sup>22</sup>

**Agricultural Production and Revenue Data:** Representative farm cropping patterns were developed for the case study counties based upon the distribution of cropland by crop in those counties, as reported by the 1982 Census of Agriculture. Farm production costs were taken from farm management budgets published by the Agricultural Experiment Stations in each State for 1985.

Ten years of historical data (1975-1984) were used to develop probability distributions for crop prices and yields for each of the four representative farms, and these distributions were assumed to hold for the simulation period (1985-1997).<sup>23</sup> County averages were used for yields, and State averages were used for prices, the sources being the State Crop and Livestock Reporting Services, and State Agricultural Experiment Stations. When conducting the analyses, prices and yields for all crops were sampled jointly (50 random draws) from the price and yield distributions for each representative farm.<sup>24</sup> These four sets of 50 values were used to calculate means and variances for the NPVs and rates of return on the four representative farms.

**Provisions of Federal Programs and Tax Code:** It was assumed that agricultural production from the model farms was eligible for commodity program benefits (nonrecourse loans and deficiency payments) at the 1985 levels (1981 law). Test runs indicated that crop insurance was an unattractive risk-management option, and therefore, it was assumed that the representative farms do not participate in this program.<sup>25</sup>

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<sup>21</sup> In 1983 there were 5.1 million acres of forested bottomlands in the 84 Delta agricultural counties growing soybeans, rice, cotton, and/or sugarcane. From the Service's analysis of the nature of these counties, 77 appear to be represented by the case studies, and these contain 4.8 million or 93 percent of the bottomland hardwood acres. See Kramer and Shabman, 1986 for a complete discussion of the representativeness of the case study counties.

<sup>22</sup> In sensitivity analyses conducted by the Department, the profitability of conversion and development proved highly sensitive to changes in clearing and drainage costs. Doubling clearing and drainage costs cut economic returns approximately in half and substantially increased the risk associated with conversion.

<sup>23</sup> One can easily argue that the probability distributions for yields and prices will be different in the future from those of the past ten years. For example, due to new U.S. export expansion efforts and rising populations abroad, agricultural prices could be higher or less variable in the near future. Conversely, prices could be lower and perhaps more variable due to agricultural surpluses in many parts of the world. It is not possible to establish with any degree of confidence how distributions, particularly price distributions, will change in the future. Thus, the distributions were assumed to be constant over the simulation period.

<sup>24</sup> A multivariate, normal random number generator is used to do the sampling.

<sup>25</sup> Sales for the crop insurance program have been quite limited. This may be due in part to the fact that in many cases premiums are high relative to expected indemnities.

The Federal tax code provisions modelled are those in effect in 1985. Thus, the simulation model does not reflect the reforms embodied in the Tax Reform Act of 1986. As discussed in Chapter 2, tax reform eliminated the deductibility of certain agricultural land conversion and development costs common to wetland conversion, as well as any differential capital gains treatment on sales of wetlands converted to agriculture. Thus, the analytic results stand as an estimate of the extent of the incentive to convert provided by the former provisions, or alternatively, the extent of the incentive which would be provided should these provisions be reinstated.

*Conservation Easements and Hunting Leases:* A hunting lease value of \$5 per acre and a conservation easement payment of \$10 per acre were used for the full amount of the tract considered for conversion. Local expert opinion was the source of these estimates.

## Results of the Farm-Level Simulation Analysis

The results of the farm-level simulations for the four representative Delta counties are given in Tables III-8 and III-9. Table III-8 contains the values for the economic feasibility measures (mean and coefficient of variation for NPV and rate of return, as well as the equivalent annual value for NPV). Table III-9 contains the values for the financial feasibility variable (the probability of a negative net cash flow). The discussion here focusses on Table III-8, following which Table III-9 will be virtually self-explanatory.

When interpreting the results, it is important to keep a number of things in mind:

- (1) Some costs of production are not accounted for by the model, and hence, the calculated economic returns are not available solely as returns to the capital investment in clearing and conversion. If conversion is to be profitable, the returns must also cover the unmeasured costs of management, general overhead, and risk. These costs were left unmeasured because they are highly subjective and vary with the individual landowner/investor/manager.
- (2) Because the historic rate of return to agricultural investments is roughly five percent, five percent is used as the target rate of return in this analysis, and considered to be the return to capital (after all other costs are covered) which would make conversion just normally profitable. Again, since there are unmeasured costs in this analysis, a value of five percent for rate of return in Table III-8 leaves nothing to cover these unmeasured costs, and does not make conversion attractive.
- (3) The discount rate used to calculate the NPVs in Table III-8 was five percent. Thus, an NPV greater than zero means that a return of five percent has already been paid on the investment in conversion and the entire NPV is available to cover the cost of management, general overhead, and risk.

### Base Case:

The first line of Table III-8 presents the results of the economic feasibility analysis for the base case. In the base case it is assumed that the farm is enrolled in the available agricultural price and income support programs and that the landowner takes advantage of tax provisions which allow for the expensing (rather than capitalizing) of land clearing costs. The landowner is assumed to be myopic with respect to alternative uses for the land, however. That is, in assessing the feasibility of conversion, the base case landowner does not take into account the foregone income from timbering, recreational hunting leases, or a conservation easement. The justification for the myopia assumption comes from the results of analysis of landownership data conducted by the Department as part of this research project. The landownership analysis

TABLE III-8: SIMULATED ECONOMIC RETURNS FROM AGRICULTURAL DEVELOPMENT OF WETLANDS IN FOUR DELTA COUNTIES UNDER ALTERNATIVE PROGRAMS AND BEHAVIORAL ASSUMPTIONS

	Catahoula Parish, La.			Lee County, Ark.			Bolivar County, Miss.			Pointsett County, Ark.		
	NPV per acre	Annual Equip. NPV <sup>3</sup>	Rate of Return <sup>4</sup>	NPV per acre	Annual Equip. NPV	Rate of Return	NPV per acre	Annual Equip. NPV	Rate of Return	NPV per acre	Annual Equip. NPV	Rate of Return
Base Case	\$151 (1.53) <sup>2</sup>	\$16.07	11.0% (.629)	\$458 (.387)	\$48.75	24.9% (.333)	\$217 (.869)	\$23.10	9.6% (.407)	\$651 (.260)	\$69.30	33.1% (.203)
Remove agric. supports	\$98 (2.63)	\$10.43	9.7% (.743)	\$331 (.644)	\$35.23	19.3% (.491)	\$181 (1.13)	\$19.27	9.0% (.456)	\$485 (.510)	\$51.63	25.7% (.431)
Remove tax provisions	\$122 (1.86)	\$12.99	9.5% (.643)	\$418 (.424)	\$44.49	20.4% (.334)	\$117 (1.48)	\$12.45	7.5% (.445)	\$611 (.278)	\$65.04	27.2% (.244)
Remove tax provisions and agric. supports	\$69 (3.66)	\$7.35	8.4% (.755)	\$291 (.703)	\$30.98	15.7% (.502)	\$83 (2.22)	\$8.84	6.9% (.486)	\$445 (.556)	\$47.37	21.1% (.440)
Include timber income and hunting lease	\$42 (5.50)	\$4.47	7.1% (1.27)	\$357 (.497)	\$38.00	23.5% (.393)	\$117 (1.61)	\$12.45	7.8% (.555)	\$550 (.309)	\$58.53	32.5% (.269)
Include timber, hunting, & conservation easement	\$-52 (NA)	\$-5.54	3.9% (2.24)	\$259 (.685)	\$27.57	18.4% (.497)	\$18 (10.48)	\$1.92	5.9% (2.27)	\$455 (.373)	\$48.44	27.7% (.317)
Combine all of above	\$-106 (NA)	\$-11.28	1.9% (5.21)	\$92 (2.31)	\$9.79	9.5% (.913)	\$-116 (NA)	\$-12.35	3.1% (1.22)	\$245 (1.01)	\$26.08	15.5% (.635)

1. The economic returns are after-tax. The rate of return is to both the investment in bottomland development and unmeasured resources (management, overhead, and risk). The NPVs are calculated with a discount rate of 5%, equal to the target rate of return to capital. NPVs are available to cover the cost of unmeasured resources and pay a return to capital in excess of 5%.

2. Numbers in parentheses are coefficients of variation. Higher values indicate greater risk.

3. The annual equivalent NPV is the net revenue per year which when discounted would produce the indicated NPV/acre.

4. This is the internal rate of return or the discount rate which would make NPV = 0.

found that owners of small woodlots have little interest in timber management and that corporate owners of forested wetland tracts are unlikely to manage the tracts for timber production.

Because the rates of return to the investment exceed five percent for all four representative counties in the base case, one might be tempted to conclude that, at least in a world of agricultural price and income supports and special tax treatment of land clearing expenses, conversion in the Delta is attractive. A critical examination of the case study results suggests, however, that even in the base case bottomland development is a marginal proposition in all but one of the representative counties (Pointsett). Although in all four case studies bottomland conversion and development generates enough revenue to pay the target five percent return to capital, the amount left over to cover the costs of management and overhead and provide a reward for undertaking the risks of farming is limited. The annual equivalent NPV is all that is available to cover the cost of these unmeasured factors. A study of crop budgets in Louisiana estimated overhead costs alone to be \$60.51 per acre (Paxton, et al. 1985). Only in Pointsett County does the annual equivalent NPV exceed this estimate, and even there not much is left over to reward management and risk taking.<sup>26</sup>

The simulation results are not at odds with the historic rate of clearing in the Delta and the past profitability of conversion. The simulation model is a prospective model, which takes 1985 conditions as a given, extends 13 years into the future, and assumes that these conditions are invariant over that period. Basic economic conditions are no longer as favorable to bottomland development as they have been over the past two decades. Agricultural production costs have risen sharply over the past decade, and commodity prices have not kept pace.

**TABLE III-9: FINANCIAL FEASIBILITY OF AGRICULTURAL DEVELOPMENT OF WETLANDS IN FOUR DELTA COUNTIES UNDER ALTERNATIVE PROGRAMS AND BEHAVIORAL ASSUMPTIONS**

	<u>Probability of Negative Net Cash Flow</u>			
	Catahoula	Lee	Bolivar	Pointsett
Base Case	18%	0%	0%	0%
Remove agric. supports	26%	6%	4%	0%
Remove tax provisions	18%	0%	0%	0%
Remove tax provisions and agric. supports	26%	6%	4%	0%
Include timber income and hunting lease	18%	0%	0%	0%
Include timber, hunting, and conservation easement	18%	0%	0%	0%
Combine all of above	26%	6%	4%	0%

<sup>26</sup> The Department has some reservations regarding this per acre overhead cost estimate. The Louisiana researchers surveyed farmers for total overhead costs, and then divided by farm size to obtain the per acre value. The problem with this calculation is that overhead costs are largely fixed, and do not vary much with farm size. However, the Department's concern about the reliability of the overhead cost estimate does not detract from the conclusion that the economic returns available to cover the cost of the unmeasured resources are sparse.

One important feature of the simulation results is that the risk of investing in conversion and development (as measured by the coefficient of variation) increases at lower values for NPV. This is true not only for the base case, but throughout Table III-8.

Given the uncertainty about future prices for agricultural commodities, the Department conducted some sensitivity analysis using different price series. The simulation analysis was repeated using commodity price series which were derived by adjusting the historic series employed for the base case analysis downward by 20 percent. (It is worth noting that when the simulator was applied to these adjusted series, it produced price distributions whose means were similar to the agricultural commodity prices currently being received by farmers, thus lending coincidental, but added significance to the sensitivity analysis.) The economic returns from agricultural development in the new base case were approximately one-third less than those in Table III-8. Thus, the profitability of conversion and agricultural development appears to be highly sensitive to changes in commodity prices.

#### **Agriculture Programs:**

The impact of making bottomland conversion and development ineligible for Federal agricultural income and price support programs is given in line 2 of Table III-8. As expected, removal of agricultural supports reduces NPV and increases risk in every case.

Again, because of the uncertainty about future prices for agricultural commodities, the Department conducted sensitivity analyses on the impact of agriculture programs, using the adjusted price series described above. The combined impact of denying agricultural program benefits and reducing agricultural prices by 20 percent was to lower the rate of return in Pointsett County from 33 percent to 7.4 percent, reduce the annual equivalent NPV from \$58.55 to \$3.19, and increase the risk factor 15 fold. Given that Pointsett was the county with the highest returns to conversion, it seems clear that under current, depressed market conditions and in the presence of Swampbuster, there are limited opportunities for profitable conversion and development of wetlands in the Delta.

#### **Tax Code Provisions:**

In line 3 of Table III-8, the representative farms remain eligible for agricultural support programs, but the land clearing deduction has been eliminated from the modelled tax code. (Land clearing expenses are capitalized into the value of the converted land on line 3, and deductible only when the land is sold.) Removing the special tax code provisions reduces NPV and increases investment risk significantly, but not by as much as the elimination of the agriculture programs.<sup>27</sup>

#### **Combined Effect of Agriculture Programs and Tax Code Provisions:**

Line 4 of Table III-8 is as close as the Department's model can come to simulating the effect (on myopic operators) of the 1986 tax reform, Swampbuster, and the current agricultural economic climate. On line 4, the investors continue to overlook alternative income-producing uses for their land; the land clearing deduction has been eliminated from the tax code; the commodities produced on the converted wetlands are ineligible for agricultural program benefits; and the economic climate under which the representative farms operate reflects the declining profit margins of the last decade.

Relative to the base case, the results are disastrous for the economic feasibility of bottomland conversion and development. The NPVs and rates of return plummet, and the risk quotients double.

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<sup>27</sup> As we shall see in the next chapter, the land-clearing tax deduction has a greater impact on the economic feasibility of conversion in the Delta than in the Prairies. Conversion costs in the Delta are higher, and hence, the deduction is more important.

For several reasons the true effects are likely to exceed the simulated impacts. First, the central provision of Swampbuster says that if a producer grows an agricultural commodity<sup>28</sup> on a converted wetland, that producer is ineligible to participate in the principal Federal agriculture programs on *any lands* during that crop year.<sup>29</sup> Because the model assumes that the operator of a representative farm grows agricultural commodities only on that farm, programmatic benefits are eliminated only for that 1,000 acres. If the operator of a representative farm is involved in producing agricultural commodities on other lands, his penalty for producing on converted wetlands will extend to those other lands and will be larger than that simulated by the model.

Secondly, the model only accounts for the lost benefits from price and income support programs. Swampbuster renders a producer ineligible for a larger array of programs.

Finally, unless the agricultural economy improves, prices for farm commodities will be generally lower than those utilized in the simulations. Agriculture program benefits are larger when lower market prices prevail, and the elimination of these larger benefits will have a more pronounced impact on the economic and financial feasibility of conversion than the simulated impacts.

#### **Programmatic Effects, Taking Into Account Alternative Uses for the Land:**

Thus far we have examined the economic feasibility of conversion in the representative counties, assuming that the landowner was myopic. If the landowner is perceptive, however, he will recognize that there are alternative uses for the land in its natural state which can generate income. When the land is converted, these potential income sources are lost, and must be counted as a cost in assessing the investment returns. Clearly, the gains from conversion will not be as great as when these income sources were not recognized by the landowner.

In lines 5 and 6 of Table III-8, the myopia assumption is dropped. These lines constitute the base case for the perceptive landowner, and substitute for line 1. Line 5 accounts for income from timbering and hunting leases, and line 6 reflects the lost income from timbering, hunting leases, and a Federal conservation easement. The economic returns are reduced, the risks increased, and conversion is even less attractive than before. Indeed, in Catahoula Parish the prospects for conversion are so poor that the landowner would be better off paying \$52 not to have to convert and farm the land.<sup>30</sup>

Line 7 substitutes for line 4, and reflects the impact of tax reform and ineligibility for agriculture programs, when the lost potential income from timbering, hunting leases, and conservation easements is taken into consideration. Again, given the limitations of the model, the results in line 7 are as close as we can come to simulating the effects of tax reform, Swampbuster, and the current agricultural economic climate for the perceptive landowner.

## **Summary and Conclusions of the Farm-Level Simulation Analysis**

A farm-level, cash-flow model was developed in order to investigate the potential impact which Federal agriculture programs, conservation programs, and tax code provisions have on the decision to convert bottomland hardwoods to agriculture in the Delta. Using 1975-1984 data, the model simulated the operation of representative farms in four Delta counties, selected to reflect a mix of ownership, cropping patterns, and geographic differences. The Department believes that the case study counties reliably reflect conditions in the Delta as a whole and that the results of the simulation analysis are applicable throughout the Delta.

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<sup>28</sup> Defined in the regulations to be any crop planted and produced by annual tilling of the soil or sugarcane.

<sup>29</sup> The list of programs for which a producer becomes ineligible includes price and income support programs, farm storage facility loans, disaster payments, crop insurance, certain FMHA loans, and payments for storage of Federally owned agricultural commodities. See chapter 5 for a complete discussion and analysis of Swampbuster.

<sup>30</sup> Since Table III-8 does not take into account farming, a landowner in Catahoula Parish should be willing to pay considerably more than \$52 to avoid conversion and cultivation.

The case study results suggest that under current (1975-1984) economic conditions bottomland development has only marginal economic feasibility:

- Even in the base case, the simulated returns are insufficient to cover the cost of all factors of production (including management and overhead) and still grant an adequate return to capital and a reward for undertaking the risks of farming. The apparently high returns in a county such as Pointsett are deceiving, because the model does not account for the cost of management and overhead or a return for the risk of farming. Introducing a charge for overhead alone into the calculations (such as the \$60 per acre used in the Louisiana published budgets) is enough to make the prospects for profitable conversion and development dim. The results for the other three, less lucrative case study counties clearly indicate the marginal feasibility of conversion.
- Swampbuster and tax reform have the potential for significantly reducing the returns to conversion in the Delta. These legislative reforms were enacted after the simulation model was developed when the Department's study was close to completion. Consequently, the specific details of the reforms could not be incorporated into the model. However, the legislative features which were modelled were similar enough to Swampbuster and tax reform that a lower bound estimate of the impact of these reforms on the incentives to convert wetlands was estimated. When the model farms the cost of management and overhead or any return for undertaking the risks of were made ineligible for agricultural price and income supports and the land clearing tax deduction was eliminated, the simulated returns fell substantially and the risks of farming and development increased dramatically. If Swampbuster and tax reform are vigorously enforced, the true effects are likely to be significantly greater than the simulated impacts.<sup>31</sup>
- Current (1987) expectations for agricultural price/cost relationships may be less favorable than those used in the model unless the agricultural economy improves. Although bottomland development has been a common activity in the Delta during the past two decades, it now appears that the basic economic conditions are no longer favorable to such development.<sup>32</sup> Prices paid by farmers for factors of production have risen over the past decade, while prices received for products have not kept pace.<sup>33</sup>
- Clearing costs may be higher in some areas of the Delta than those used in the model. There are no precise estimates for clearing costs in the Delta. In sensitivity analyses conducted by the Department, the profitability of conversion and development proved highly sensitive to changes in clearing and drainage costs.

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<sup>31</sup> There is no firm empirical evidence yet on the extent to which the Swampbuster provisions have reduced wetland conversions to agriculture. Although the Department's conclusions are based on simulated outcomes, we believe them to be accurate under the assumed conditions. It is worth noting, however, that a recent study conducted at USDA's Economic Research Service reached less optimistic conclusions than DOI about Swampbuster's potential effectiveness in the Delta (Heimlich 1988). Heimlich estimated that nationally, Swampbuster would be effective in preventing conversion on only about 35 percent of those non-Federal wetlands with some probability of being converted to cropland. The estimates for the Delta were mixed, with Swampbuster predicted to be quite effective in the bottomlands of Arkansas (preventing conversion on 47 percent of wetlands vulnerable to conversion) and considerably less effective (13.7 percent) in Mississippi and Louisiana. Swampbuster's effectiveness in all three States combined was estimated at 25.6 percent.

<sup>32</sup> This conclusion is based on the assumption that crop prices and yields during the simulation period (1985-1997) will be the same as those for the period 1975-1984. Largely because of the drought in 1988, crop prices have risen significantly, especially soybean prices which have doubled since 1987. Should crop prices continue at the 1988 level, the economics of clearing in the Delta will change significantly, and development of the bottomland hardwoods for agriculture will become attractive again.

<sup>33</sup> In 1985 the ratio of the USDA index of prices received to prices paid was 79. In 1972 the ratio was 111, in 1973 it was 138, in 1974 it was 130, and in 1975 it was 113.

## Landownership Characteristics in the Delta and the Implications for Wetland Conversion

The case study results suggest that under current economic conditions bottomland development has only marginal economic feasibility. However, different owners have different motivations for developing bottomland forests, and the likelihood that land will be converted depends on the characteristics of the landowners. Consequently, in order to augment and supplement the simulation results and analysis, the Department conducted an analysis of an existing USDA data base which permitted description of the characteristics of owners of all types of land in the Delta portions of Arkansas, Louisiana, and Mississippi.<sup>34</sup>

Although the case study results suggest that bottomland development has only marginally feasibility, the results of the Department's study of ownership patterns of bottomland hardwoods indicate that in the long run these wetlands remain vulnerable to agricultural development. Managing bottomland forests for timber production can enhance the income potential of the tracts, but dedication of the bottomland forests in the Delta to timber production over an extended period of time is unlikely, given the characteristics of the landowners and the low returns and long pay back period associated with investing in timber production and management (at current land prices).<sup>35</sup> Given the marked differences in their characteristics and motivations and in the nature of their land holdings, corporate and non-corporate owners are treated separately in the following discussion of landownership patterns.

### Corporate Owners:

The Department estimates that approximately half of the forested acreage on wet soils in the Delta is owned by corporations and that roughly 90 percent of that acreage is held in large tracts (over 5000 acres) by relatively few corporate landowners.<sup>36</sup> Forest products firms are not the principle owners of this land, however. The corporate ownership group appears to be composed primarily of horizontally diversified companies. Only a few of the major forest products companies have land holdings in the Delta bottomlands, and there is little likelihood that they will seek to acquire more such land (at current market prices) because of its relatively poor prospects for silviculture.

Corporate owners cannot be expected to hold these forested lands indefinitely without earning a return on them. Subdivision of these large tracts for non-agricultural purposes (e.g., recreation, vacation homes) is unlikely to prove profitable. Hence, there are really only three options for the corporate landowners: manage the land for silviculture; clear the land and develop it for agriculture; or sell at reduced prices.

We have already suggested that given the nature of the firms and the limited prospects for profitable silviculture on these lands, managing the land for timber harvesting seems unlikely.

It may be that the tracts will be held until the agricultural economy improves and clearing is economical. Although such an improvement in the market may be several years away, these owners may perceive no alternative to waiting. If this is the case, Swampbuster and tax reform will have changed the timing and slowed the rate of wetlands development, but will not have changed the ultimate extent of such development.

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<sup>34</sup> The data base analyzed was created from the merger of the 1978 landownership survey conducted by the Economic Research Service and the 1977 Natural Resources Inventory conducted by the Soil Conservation Service. For a full description of the data and the analysis see Kramer and Shabman, 1986.

<sup>35</sup> The low returns to both silviculture and agriculture are partly due to the level of prices for forested bottomland. The land prices used in the model precede Swampbuster and tax reform. If these prices fall (and that seems the inevitable result of the legislative reforms and the generally depressed agricultural economy), the rate of return associated with engaging in silviculture or agriculture will rise.

<sup>36</sup> The Department estimates that 18 percent of the corporations own 90 percent of the acreage.

Alternatively, if the landowners have other sources of income (and this is likely to be the case for diversified corporations), they may decide not to wait to clear until the agricultural economy recovers and the returns to the investment in conversion are positive. Losses from developing and selling bottomlands or converting and cultivating bottomlands can be used to reduce tax liabilities from other enterprises. Although Swampbuster and tax reform will have imposed capital losses on the landowners, agricultural development may still prove to be the alternative that minimizes losses.

Finally, the corporate owners can sell the land at the reduced prices forced by the depressed agricultural economy, Swampbuster, and tax reform. The options confronting the new owners will not be any different, however: agriculture or silviculture, with agriculture being the most likely sector.<sup>37</sup> Thus, although the destiny of these lands is somewhat uncertain, their tenure as pristine hardwood forests seems limited.

#### **Non-Corporate Owners:**

The Department estimates that half of the forested bottomland acreage is held by non-corporate owners and half of this is in relatively small tracts. Small tract size can raise the cost of managing the timber stands for optimal yields and of harvesting the timber. Even if the cost disadvantages could be overcome, small tract size offers little promise of profits sufficient to justify the management effort because of the generally poor quality of the standing timber. Further, timber management is rarely practiced by small woodlot owners. Surveys of owners' objectives indicate that 29-58 percent plan to use their land to grow timber, but most of these have no intention of managing the stands. Only 10 percent plan to employ management practices.

While the non-corporate owners do not seem disposed to manage the land for optimal timber yield, it is also unlikely that they will develop the land for agriculture as owner-operators. Most of the non-corporate owners of forested bottomland tracts are not farmers: only 1.8 percent of those in the Department's survey identified their primary occupation as farming. Further adding to the uncertainty about the destiny of these lands is the fact that the owners tend to be elderly: over 80 percent of the acreage is owned by people over age 50. Thus, the land is likely to change hands soon, and like the large, corporately owned tracts, the destiny of the small woodlots is uncertain. Although their development may not be imminent, their future as hardwoods is clearly not secured, either, and it seems likely that the agriculture sector will ultimately absorb them.

## **Conservation Opportunities in the Current Economic Climate**

The reduction of economic returns to agricultural development of the forested wetlands due to the current economic climate and the recent legislative reforms may create low cost conservation opportunities. Tax reform and Swampbuster lowered the commercial value of wetlands, and this reduction is temporarily amplified by current economic conditions. The price at which the landowners will be willing to sell the land or grant a conservation easement will have fallen, providing an economical opportunity to conservation organizations (State, local, Federal, and private) for wetlands protection. This opportunity for wetlands conservation at budgetary savings may or may not be short-lived, depending upon the length of the agricultural economic cycle.

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<sup>37</sup> Lower prices for land could alter the relative profitability of agriculture versus silviculture and result in a resurgence of forestry in the Delta, but this seems unlikely given the market for hardwoods, natural features in the Delta which restrict the extent and rate of tree growth, and the current characteristics of landowners.

Whatever the decision regarding increased public acquisition, educational and market-organizing programs could be invaluable in promoting forestry in the Delta. The analysis for the perceptive landowner assumed that once the value of the land as hardwoods is acknowledged, forestry management will occur, hunting leases will be sold, and the likelihood of clearing for agricultural development will diminish. This may apply to the corporate landowners, but it is a most optimistic assumption for the small woodlot owners, even though tax reform and Swampbuster have reduced the potential returns from conversion. As indicated above, there is substantial evidence that small woodlot owners are reluctant to utilize forestry management practices.

Educational programs could be used to promote the recognition of the economic value of the land in its natural state and induce forestry management, but the economic climate may need to be enhanced as well, e.g., the development of timber marketing cooperatives and improved contracting between the larger timber companies and small woodlot owners. Also, aggressive actions to formalize the market for hunting leases, perhaps using the State game departments as clearing houses for willing buyers and sellers, may improve the prospects for profitable, recreational use of the land. Both educational and market-organizing programs could be conducted at modest cost, and although the resulting forested lands might not be pristine, they would be far closer to undisturbed bottomlands than agricultural land, and would conserve many of the original environmental values.

### **Summary of the Impact of Federal Programs on Conversion of Forested Wetlands in the Delta**

1. During the period 1935-1984, tributary flood control and drainage projects played a more important role in wetland depletion in the Delta than any other factor, although natural hydrologic conditions, the mainline levee system, conversion costs, dry weather, and increases in real agricultural product prices were also important.
2. Wetlands depletion attributable exclusively to the influence of tributary flood control and drainage projects built between 1935 and 1984 (essentially the Tributary Features of the MR&T and SCS small watershed projects) amounted to approximately 25 percent of total depletion (Table III-7).
3. The joint effect which natural topography and the mainline levee system had on conversion during the period 1935-1984 was only slightly less than that of the tributary projects constructed during that period.
4. The effect of rising farm product prices on wetland conversion ranked below the effects of all other economic, hydrological, and climatic factors except net revenue from forestry. In particular, rising farm product prices induced about half as much clearing as the tributary flood control and drainage projects which were constructed between 1935 and 1984.
5. Under current, depressed market conditions there are limited opportunities for profitable conversion and development of wetlands in the Delta.
6. Making crops grown on converted wetlands ineligible for Federal agricultural income and price support programs reduces the economic return to and increases the risk associated with conversion and agricultural development in the Delta.
7. Eliminating special tax code provisions which favored conversion of wetlands to agricultural land also reduces the economic return to and increases the risk associated with conversion and agricultural development in the Delta, but not by as much as elimination of the agriculture programs.

8. The combined effect of ineligibility for agricultural support programs and elimination of those tax deductions which favored conversion has a very significant impact on the economic feasibility of bottomland conversion and development: the rate of return to the investment is reduced dramatically and the risk increased.
9. Although under current (1975-1984) economic conditions bottomland development has only marginal economic feasibility, the future for these wetlands is quite uncertain and over the long run the wetlands in the Delta will be susceptible to agricultural development whenever economic conditions yield high returns in agriculture.
10. The reduction of economic returns to agricultural development of the forested wetlands due to the current economic climate and the recent legislative reforms may create a temporary, low cost opportunity for conservation (State, local, Federal, and private). Tax reform and Swampbuster reduced the commercial value of wetlands, and this reduction is temporarily amplified by current economic conditions. These events depress the price at which the landowners are willing to sell land or grant conservation easements.
11. Educational programs might be used to promote the recognition of the economic value of the land in its natural state and induce forestry management, but the economic climate may need to be enhanced as well, e.g., the development of timber marketing cooperatives and improved contracting between the larger timber companies and small woodlot owners. Also, aggressive actions to formalize the market for hunting leases, perhaps using the State game departments as clearing houses for willing buyers and sellers, may improve the prospects for profitable, recreational use of the land.

## APPENDIX III-1: Econometric Model of Forested Wetland Conversion

The model of forested wetland conversion consists of a land-conversion relationship (equations 3.1a, 3.2a, and 3.3a) and a set of agricultural yield functions (equation 3.4a). The land-conversion relationship can be used independently of the agricultural yield functions. Indeed, most of hypotheses were tested using only the land-conversion relationship. The agricultural yield functions were developed for a very limited purpose, described below.

The land-conversion relationship expresses the percentage change in the forested acreage in county  $i$  ( $i = 1, \dots, 36$ ) during period  $t-1$  to period  $t$  (a five-year interval, there being 10 such during the study period 1935-1984) as a function of relevant climatic, hydrologic, and economic variables. In particular, the explanatory variables in the land-conversion equation include:

- the variables which affect net agricultural revenue (prices, yields, acreages, and production costs for four crops -- soybeans, cotton, rice, and corn);
- the variables which affect forestry net revenue (prices, volumes, growth rates, and yields of sawlogs and pulpwood);
- artificial flood protection and drainage (acreage protected) provided by Federal projects built between 1935 and 1984;
- a variable measuring the combined extent of natural flood protection and drainage (provided by the topography of the land) and the protection provided by the mainline levee system;
- weather conditions (precipitation, solar radiation, and flood stages of the Mississippi River); and
- the costs of converting forested wetlands to farmland.

According to the Corps and the SCS, flood control and drainage projects provide two types of benefits: "flood-control benefits" (benefits associated with the increased expectation of successful crop production) and "yield-intensification benefits" (benefits derived from the increased productivity of protected lands). In order to estimate the impact which each of these two types of benefits had on wetland conversion, yield functions were developed and included in the model. The yield equations express crop yields as a function of:

- artificial flood protection and drainage;
- technological change;
- meteorological factors; and
- environmental factors (differences in soil qualities across counties).

The model is given below, followed by an explanatory discussion of the equations:

$$\text{FORCH}_{it} = a_{0i} + [a_1 \text{AGREVA}_{it} \text{PROB}_{it} + a_2 \text{AGCOS}_{it} + a_3 \text{FNRA}_{it} + a_4 \text{CONVCS}_{it}] (\text{FORAV}_{it} / \text{MAVAC}_i) + u_{1it} \quad (3.1a)$$

$$\text{PROB}_{it} = 1 / [1 + e^{-P(X)}] \quad (3.2a)$$

$$P(X) = [b_0 + b_1(\text{ACCU}_{it} + \text{SCCU}_{it}) + b_2(1 - \text{FLRISK}_i)] e^{b_3 \text{PHDI}_{it}} \quad (3.3a)$$

$$\text{YIELD}_{ijt} = c_j + d_{1j}(\text{ACCU}_{it} + \text{SCCU}_{it}) + d_{2j} \text{PHDI}_{it} + d_{3j} \text{DSCHG}_t + d_{4j} \text{TIME}_t + u_{2it} \quad (3.4a)$$

- where  $FORCH_{it}$  = percentage change in forested acreage of county  $i$  during the period  $t-1$  to  $t$ ;
- $FORAC_{it}$  = forested acreage in county  $i$  ( $i = 1, \dots, 36$ ) at time  $t$  ( $t = 1, \dots, 10$ ), with  $t-1$  indicating a one-period (five-year) lag;
- $FORAV_{it} = (FORAC_t + FORAC_{t-1})/2$ , i.e., the average forested acreage in county  $i$  during the period  $t-1$  to  $t$ ;
- $MAVAC_i$  = total acreage of county  $i$  within the Lower Mississippi Alluvial Plain;
- $AGREVA_{it}$  = real agricultural revenue per acre in county  $i$  during the period  $t-1$  to  $t$ ;
- $PROB_{it}$  = expected probability of successful crop production, a measure of the average suitability of the land in county  $i$  for agriculture during the period  $t-1$  to  $t$ ;
- $AGCOS_{it}$  = real agricultural cost of production per acre in county  $i$  during the period  $t-1$  to  $t$ ;
- $FNRA_{it}$  = real forestry net revenue per acre in county  $i$  during the period from  $t-1$  to  $t$ ;
- $CONVCS_{it} = (CONVCO_t)(e^{PHDI_{it}})$ ;
- $CONVCO_{it}$  = real cost of conversion (per acre) in county  $i$  during the period  $t-1$  to  $t$ ;
- $ACCU_{it}$  = area protected by U.S. Army Corps of Engineers flood control and drainage projects in county  $i$  at time  $t$  (i.e., cumulative project construction through year  $t$ ), measured as a percentage of total county acreage, such that  $0 \leq ACCU \leq 100$ ;
- $SCCU_{it}$  = area protected by Soil Conservation Service flood control and drainage projects in county  $i$  at time  $t$  (i.e., cumulative project construction through year  $t$ ), measured as a percentage of total county acreage, such that  $0 \leq SCCU \leq 100$ ;
- $FLRISK_i$  = percentage of county  $i$ 's land area naturally subject to flooding, measured such that  $0 \leq FLRISK \leq 100$ ;
- $PHDI_{it}$  = estimated average soil moisture in county  $i$  during period  $t-1$  to  $t$ , measured by the Palmer Hydrological Drought Index, varying from approximately  $-4$  for intense drought to  $+4$  for extremely wet conditions, based upon current and lagged precipitation and solar radiation;
- $YIELD_{ijt}$  = average yield of crop  $j$  in county  $i$  during period  $t-1$  to  $t$ ;
- $DSCHG_t$  = discharge of the Mississippi River, north of the study area;
- $TIME_t$  = a linear trend as a proxy for technological change;
- $a_{ot}$  = a temporal intercept accounting for time period differences;
- $a_q$  = parameters (slope coefficients) on indicated variables, where  $q = 1, 2, 3, 4$ ;
- $u_{lit}$  = error term with mean zero;
- $b_h$  = parameters on indicated variables, where  $h = 0, 1, 2, 3$ ;
- $c_{ij}$  = intercept for county  $i$  in the yield equation for crop  $j$ , accounting for differential effects associated with varying soil quality in different counties;

$d_{sj}$  = parameters for the  $j$  yield equations (where  $s = 1,2,3,4$  and  $j = 1,2,3,4$ );

$u_{2it}$  = error term with mean zero;

In equation 3.1a, the product of AGREVA and PROB gives the expected real agricultural revenue per acre in county  $i$  during the period  $t-1$  to  $t$ . The probability function (from equations 3.2a and 3.3a) takes account of the cumulative protection of Federal flood control and drainage projects in county  $i$  at time  $t$  (ACCU + SCCU);<sup>1</sup> the degree to which county  $i$  is protected from flooding by the natural lay of the land ( $1 - \text{FLRISK}$ ); and climatological conditions, as reflected in an index of the average soil moisture in county  $i$  during period  $t-1$  to  $t$  (PHDI). (For a discussion of the form of equation 3.2a see Stavins 1986a.)

It is important to note in the definitions of ACCU and SCCU that these are cumulative variables, and account for the current flood protection and drainage benefits provided by all past construction. It is entirely possible that current clearing might be related not just to construction of Federal projects in the present period, but to projects which were constructed in previous periods, as well. The model is structured in this way to account for both current and lagged impacts of flood control and drainage projects. The study period begins in 1935, and, through ACCU and SCCU, accounts for all flood protection and drainage provided by Federal projects after that date, i.e., the benefits of the Tributary Features of the MR&T and the SCS small watershed projects.

In addition to the tributary projects, it is important to include a variable to account for the flood protection benefits provided by the mainline levee system. Eighty percent of the mainline levee system authorized in 1928 was complete by 1934, and about 90 percent of the system authorized in 1941 was complete by 1945. Indeed, the entire mainline levee system can be viewed as effectively complete by 1937, since the system has not been breached since that date.<sup>2</sup> Thus, virtually from the beginning of the study period the mainline levee system was in place and providing protection.

Direct data on the area protected by the mainline levee system are not available. However, the Corps estimates this protected area to be roughly proportional to the area flooded by the 1927 flood.<sup>3</sup> Consequently, a variable called MNLN was constructed and included in equation 3.3a inside the square brackets. As expected, it was highly correlated with ( $1 - \text{FLRISK}$ ), and created serious multicollinearity problems. Thus, MNLN was omitted from the model. As a result, the estimated value for  $b_2$  contains omitted variable bias and is upward biased. Consequently, the estimated value for  $b_2$  should be interpreted as the combined effect of the natural topography and the mainline levee system. Thus, any estimated impact on the forested wetlands by ACCU and SCCU is due exclusively to secondary or interior levee development, not to the mainline system.

The next two terms in equation 3.1a are self-explanatory: they account for real agricultural production costs (AGCOS) and the real net revenue from forestry (FNRA).

One has to be careful when interpreting the next term in equation 3.1a. CONVCS is not simply the cost of land conversion in county  $i$  during period  $t-1$  to  $t$ , but rather the product of the cost of land conversion and a function which reflects soil moisture in county  $i$  during the period in question. CONVCS was structured in this way, because soil moisture has the effect of increasing conversion costs, due to the difficulty of moving heavy machinery onto the land and

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<sup>1</sup> An effort was made to distinguish between the impacts of Corps and SCS projects. Because the estimated parameter values for the separate Corps and SCS variables proved statistically equivalent, the analysis was conducted with one variable, representing the combined impact of Corps and SCS projects.

<sup>2</sup> Richard Stuart, Lower Mississippi Valley Division, U.S. Army Corps of Engineers in a private communication, July, 1985.

<sup>3</sup> Ibid.

the difficulty of achieving satisfactory burns of felled timber and brush. Thus, any estimated values for  $a_4$  have to be interpreted as the effects of conversion costs as they are affected by soil moisture.

The variables within the first set of square brackets in equation 3.1a take account of major economic, hydrologic, and climatic factors which might reasonably be expected to influence land conversion. If these variables were entered in an unadjusted form, however, there is a strong possibility that the model would be misspecified. If the explanatory variables were to take on values which would be expected to induce significant conversion, but all the forested acreage in county  $i$  had already been cleared ( $FORCH = 0$ ), the model could predict further conversion. This would be unrealistic. In order to avoid this problem and obtain accurate estimates of the coefficients, these variables were scaled by the percentage of county  $i$  which was forested during period  $t-1$  to  $t$  ( $FORAV/MAVAC$ ).

Equation 3.4a is largely self-explanatory. The YIELD function estimates the average yield of crop  $j$  in county  $i$  during period  $t-1$  to  $t$  as a function of: artificial flood protection and drainage ( $ACCU + SCCU$ ); technological change ( $TIME$ ); meteorological factors ( $PHDI$  and  $DSCHG$ ); and differences in soil qualities across counties ( $c_{ij}$ ). The model has the flexibility to accept either historic yields or simulated yields from equation 3.4a in  $AGREVA$ .

APPENDIX TABLE III-1: LAND CONVERSION EQUATION; ESTIMATION RESULTS UNDER ALTERNATIVE SPECIFICATIONS

Parameter	Variable	VC	VI	VIII	IX	XI	XII	XIV	XV
a <sub>0</sub>	Constant	-0.01629 (-4.78) <sup>a</sup>	b <sub>0</sub> -	-0.1563 (-4.60)	b <sub>0</sub> -	-0.01626 (-4.81)	b <sub>0</sub> -	-0.01560 (-4.63)	b <sub>0</sub> -
a <sub>1</sub>	AGREVA	-0.000382 (-6.15)	-0.000333 (-5.68)	-0.000369 (-6.11)	-0.000327 (-5.75)	-0.000381 (-6.16)	-0.000335 (-5.63)	-0.000370 (-6.18)	-0.000327 (-5.66)
a <sub>2</sub>	AGCOS	-0.000061 (0.89)	0.000045 (0.69)	-	-	0.000056 (0.82)	0.000045 (0.69)	-	-
a <sub>3</sub>	FNRA	0.001869 (2.38)	0.001906 (1.83)	0.001590 (2.10)	0.001531 (1.52)	0.001804 (2.33)	0.001865 (1.79)	0.001542 (2.05)	0.001495 (1.48)
a <sub>4</sub>	CONVCS	0.001745 (2.63)	0.001896 (2.91)	0.001748 (2.65)	0.001839 (2.84)	0.001759 (2.69)	0.001890 (2.91)	0.001757 (2.70)	0.001826 (2.79)
b <sub>0</sub>	Probability Constant	-2.3204 (-2.72)	-2.60 (-2.28)	-2.42 (-2.76)	-2.76 (-2.42)	-2.37 (-2.77)	-2.57 (-2.27)	-2.45 (-2.85)	-2.75 (-2.31)
b <sub>1</sub>	ACCUH-SOCU	0.1700 (2.20)	0.1448 (2.22)	0.1774 (2.25)	0.1472 (2.32)	0.1692 (2.23)	0.1421 (2.26)	0.1764 (2.33)	0.1465 (2.37)
b <sub>2</sub>	(1-FRISK)	0.02862 (2.00)	0.03220 (1.95)	0.02823 (1.89)	0.03242 (1.86)	0.02979 (2.07)	0.03087 (1.83)	0.02892 (1.97)	0.03091 (1.72)
b <sub>3</sub>	PHDI	-0.06691 (-0.47)	-0.10818 (-0.52)	-0.04229 (-0.30)	-0.12568 (-0.59)	-	-	-	-

a<sub>1</sub>-statistics appear in parentheses below the coefficient estimates. A t-statistic indicates the level of confidence one can have in the estimated values for the parameter. A t value of ± 1.96 indicates a 95% level of confidence; a t value of ± 1.645 indicates 90%.

<sup>b</sup>A constant term (a<sub>0t</sub>) was estimated for each time period, but the individual coefficients are not reported here. Roman numerals refer to different versions of the model. See Stavins 1986a and 1986b for details.

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## THE PRAIRIE POTHOLE REGION

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This chapter examines the effect of Federal agriculture programs, water management programs, highway programs, conservation programs, and income tax provisions on farm operators' decisions to drain prairie potholes. The chapter has three major purposes:

- identify potential causes of wetland loss in the Prairie Pothole Region (Prairies) of eastern Montana, North Dakota, South Dakota, Minnesota, and Iowa;
- identify Federal programs which have stimulated wetland conversion; and
- examine the overall importance of Federal incentives to drain wetlands.

Although prairie pothole losses have been attributed to construction of highways, dams, reservoirs, and irrigation systems, soil erosion and siltation, urban sprawl, and pollution, the majority of prairie pothole losses have been due to conversion to cropland.

From the early 1960's to the present, a general shift in the structure of agriculture has occurred in the Prairies, involving increased farm size, larger farm machinery, irrigation, and other intensive farming practices. All of these changes have accelerated drainage of prairie potholes. Historically, small grain and row crop agriculture has been the primary land use in the Prairies and, along with livestock grazing, has strongly influenced land use patterns. Wetland drainage in this region has been an important means of bringing more land into crop production and increasing yields on existing cropland.

Economic factors are often cited as reasons why farmers choose to drain wetlands in the Prairies. Wetlands are frequently viewed as a nuisance which result in production losses to farmers and necessitate irregular and inefficient planting patterns. Farm equipment can become mired and damaged in the unstable wetland perimeter. Wetland waterfowl may feed on nearby crops, further adding to production losses. Finally, the wetland represents a foregone source of income to the farmer: the farmer is not realizing income he would receive if these areas were drained and cropped. This opportunity cost increases as land values and crop prices rise.

### Description of the Region

The Prairie Pothole Region (Figure IV-1) began forming about 12,000 years ago as glaciers receded from the central portion of North America. Retreating ice left behind millions of depressions in glacial drift that held rainfall and snowmelt, forming lakes and wetlands. The area's name comes from the small, shallow depressions which are scattered throughout the region. The Prairies include portions of Montana, North Dakota, South Dakota, Iowa and Minnesota and extend northwest into Manitoba, Saskatchewan and Alberta. The Prairies cover about 227,000 square miles of which about 60,000 lie in the United States. Originally there were about 20 million acres of prairie wetlands in the United States; only about 7 million acres or 35 percent of the original prairie potholes remain intact.

Prairie potholes are among the most important and also most threatened ecosystems in the United States. They are prime nesting grounds for many species of North American waterfowl.

Up to 50 percent of the United States production of migratory waterfowl is raised in the United States portion of the Prairies in some years. Such wetlands with associated nesting cover are thought to be the most important factor regulating production of waterfowl. Prairie pothole ecosystems support numerous other forms of wildlife, including deer, mink, raccoon, muskrat, fox, rabbit, and pheasants. Additionally, the roles that prairie potholes play in hydrologic cycling, vegetative diversity, and removal of chemicals from runoff water are thought to be extremely important.

While approximately 20 percent of all remaining prairie potholes are protected,<sup>1</sup> North Dakota's prairie potholes are being drained at an estimated rate of 20,000 acres per year. Nearly all prairie potholes that are susceptible to drainage are on privately owned land in an extensively cultivated region. Prairie potholes that remain unprotected today are of all types. Most of those easiest and least costly to drain have already been drained, leaving behind those which are less profitable to convert or those on which there is a constraint to drainage (e.g., absence of an outlet). Despite the higher conversion costs, however, drainage continues.

The method of draining wetlands in cropland changes from subsurface tiles to surface ditches as one moves northwestward across the pothole region. Nearly all drainage in the Dakotas and on the Canadian prairies has been through surface ditches. This is due both to topography and the fact that land values do not support the higher per acre investment for subsurface tile

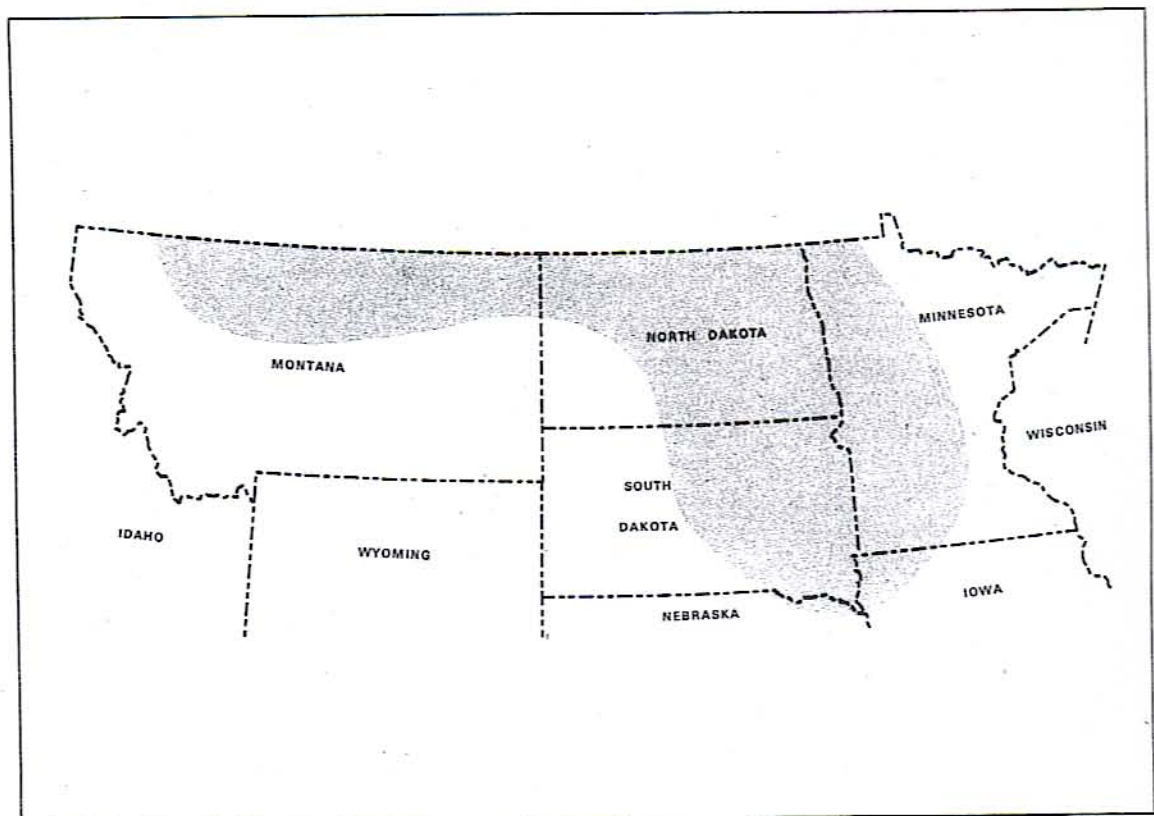


FIGURE IV-1: PRAIRIE POTHOLE REGION OF NORTH AMERICA

<sup>1</sup> Protection includes, but is not limited to: ownership by Federal or State governments, short- and long-term government easements, and private conservation group ownership.

drainage systems. Some land leveling is done in the Red River Valley where land values are high; however, there are few natural potholes left in the Valley. Drainage is often done in the fall, after crops have been harvested and fields are dry. Today's high horsepower, four wheel-drive tractors enable prairie farmers to do much of their own drainage. Farm operators have the know-how, the equipment, and the capital to drain prairie potholes in many instances.

Land tenure and farm size are dynamic in the Prairies. Any single tract of privately owned Prairie land may eventually be operated by an advocate of drainage. Thus, even though farm operators at a given time may support wetland conservation and not be considering drainage, land ownership will eventually change. Development-oriented operators may have much stronger desires to drain. Once drained, wetlands tend to remain drained, since the costs of drainage and the potential net returns are capitalized into the price of drained farmland. Anyone who pays a higher price for already drained land is not likely to restore wetlands or allow ditches to go unmaintained. Thus, although restoration is technically possible, drainage is generally a one-way process: once wetlands are converted to cropland, farm-level economics precludes reversion to wetland.

## Cultural History

Settlement of the northern portion of the Prairies began in the 1870's with the end of the Indian wars, following first a period of fur trade (early 1800's), then a military period (through 1860's), and the coming of railroads in the 1870's. The region remains sparsely populated by descendants of Scandinavian and other European settlers. The first settlers who came to farm the glacial drift found that the prairie was sometimes hilly or rocky and frequently too wet for cultivation. Settlement was accelerated by the Homestead Act of 1862, extensions of railroads and stage lines, road building, and improved river transportation. The Swamp Lands Acts of 1849 and 1850 included 874,000 acres in Iowa and promoted drainage of wetlands that were seen as impediments to settlement. The 1860 Act expanded coverage to 4.7 million acres in Minnesota and the Dakotas. Flooding was a major problem in the late 1800's and early 1900's, and publicly assisted drainage began as early as 1885.

Direct government subsidies to convert prairie potholes to cropland continued through the 1960's and into the 1970's, when environmental interests succeeded in stopping most overt Federal support of on-farm wetland drainage. However, the view of wetlands as obstacles to progress continues in the minds of many prairie farmers and others promoting economic development. For example, the reaction of local, elected officials to the Swampbuster provisions of the Food Security Act of 1985 has generally been to encourage legalization of past, current, and desired future drainage through expedited processing of drainage permits just prior to enactment and promoting legislative modifications or exemptions.

Agriculture remains the backbone of economic activity in the Prairies. Variation in the growing season and rainfall across the Prairies brings about differences in crops, from corn and soybeans in southern Minnesota and Iowa to canola and barley in Alberta. Except for these differences in crops grown, the prairie landscape, with its numerous potholes and drainage ditches, is essentially similar across the region.

## Structure of Studies

The Department conducted two separate studies to examine the effect which Federal agriculture programs and tax provisions have had on the incentives and farmers' decisions to convert prairie potholes to agriculture. A farm level simulation model was used to estimate the effect of various programs on the net present values of six representative farm types (McColloch and Wissman 1986). A review of past research augmented by selected case studies and focus group interviews was also conducted (Leitch and Nelson 1986). In addition, the Department examined

the extent to which runoff ditches for federally aided roadways have been used by farmers as outlet ditches for draining prairie potholes and the impact which the construction of Federal dams, reservoirs, channels and irrigation systems have exerted on wetlands in the Prairies. Time series data on wetland losses are not available for the Prairies, and hence, a statistical analysis like that done for the Delta could not be conducted.

One technique used throughout the analysis to determine the impact which a Federal program had on wetland conversion was to assume that landowners who converted wetlands to agriculture would be selectively ineligible for program benefits. For example, when analyzing the effect of agricultural price supports, it was assumed that they were withheld only from selected farm operators and not eliminated altogether.

#### **Descriptive Study:**

Past research was reviewed in order to summarize the findings and to identify the analytical methods used. A description of farm-level drainage decision-making was developed as an aid in understanding how different incentives may affect farm operators in general and each of three specified farm types in particular. (See Appendix Table IV-1 for description of farm types.) A decision-making framework including legal feasibility, financial feasibility, economic feasibility, intangible site and personal factors, and random variables (e.g., weather) was developed, with emphasis on on-farm drainage economics and the role of Federal programs. Finally, farm operators were interviewed to obtain up-to-date insights from active agricultural producers and to discover their rationales for past drainage.

#### **Simulation Model:**

The simulation model for the Prairies was similar in structure and concept to the one used for the analysis of the Delta.<sup>2</sup> The Prairie model simulated six representative farms over a 10-year planning horizon (1975-1984). For each of the representative farms the model performed 50 iterations during a stochastic analysis. These six sets of 50 values were used to calculate means and variances for the NPVs on the representative farms.

Simulation results were used to assess effects of Federal programs on wetland conversion given historic production costs, crop prices, taxes, and other key variables. A detailed discussion of all the data, data sources, and how they were utilized by the model can be found in the background study (McColloch and Wissman 1986). Only a brief discussion of the model and the data is given here.

The most recent 10-year time period for which data were available was the period 1975-1984. This was a period of price support activity and of both high prosperity (early 1970's) and declining farm income (1979 and on). The diversity of this period, combined with the availability of adequate and complete data sources for the simulations, made 1975-1984 a good period to examine. Though the results are historical, they are not out-dated.

The Prairie simulation model does not predict outcomes; rather it was designed to test hypothetical conditions. For example, if simulation "A" is conducted with a set of programs in-place, and simulation "B" is conducted with one of the programs removed, the economic influence of the eliminated program can be estimated by comparing net present values (NPVs) and coefficients of variation (cvs). NPV is used as a statistic for comparison because it represents the change in net worth of the farming operation over the 10-year simulation period. The coefficient of variation associated with a particular NPV serves as a measure of the risk of farming under the specified circumstances.

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<sup>2</sup> The simulation model utilized was the Farm Level Income and Policy Simulation Model (FLIPSIM) developed by James W. Richardson and Clair J. Nixon in 1981. A full description of the model appears in the background study (McColloch and Wissman 1986).

In order to estimate the economic effect (and, therefore, the potential effect on drainage) of each program examined, the NPV and cv of a baseline scenario which includes all programs was compared to the NPV and cv of a simulation for which the program under review was eliminated. Thus, the influence of the program on these statistics at the end of the 10-year simulation period for similar drained and undrained farms was quantified. If the presence of a program increased NPV to a greater extent on a drained than on an undrained farm, it can be assumed to have offered an incentive to drain. Similarly, if cv fell (i.e., the risk of farming was reduced), the program also encouraged drainage.

The basic procedure involves three general steps:

1. Calculate NPV and cv for a representative farm with all Federal programs and without drainage;
2. Calculate NPV and cv for a representative farm with all Federal programs and with drainage of all wetlands; and
3. Remove the program of interest from NPV calculations 1 and 2 to estimate how that program contributed to NPV and affected the riskiness of farming.

In order to run the simulation model, a large amount of data is required for each representative farm. These requirements include information on production inputs, policy guidelines and benefits, and selected financial information on the farm and farm family. Two key inputs were historic prices and yields. Secondary data sources were used, with most of the data obtained from individuals in local Federal land banks, production credit associations, commercial banks, and county extension services. Appendix Table IV-2 lists the data requirements and sources used.

To account for factors such as crop mix, farm size, climate and region, six model farms, representative of the sizes and types of farms found in the Prairies were simulated. (See Appendix Table IV-3 for a description of the representative farms and Appendix Figure IV-1 for a map showing the location of the representative counties.) Each of the six model farms included a specified amount of drainable wetlands along with noncrop acreage based on the average noncrop acreage in that area. Every effort was made to insure model farms were representative of the area. Each farm was allowed to increase cropland acreage only by drainage. Land purchase or leasing was not allowed in the model. Each farm was modelled with moderate debt and high debt to test the effects of Federal programs on farms with varying debt structures.<sup>3</sup>

## Results of the Simulation Analysis

The results of the simulation analysis are given in Table IV-1. The analysis was conducted by first calculating two baseline net present values (NPV)--one with wetlands drained and the other without drainage--for each of the six representative farms. These baseline scenarios represent the net present values of each of the farms at the end of the 10-year simulation period (1975-1984). NPV measures the profitability of the representative farms over time, and is an estimate of the accumulated returns to labor, management, and capital over the simulation period.

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<sup>3</sup> A no or low debt farm operation was not simulated. The analytic results for moderate and high debt farms were not significantly different. Consequently, the discussion addresses only the results for moderate debt farms. It has been reported that in 1986, 45 percent of the Nation's farm operators were debt free, another 40 percent had their debt under control (moderate debt), and the remaining 15 percent were in financial trouble (high debt).

TABLE IV-1: NPV (IN DOLLARS) OF REPRESENTATIVE FARMS, WITH AND WITHOUT SELECTED PROGRAMS/POLICIES, UNDER CONDITIONS OF MODERATE DEBT

(1) Program/Policy Removed <sup>a</sup>	DRAINED						(7) Farm 6 NPV (cv) Rank
	(2) Farm 1 NPV (cv) Rank	(3) Farm 2 NPV (cv) Rank	(4) Farm 3 NPV (cv) Rank	(5) Farm 4 NPV (cv) Rank	(6) Farm 5 NPV (cv) Rank		
(1) Large equipment	292,531 (13.1) 1	90,853 (46.9) 1	304,512 (10.5) 1	392,079 (8.6) 2	N/A	1	N/A
(2) ASCS cost share	274,890 (11.9) 2	82,355 (44.7) 3	292,383 (10.2) 2	390,134 (7.4) 3	114,219 (16.2) 2	2	209,479 (5.0) 2
(3) Income tax expense	274,713 (11.9) 3	82,437 (44.2) 2	292,140 (10.0) 3	390,682 (7.4) 1	113,670 (15.8) 3	3	208,643 (5.1) 3
(4) Baseline	274,700 (11.9) 4	82,028 (44.6) 4	292,134 (10.0) 4	389,788 (7.5) 4	113,575 (15.8) 4	4	208,345 (5.1) 4
(5) Disaster assistance	273,286 (12.2) 5	76,650 (50.6) 5	292,020 (10.3) 5	389,788 (7.5) 5	113,574 (15.8) 5	5	208,346 (5.1) 5
(6) Interest subsidy	261,546 (12.7) 6	62,797 (67.0) 6/7	280,584 (10.9) 6	380,121 (7.6) 6	105,427 (18.3) 6	6	202,409 (5.2) 6
(7) Price and income supports	256,673 (14.6) 7	51,994 (82.3) 9	267,929 (15.3) 7	373,937 (9.6) 7	104,529 (16.7) 7	7	193,817 (7.5) 7
(8) ALL programs	242,110 (16.0) 9	27,824 (179.4) 13	255,426 (16.6) 8/9	365,036 (9.8) 8	96,765 (19.9) 8	8	179,576 (8.6) 9
(9) Preservation programs	249,895 (12.4) 8	12,912 (215.8) 14	250,840 (10.4) 8/9	330,476 (7.9) 9	54,838 (23.4) 9	9	182,759 (5.1) 9
(10) Large equipment	237,065 (13.6) 10	62,727 (39.9) 6/7	187,860 (12.2) 11	242,730 (9.1) 12	N/A	10	N/A
(11) Baseline	219,002 (12.5) 11	46,476 (44.4) 8	178,564 (9.7) 12	241,867 (7.2) 11	28,203 (32.0) 13	12	139,995 (4.9) 12
(12) Disaster assistance	216,952 (12.8) 12	45,735 (45.6) 10	178,481 (11.4) 13	241,135 (7.2) 13	28,271 (32.0) 12	13	139,812 (4.9) 13
(13) ALL programs	216,137 (17.7) 13	-23,332 (151.0) 15	213,522 (18.7) 10	305,660 (10.8) 10	36,588 (35.8) 11	11	168,777 (6.5) 11
(14) Interest subsidy	202,901 (14.2) 14	37,097 (61.4) 11	163,671 (13.7) 14	232,771 (7.6) 14	18,090 (54.8) 14	14	133,461 (5.5) 15
(15) Price and Income supports	202,796 (15.4) 15	32,312 (71.9) 12	163,344 (20.7) 15	230,009 (9.3) 15	20,390 (41.1) 14	14	139,154 (5.4) 14

a. Only the program/policy listed was removed from the simulation; all others remained intact.  
 b. Rank represents the order in which farm operators would prefer combinations of NPV and cv. In only one case, farm 2 in rows (7) and (11), is the risk (cv) of a higher NPV great enough for a lower NPV with lower risk to be preferred.

The baseline scenarios include all programs that were analyzed. Thus, baseline NPVs reflect participation in all of the following programs:

- FWS easement;
- cost sharing for drainage;
- price and income supports;
- disaster assistance/crop insurance;
- Water Bank;
- interest rate subsidies; and
- income tax expensing of drainage costs.

The baseline net present values for both the drained and the undrained states are given in Table IV-1. The corresponding coefficients of variation appear in parenthesis.<sup>4</sup> For brevity the baseline discussion is limited to the NPVs.

Row (4) of the table presents baseline NPVs for each of the six representative farms when all wetlands are drained. Row (11) presents baseline NPVs when all wetlands are undrained. Each of the other rows in Table IV-1 presents the NPVs at the end of the 10-year simulation period in the absence of the indicated program. Thus, the impact that a program has on the NPV of a particular farm is given by the difference between the baseline NPV and the NPV in the row without the program.

For example, with all programs included the baseline NPV for farm 1 is \$274,700 with wetlands drained (row 4, column 2). When price and income support payments are removed, the ending period NPV for farm 1 with wetlands drained is \$256,673 (row 7, column 2). Thus, the impact of price and income support payments on the NPV of drained farm 1 is \$18,027. Similarly, when the interest subsidy is removed, the ending period NPV for farm 1 is \$261,546 when drained (row 6, column 2), and the effect on NPV is \$13,154 (from \$274,700 less \$261,546).

In Figure IV-2, the net present values from Table IV-1 are graphed. NPVs are measured on the vertical axis with the modelled scenarios on the horizontal axis. The most striking result of the analysis is immediately apparent in Figure IV-2: for all farms, under all scenarios, net present values were higher when wetlands were drained. Thus, drainage always improved a farm's income, whether or not a particular program was in force.

#### Price and Income Supports:

Price and income support programs were designed to raise farmers' incomes and to stabilize commodity prices. Both these objectives are reflected in the results in Table IV-1. As expected, for both the drained and undrained farms, NPVs fell when the price and income support programs were removed. And, as indicated previously, NPV was higher in the drained than undrained state (Figure IV-2). The price and income support programs increased NPVs more for drained than for undrained farms, simply because more acres were farmed on the drained farms.

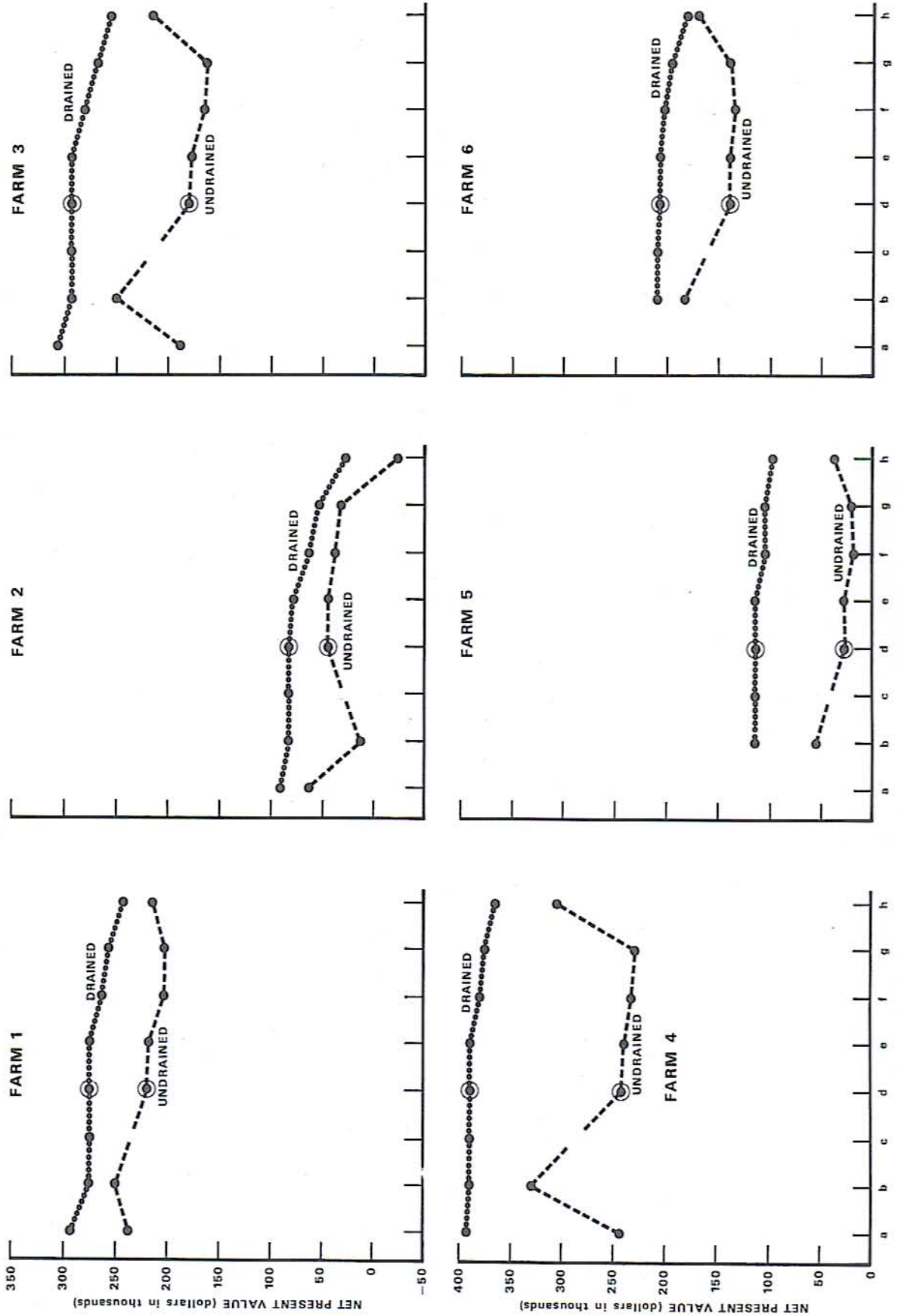
In every case the risk of farming, as measured by the coefficient of variation (cv), increased in the absence of price and income support programs. For example, undrained baseline cv for farm 1 is 12.5 (row 11, column 2); the cv increased to 15.4 (row 15, column 2) when price and income supports were removed. Thus, price and income support programs stabilized incomes on the model farms as they were designed to do.

Of all the programs examined, price and income supports had the greatest effect on NPV for both drained and undrained farms. Further, in the portion of the analysis that considered the

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<sup>4</sup> The coefficient of variation (cv) associated with an NPV in the table is a measure of the relative variability of NPV over the 50 iterations of the simulation for the scenario and farm type in question.

FIGURE IV-2: RELATIONSHIP OF NPV FOR EACH MODEL FARM TO SELECTIVE REMOVAL OF PROGRAMS/POLICIES



- a - exclude large equipment
- b - exclude ASCS cost share (drained)
- c - exclude income tax expensing
- d - BASELINE (with all programs)
- e - no preservation programs (undrained)
- f - exclude interest subsidy
- g - exclude price and income supports
- h - exclude all government programs

combined effect of a particular program on the level of NPV and the riskiness of farming, price and income supports were found to be the most important program.

It is difficult to conclude, however, that price and income support programs were instrumental in inducing drainage. While farmers who enrolled in such programs could expect more government payments after drainage, it was profitable to drain even in the absence of such programs. In every case, the "drained-without-price-and-income-supports" NPVs (Table IV-1, row 7) were greater than the "undrained-baseline" NPVs (row 11). For example, after drainage, but without the price and income support programs, NPV on farm 1 was \$256,673 (row 7, column 2), while NPV undrained with the programs was \$219,002 (row 11, column 2). Drainage was profitable, and the existence of price and income support programs made it that much more attractive by increasing income and reducing risk.

Given the pervasiveness of these results, one is tempted to conclude that withholding price and income support payments from farmers who convert wetlands (as under the present Swampbuster legislation) will not be an effective deterrent to drainage. For several reasons, this conclusion may be premature:

- The simulations utilized representative or average farms. Support programs may be critically important for below average farms of marginal profitability.
- The simulation model can only account for impacts to the NPVs of the representative farms. An individual who has a financial interest in several farms triggers the Swampbuster provisions on all of those properties when he cultivates converted wetlands on one farm.<sup>5</sup>
- As more wetlands are drained, the cost of drainage is likely to increase, since farmers tend to initiate drainage on their farms with the wetlands that result in the highest net return. Assuming productivity is uniform, this means the wetland that was cheapest to drain was drained first. Thus, while past drainage may have been profitable even in the absence of price and income support programs, some future drainage may be profitable only with these programs. This is especially true if commodity prices are depressed and the difference between market prices and government support prices increases, as was the case in 1986.

#### **Wetland Preservation Programs:**

Preservation program payments offset the opportunity cost of wetland ownership (by allowing the landowner to earn some revenue from his wetlands) and reduce the risk of land ownership (since a fixed payment is received in lieu of variable returns to farming). Two alternative wetland preservation options were modelled for the six representative farms. In one option undrained farms were enrolled in both the Federal wetlands easement and Water Bank programs, requiring an exclusion of the wetland and some surrounding upland acres from crop production. Concurrent enrollment reduces the payment for individual programs, but increases the total payment. In the other preservation option the farms were enrolled in only the easement program, which does not require setting aside upland acres, nor does it prohibit farming the wetland in dry years.

The simulation results bore out the risk-reduction aspect of the programs: the riskiness associated with operating the model farms increased when the preservation programs were eliminated from the simulations and the previously enrolled lands were converted and cultivated. In general, however, the NPVs of the farms were higher in a drained/cultivated state than undrained and enrolled in the preservation programs. On only one farm was it financially advantageous to enroll in preservation programs. On all other farms, NPV was higher without the preservation programs, indicating that preservation payments were not sufficient to offset foregone cash income from crop sales and Government crop subsidies on the enrolled acres.

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<sup>5</sup> The financial interest must be in excess of 20 percent for this associated triggering of Swampbuster to occur.

These results seem counter-intuitive, since wetland preservation programs are designed to compensate landowners for the foregone revenues associated with excluding wetland and surrounding upland areas from production, and many farm operators do participate in the programs. Indeed, in several recent years in the Prairie Pothole Region, Water Bank participation has exhausted program funding levels.<sup>6</sup>

One reason for the counter-intuitive results may be that the simulation model utilizes average or representative farms. However, there are farmlands and farm operators that are marginal and that benefit more from preservation programs than from farming, such as farm 2 in the simulations. There are also conservation-minded operators who derive pleasure from having wetlands on their property. Further, although both programs allow discretion over the level of payment offered to individual farm operators, this flexibility could not be incorporated in the simulation model. Thus, the modelled payments may be inappropriate, given the profitability of the representative farms.

These caveats notwithstanding, the results of the literature review complement the outcomes of the simulation analysis. That is, given the level of payments, farmers should be indifferent between participating in a preservation program and converting and cultivating their wetlands. But, for a variety of reasons, simply replacing foregone cash flow from farming often appears to be insufficient to induce farm operators to participate:

- Some operators seem to enjoy engaging in drainage in their spare time;
- Others are better than average managers having higher than average productivity on their cropland, and the ceiling on preservation program payments may be less than the amount necessary to offset the returns from conversion;
- Some believe drainage is necessary to farm efficiently and accommodate large machinery or irrigation equipment. While a preservation payment may offset or exceed agricultural production returns, it does not compensate for nuisance factors. One of the operators interviewed said that drainage of a single pothole facilitated farming a much larger area; and finally,
- Many farm operators appear to be unfamiliar with the availability and provisions of preservation programs.

The research results regarding the ineffectiveness of the preservation programs should be viewed cautiously. The extent of participation in the preservation programs indicates their attractiveness to some farm operators is greater than the simulation calculations and the general consensus in the literature would indicate.

#### **Cost Sharing and Technical Assistance:**

Government subsidies for drainage no longer exist in the Prairies, but empirical studies and farm operator surveys show that drainage cost subsidies of up to 50 percent were provided in the past. Since Federal cost sharing lowered the cost of drainage, it is reasonable to expect that the program increased the amount and rate of conversion.

However, the cost of drainage in the Prairies is relatively low compared to the overall cost of farming. Draining an area often involves only the variable cost of operating machinery that is already available on the farm and a low (or zero) opportunity cost for the farm operator's labor.<sup>7</sup> Where drainage costs are modest, the incentive provided by cost sharing to convert wetlands may not be significant, even if the cost sharing rate is sizable.

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<sup>6</sup> Water Bank has a nationwide appropriation of approximately \$8 million per year, much of which is committed to the Prairies. However, this funding level only allows about 160,000 wetland acres and 350,000 adjacent upland acres to be enrolled in the program at any one time. Thus, the protected acreage is small relative to the developmental pressure and the annual amount of conversion.

<sup>7</sup> As noted elsewhere, the historically low marginal costs of drainage are expected to rise.

In the simulation analysis, the effect of cost sharing and technical assistance on NPV and risk was calculated using a range of drainage costs and a fixed cost-sharing rate. For modelling purposes it had to be assumed that all drainage occurred and was paid for during the first year of the 10-year simulation period. Because of this modelling requirement and the ceiling on Federal cost sharing of \$2500 per farm per year, total drainage expense may have been subsidized very little on some farms in the simulation analysis.<sup>8</sup>

The simulation results showed no significant change from baseline levels in either economic returns or risk when no drainage assistance was available. (There is no appreciable difference between NPVs and cvs in rows (2) {drained-without-cost-share} and (4) {drained-baseline} in Table IV-1.) These results suggest that drainage costs (and, hence, drainage assistance programs) may not have exerted an important influence on wetland conversion in the Prairies. They also reinforce the finding that drainage has been profitable in the Prairies under a wide variety of conditions, including (simulated) circumstances in which conversion costs are exaggerated and incurred entirely in one year, rather than spread over time.

Although the simulation results suggest that drainage assistance programs were not particularly important as an inducement to drainage, generally, the availability of any program which directly reduces the cost of an activity can be assumed to offer an economic incentive. The margin within which this incentive becomes important for drainage is narrow, however. A small change in costs will only change decisions at the margin for a few farm operators. When combined with other programs, however, this change contributes to an overall important effect.

Finally, cost sharing and technical assistance may have had an impact on drainage beyond their effect on the cost of conversion and profitability. The mere existence of the programs extends Federal encouragement and approval for drainage, and may well have influenced investment decisions.

#### **Interest Rate Subsidies:**

Farm credit is now mostly private, but below-market rate loans were available to farmers through the Government until 1980. Farm credit was generally available at 2 to 3 percentage points less than commercial credit over the past 20 years.

Previous research on the effect which interest rate subsidies had on drainage indicates that the subsidies had a minimal impact on conversion. Drainage costs are small relative to the total cost of farming, and most farmers do not borrow solely to drain. However, below-market farm credit may have encouraged drainage indirectly: by enhancing the overall financial condition of the farm sector and helping to maintain its size, more conversion may have occurred. It is not entirely clear that this extension of financial support induced more wetland conversion, though. Subsidized farm credit tends to keep marginal farm operators (those who cannot obtain credit elsewhere) in business, and marginal operators are less likely to engage in drainage than more efficient, expansion-minded operators. If marginal farmers had not been supported and consolidation in the agriculture sector had moved at a more rapid pace, wetlands might have been more vulnerable to drainage than they were.

In the simulations, government interest rate subsidies had a sizeable impact on the economic returns and riskiness of the model farms, second only to the effect exhibited by price and income supports (Table IV-1). However, their impact on the decision to drain is unclear. Removal of these program benefits reduced, but did not eliminate the net returns from drainage, and as indicated earlier most farmers do not borrow solely to drain. Because these subsidies are no longer available, their impact on drainage is largely of historic interest.

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<sup>8</sup> For example, at \$74 per acre the total cost of draining all 120 acres of wetland on farm 3 is \$8,880. At a cost-sharing rate of 50% and with drainage conducted evenly over time, the operator would have received a subsidy of \$4,440. Since the model required all drainage to be conducted during the first year of the simulation, he only received a subsidy of \$2500.

### **Income Tax Provisions:**

All income tax provisions for expensing land development costs associated with converting wetlands to agriculture were eliminated by the Tax Reform Act of 1986. The Office of Technology Assessment's recent study of the use and regulation of wetlands identified tax deductions and credits available prior to tax reform as the most significant Federal incentive to clear and drain wetlands nationwide (OTA 1984). The Department's research did not confirm this finding.

Based on the results of both the simulation modelling and the review of previous research, the Department found that income tax provisions were not an important influence on the decision to drain in the Prairies. The literature review did not identify any previous empirical work on the effects of income taxes on drainage in the Prairies. Most past research was based on secondary sources, surveys of farm operators' attitudes, or assumptions about optimal behavior by farm operators.

The consensus among previous researchers was that only when high marginal tax rates were coupled with high drainage costs would the Federal income tax code affect drainage decisions in the Prairies. This combination of conditions would produce tax deductions large enough to have an influence, but historically these conditions have not existed in the Prairies. Prairie farm operators often do not have a Federal income tax liability, because their farm production expenses are usually sufficient to reduce their taxable income to a low level. Further, drainage costs have been low relative to overall farm production expenses, and thus would not be an important tax deduction.

Model farm simulations produced results on the potential influence of income tax provisions that complemented those reported in the literature. Neither ending-period net present values nor risk were affected when income tax expensing was removed from baseline scenarios. (Compare rows (3) and (4) in Table IV-1.)

Another potential influence of income tax provisions on the drainage decision is the incentive to overcapitalize (i.e., to buy more and/or larger equipment than is optimal). Prairie farm operators overcapitalized, in part, to avoid paying taxes on the increase in income which they experienced during the study period years and, some have argued, for conspicuous consumption. The availability of large equipment facilitates on-farm drainage and offers a further incentive to drain to avoid the increased nuisance cost of farming around wetlands with the larger equipment. Results of the simulations indicated Prairie farmers were overcapitalized. Additionally, all three farm operators interviewed reported doing most of their drainage with their own equipment.

### **Disaster Assistance/Crop Insurance Programs:**

The disaster assistance program offered only minimal benefits to participating farm operators in the Prairies. Its objective was to reduce the riskiness of farming by providing a guaranteed level of income. This program was available at no cost to agricultural program participants. The Federal Crop Insurance Act of 1980 (FCIA) ended the disaster assistance program for counties in which Federal Crop Insurance was available. Farm operator participation in the Prairies was low after the program was restructured in 1982 to include a premium.

The simulations revealed little difference in the net present values of drained or undrained modelled farms with or without disaster assistance. (Compare row (4) with (5) and row (11) with (13) in Table IV-1.) Thus, one can conclude that the disaster assistance program had little effect on drainage decisions in the Prairies.

### **Acreage Limitation Provisions:**

Participation in some government agriculture programs required that certain amounts of cropland be idled. This type of requirement is thought to have encouraged drainage in the

Prairies to increase a farm's base program acreage or to be used as set-aside in future years. Conversely, less productive cropland may have been set aside, while wetlands located in more productive cropland were drained. Whatever the case, programs that allowed farm operators to select set-aside lands, probably led to increased drainage in the Prairies.

**PIK:**

The Payment-In-Kind (PIK) program of 1983 provided an interesting case in wetland drainage incentives. Participating Prairie farm operators did not plant a substantial amount of their cropland. The combined influence of a guaranteed in-kind income, idle equipment, and bare fields resulted in higher than average prairie pothole drainage in 1983.

**Federal Aid for Roadways:**

Highways and highway construction are the only significant factors other than agriculture and water resource development affecting wetland conversions in the Prairies. For instance, a 1975 study by the Service revealed that drainage of nearly 100,000 acres of prairie potholes in western Minnesota was facilitated by outlet ditches provided through construction of roads and highways. However, the 1975 study found that 93,500 acres of the drained wetlands were lost (directly or indirectly) as a result of county and township highways. Federal and State highways accounted for only 6,500 acres (6.5 percent) of the total loss. While the Federal-aid program appears to have been a factor in wetland losses in western Minnesota, a much larger impact can be attributed to county and other local road systems.

In a further study conducted in 1986 (Nomsen et al. 1986), the Department conducted an aerial survey and a statistical analysis in order to estimate the effect of Federal aid for highways on wetlands in the Prairies. Close to 2200 miles of federally aided roadways were sampled. The study found that cumulatively at least 49,000 acres of wetlands had been drained in conjunction with federally aided roadways in the sample survey area of the Prairies.<sup>9</sup> Forty-four percent of the wetland acreage lost was due directly to road construction, but the majority of the losses (56 percent) were induced by ready access to the highway ditches.<sup>10</sup> Seventy-six percent of the induced losses were less than 100 yards from the highway rights-of-way. On average there were 64 acres of induced wetland losses per 100 miles of roadway.<sup>11</sup> The results further indicated that the amount of direct and induced drainage was related to wetland densities and the propensity of landowners in the region to drain. Preliminary analysis by the Service suggests that the total wetland loss in the Prairie Pothole Region associated with federally aided roadways is at least 4 to 5 times greater than the estimated loss in the sample region.

While roadway construction leads to direct wetland loss and offers an attractive incentive to drain adjacent wetlands into highway ditches, the trend in the Prairies is toward very few new roads. However, much past drainage into road ditches appears to have been in violation of Federal highway aid provisions and existing road ditches continue to offer an incentive to drain adjacent farmlands. Without enforcement of existing FHWA regulations against encroachment (23 CFR 1.23), wetland drainage into the rights-of-way on federally aided roadways can continue to be expected in significant amounts.

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<sup>9</sup> The Department believes that the survey results are conservative and constitute a lower bound on the wetland losses due to Federal aid for highways. Although the sampling procedure was designed to be as comprehensive as possible, there are certain types of impacts which the survey would not be able to identify.

<sup>10</sup> These are active, functioning drains.

<sup>11</sup> Wetland losses due to all roadways are higher than this. The study did not address the effect of roads constructed without Federal aid, such as township and county roads.

The regulations are strongly worded and unequivocal. FHWA regulations in effect since 1960 state that highway rights-of-way shall be devoted exclusively to public highway purposes unless the Administrator finds that some other use is in the public interest and will not impair the highway or interfere with traffic.<sup>12</sup> According to FHWA officials, no such finding has ever been made.

In 1978, the Administrator delegated the authority for making public interest findings with regard to wetland drainage to the "appropriate" State and local officials.<sup>13</sup> Despite concerns by environmental groups and the Service that this delegation of authority would undermine the regulations, no findings have been made and no permits issued for draining into highway rights-of-way. Hence, the drainage that does occur is illegal.

Enforcing the regulations is a labor-intensive and costly task, the responsibility for which has also been delegated to the States. Although offenders are occasionally forced to plug drains, no one has ever been prosecuted for such an offense.<sup>14</sup> A system in which enforcement is costly and infrequent and the penalty for violation is not particularly punitive does not pose much of a threat to violators, and cannot be self-enforcing.

Although the FHWA could encourage the States to enforce more vigorously, the mechanism available for this purpose is unwieldy. The FHWA could withhold Federal highway funds from States which do not enforce the regulations, but such an action would likely have political repercussions and might be viewed as too severe for the problem at hand.

#### **Water Management Programs:**

Corps, SCS, and Bureau of Reclamation projects have affected a sizable number of wetlands in the Prairies. The impacts have varied according to the type of project or activity, but have involved both direct and indirect effects on the quantity and quality of wetlands. Direct effects have occurred during project construction, operation, and maintenance, and there have even been some significant effects prior to construction of a project.<sup>15</sup> Indirect effects have occurred because the projects have made it feasible to and financially more attractive to convert and develop wetlands.

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<sup>12</sup> The strong wording reflects the self-interest of the FHWA. Drainage into highway rights-of-way can undermine the structural integrity of the roadway, and repairing the damage can be costly. In one instance in the Prairies, it cost \$270,000 to repair highway damage due to drainage of one large, semi-permanent wetland.

<sup>13</sup> Memorandum from Federal Highway Administrator to Regional Federal Highway Administrators, April 10, 1978.

<sup>14</sup> Based on private communications with FWS field office, Bismark, N.D.; Office of the Chief Counsel, FHWA, Washington, D.C.; and Robert Golten, formerly a lawyer with the National Wildlife Federation who specialized in highway impacts to wetlands.

<sup>15</sup> Upon authorization of the Garrison Diversion Unit (GDU) in 1965, the Service entered into an agreement with the Bureau to avoid acquiring wetland easements on land to be developed for irrigation by the project and on a surrounding buffer zone, as well. The agreement was established in order to avoid conflicts with project development. The GDU met with considerable resistance, however, and although some construction occurred over the years, it was not until 1986 that a compromise was worked out among the various environmental and development interests which allows completion of the project. The reformulated project calls for approximately half as much irrigated acreage as the original design. The Service contends that during the intervening years many prime wetlands were converted in this area, wetlands that the Service was precluded from protecting due to the agreement with the Bureau.

The Service's wetlands easement and acquisition program suffered a further setback in 1977, when the State of North Dakota essentially held the program hostage in exchange for construction of the GDU. The State refused to approve FWS purchases of wetlands in North Dakota until the GDU was allowed to proceed. Prior to this the Service had protected approximately 45,000 acres of wetlands by easements annually in North Dakota and 5500 acres by fee simple. Although it seems a bit of a distortion to attribute the wetlands lost due to lack of protection during this period to a Federal program, it is undeniable that the losses were related to the proposed construction of the GDU.

*Direct effects:* The Corps constructed five large dams and reservoirs along the mainstem of the Missouri River during the 1950's and 1960's. The Bureau has constructed dams and reservoirs on the Missouri River tributaries, as well as irrigation canals and nonagricultural delivery facilities for water supplies. Wetlands in the path of construction have been unavoidably eliminated, and as reservoirs have filled, wetlands have been inundated.<sup>16</sup> The mainstem Missouri River projects resulted in the loss of nearly all the riparian wetlands and oxbow lakes in North and South Dakota (approximately 388,000 acres). None of the losses in South Dakota has been mitigated, and only very minor mitigation has occurred in North Dakota. However, approximately 30,000 acres of wetlands have developed in the arms and upper ends of the North and South Dakota mainstem projects, and the rate of wetland development is expected to increase.

Operating dams alters the timing and duration of stream flows, and in the process wetlands have been lost. Routine maintenance of canals and waterways frequently involves removal of vegetation from surrounding wetland areas.

*Indirect effects:* There have been indirect effects, as well: as development has occurred in formerly flood prone areas; as wetlands have been drained into outlet channels; and as water supplied at less than actual cost has induced irrigation where it would not otherwise have occurred. The first two of these effects have been fairly significant in the Prairies. Although modern irrigation systems can be very damaging to wetlands,<sup>17</sup> the indirect effects of irrigation on wetlands have been minor in the Prairies, because only a small percentage of the planned irrigation has materialized.

The literature review found that the consensus among previous researchers was that PL-566 stream channelization induced considerable wetland drainage. The rate of drainage increased immediately after approval of a PL-566 work plan and prior to construction. The existence of an outlet provided by a PL-566 project was the major factor influencing decisions by landowners to drain. The outlet provided by the public drain was an enticement for landowners to drain and, if a tax was levied against potential beneficiaries, the incentive was even greater. For many farm operators the outlets provided by public drains were not only sufficient, but necessary for on-farm drainage.

*Future vulnerability:* Generally, it is expected that in the future the threats to Prairie wetlands from Federal water projects will be much reduced. For a variety of reasons the prospects for construction of new, major water projects in the Prairies are limited: the most productive sites have already been developed, leaving (at best) modest benefit-cost ratios on any proposed projects; new projects tend to have high overall project costs; and the trend toward increased local cost sharing has discouraged demand. Further, an increasing sensitivity to environmental concerns makes it more likely that mitigation requirements will accompany any new authorizations and appropriations for construction.<sup>18</sup>

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<sup>16</sup> For example, the Service estimates that the Garrison dam and reservoir resulted in the inundation of approximately 55,000 acres of wetlands. To put this in perspective, two million of the original five million acres of wetlands remain in North Dakota, so Garrison accounted for a loss of about three percent of the stock. Alternatively, 20,000 acres of wetlands are lost annually in North Dakota, so Garrison is equivalent to almost three years of losses.

<sup>17</sup> Center pivot and wheel line systems are often difficult to operate in the midst of potholes, so the wetlands are frequently drained or filled prior to installation of the equipment.

<sup>18</sup> The Garrison Diversion Unit (GDU) is a case in point. Originally authorized in 1965, the GDU would have irrigated 250,000 acres. Wetland losses due to construction of the project would have been about 75,000 acres, with approximately two-thirds of these due to installation of the on-farm irrigation equipment and one-third due to the delivery system. An additional 70,000 acres of wetlands on national wildlife refuges would have experienced varying degrees of degradation. Following a compromise between development and environmental interests, the project was reauthorized in 1986, and will irrigate only 130,940 acres. Gross wetland losses due to construction will be reduced to 18,000 acres, but a mitigation plan calls for replacement of most of these.

An effort by the Bureau to bring about a more efficient use of water may have an effect on wetlands. It is expected that in the future there will be increased use of voluntary water marketing, i.e., water users transferring water to higher value uses. Increasingly water will be transferred from irrigation to municipal and industrial use. To the extent that this trend cuts down on the demand for new projects, it should help to conserve wetlands. On the other hand, water reserved for wetland conservation and the mitigation of project effects is often distributed in conjunction with irrigation water, and it may be technically more difficult or more costly to distribute the water for conservation and mitigation in the absence of the irrigation water. Further, water rights for conservation often are not as secure as rights to water for commercial uses. However, given the small amount of irrigation in the Prairies, the trend toward water marketing may exert only a modest impact on wetlands in this region.

#### **Wetland Regulatory Program:**

The Corps of Engineers program implementing section 404 of the Clean Water Act is the primary Federal process for regulating activities affecting wetlands. Persons seeking to conduct activities that would result in the discharge of dredged or fill material onto wetlands must obtain a permit from the Corps. In an effort to manage the workload and administer the program, the Corps has issued several nationwide permits (general authorizations to proceed without further consideration by the Corps of the proposed activities). One of these nationwide permits authorizes activities that affect less than 1 acre of wetlands, and places some reporting requirements on activities which would affect between 1 and 10 acres. Despite the regulatory structure, these wetlands receive insufficient protection under 404. Extensive loss and degradation continue to occur to small wetlands (1-10 acres) in the Prairie Pothole Region.

Small wetlands in the Prairies are known to be functionally important, especially to migratory and nesting waterfowl. Basins five acres or less in size compose only 35 percent of wetland area in the Prairie Pothole Region, but may support over 57 percent of the breeding waterfowl population. A significant number (36 percent) of all Prairie wetlands range from one to 10 acres. If the nationwide permit were conditioned to require individual review of proposed discharge activities into these Prairie wetlands, regulatory protection would extend to 87 percent of this region's wetlands.

#### **Farm Operator Interviews:**

Three Prairie farm operators representing the different farm types discussed in the descriptive study were interviewed in order to assess landowner attitudes toward wetland drainage and to identify factors influencing their decisions to drain.

Although the sample is small, the interviews confirmed many of the findings of the descriptive study, were consistent with the results of the simulation study, and were in concert with the bulk of recent literature on wetland drainage incentives. Briefly, all three farm operators cited economics as the primary factor influencing their drainage decisions, yet each said government programs were not important in these decisions. While these programs may not have been significant in the decision to drain, the Department's research clearly shows that they added to the profitability of drainage.

#### **Absence of all Government Programs:**

Results of model farm simulations showed that in every instance drained farms were usually economically better off with all the programs intact than without any programs.<sup>19</sup>

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<sup>19</sup> Some programs had no effect on the economic returns of modelled farms, but in no case did any program make the farm operation less profitable after drainage than before.

Simultaneous removal of all programs from the drained farms both reduced economic returns and increased the risks of farming. (Compare rows (4) and (8) in Table IV-1.) Thus, one may conclude that if Swampbuster had been in effect in the Prairies from 1975 to 1984, it would have substantially reduced the returns to landowners who drained by eliminating government program payments on their entire farms. However, as was shown earlier, drainage, even without the modelled programs, still produced higher ending period returns than remaining undrained with the programs. (Compare rows (8) and (11) in Table IV-1.) Thus, while returns are reduced, they are not reduced sufficiently to reverse the decision to drain. Swampbuster, however, may be an effective deterrent to drainage in the Prairies because:

- The simulations modelled average farms, while there are marginal farm operators who may depend on the support programs.
- The simulation model only accounted for impacts to the economic returns on representative farms. Some individuals may operate several farms, thus making Swampbuster a much stronger sanction.
- The cost of drainage is likely to increase relative to the returns. Thus, while past drainage may have been economical with or without government programs, future drainage may be profitable only with these programs. This is especially true if the difference between commodity prices and government support prices increases, as was the case in 1986.

While Swampbuster was not specifically analyzed due to the timing of the studies, the scenario in which all government programs were simultaneously removed closely approximates the provisions of Swampbuster. In general, if Swampbuster had been in effect from 1975 to 1984, it would have brought about mixed results on farms in the Prairies. It probably would have been more effective in preventing drainage on larger farms than on smaller farms. This is because the penalty for draining a single wetland on a large farm would be far greater than for draining a single wetland on a small farm.<sup>20</sup>

The Department found that Swampbuster would be effective if its provisions could be implemented and enforced in the Prairies. Swampbuster may, however, lead to strategic avoidance tactics, such as increased acreage of nonprogram crops, illegal drainage, or creative real estate transfers. And, in some cases, drainage may still be profitable in the absence of all government programs.

A 1986 USDA report which examined Swampbuster in the Prairies also looked at price and income support programs, using a model farm approach (Heimlich and Langner 1986). The conclusions were similar to those of the Department's study. The authors concluded that due to high program participation in the Prairies and relatively low percentage of land in wetland, Swampbuster could be a strong sanction against additional drainage. The authors also found that it could be profitable to drain additional wetlands in the Prairies in the absence of price and income supports and that some wetlands may be drained for other reasons, regardless of the Swampbuster sanctions. However, less sanguine results were reached in a further study conducted by one of these authors (Heimlich 1988). Heimlich estimated that nationally, Swampbuster would be effective in preventing conversion on only about 35 percent of those non-Federal wetlands with some probability of being converted to cropland. For the Prairies in particular the conclusions were mixed, with Swampbuster predicted to be moderately effective in Minnesota and North Dakota, but ineffective in South Dakota.

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<sup>20</sup> The contention that Swampbuster would have been more effective on larger farms is speculative, because it focusses exclusively on the magnitude of the penalty for cultivating converted wetlands. Although the penalty is smaller for small farms, the lost benefits may be more important to the small farm operator's profitability.

## Summary and Conclusions

A simulation model and review of past research were used to examine Federal agricultural programs and income tax provisions as they relate to conversion of prairie wetlands to agriculture. The simulation model was used to analyze the effect of selected programs on the economic returns of several representative farms over a 10-year simulation period with and without wetland drainage. A descriptive study based on a regional literature review and case studies was conducted, and an extensive body of wetland literature, including some well recognized, comprehensive works, was also drawn upon. In addition, the Department examined the extent to which runoff ditches for federally aided roadways have been used by farmers as outlet ditches for draining prairie potholes and the impact which the construction of Federal dams, reservoirs, channels and irrigation systems have exerted on wetlands in the Prairies.

From the analysis, it is clear that farm owners are financially better off after drainage than before and they almost always benefit more from the agriculture programs after draining their land than if the land had remained undrained.

The issue of whether Federal agriculture, water management, and highway programs as well as Federal income tax provisions affect wetland drainage and if so, to what extent has been addressed from a broad national approach, a regional approach, at the farm level, and on a single wetland basis. The results of this study add to the consensus that these programs, and, in particular, agricultural price and income supports, have contributed to the conversion of prairie potholes to agricultural uses. Thus, the issue has been addressed from several perspectives, at many levels, using various methods, and the conclusions continue to be:

- Drainage of prairie potholes has been generally profitable, even in the absence of government incentives.
- Federal agriculture programs have made drainage more profitable than it would have been if these programs had been withheld from farm operators who drained wetlands. The program that had the greatest impact on wetland conversion in the Prairies was price and income supports. Other influential programs were cost sharing for drainage and perhaps indirectly the incentives provided by income tax provisions to overcapitalize and the contribution to the financial health of the agricultural sector provided by below-market rate credit.
- Water management programs have affected a sizable number of wetlands in the Prairies. The effects have been both direct and indirect, but the major impacts have come during construction of five large dams and reservoirs along the mainstem of the Missouri River during the 1950's and 1960's. The mainstem Missouri River projects resulted in the loss of nearly all the riparian wetlands and oxbow lakes in North and South Dakota (approximately 388,000 acres). None of the losses in South Dakota were mitigated, and only very minor mitigation occurred in North Dakota. However, approximately 30,000 acres of wetlands have developed along the mainstem projects, and the rate of wetland development is expected to increase. It is expected that in the future the threats to Prairie wetlands from Federal water projects will be much reduced, because the prospects for construction of new, major water projects in the Prairies are limited, and the wetland impacts of new projects are likely to be mitigated.
- Highways and highway construction are the only significant factors other than agriculture and water resource development affecting wetland conversions in the Prairies. In a study conducted by the Department, forty-four percent of the wetland acreage lost was due directly to road construction, while the majority of the losses (56 percent) were induced by ready access to the highway ditches. Much past drainage into road ditches appears to have been in violation of Federal highway aid provisions and existing road ditches continue to offer an incentive to drain adjacent farmlands. Without enforcement of existing FHWA regulations, wetland drainage into highway ditches can con-

tinue to be expected in significant amounts. Enforcement is costly and infrequent and the penalty for violation is not particularly punitive. The system needs to be redesigned in order to discourage violators and reduce enforcement costs.

- Income tax provisions, such as expensing drainage costs, while important to some larger farm operations, are not generally a strong incentive to drain prairie potholes. This is probably due to historically low income tax liabilities of Prairie farmers and the small cost of drainage relative to the overall costs of farming.
- Economics is the most important factor influencing prairie pothole conversion, especially when all the costs and benefits to the individual, such as nuisance and avoidance costs, are included in the analysis.
- Both the literature review and simulation analysis indicate that the payment levels in the wetlands preservation programs (Water Bank and the Small Wetlands Acquisition Program) are insufficient to offset the incentives to drain and, hence, insufficient to induce farm operators to participate in the programs. These research results should be viewed cautiously. The extent of participation in the preservation programs indicates their attractiveness to some farm operators is greater than the simulation calculations and the general consensus in the literature would indicate. The issue of whether the payment levels are sufficient to induce participation may be mute, however, because budgetary constraints so limit the size of the programs that the protected acreage is small relative to developmental pressure and the annual amount of conversion.
- There is no simple relationship between the pace of drainage in the Prairies or the likelihood that an individual pothole will be drained and the presence of selected government agriculture programs or income tax provisions. However, the direction of influence of most programs is both self-evident and analytically demonstrable.
- There is little incentive for farm operators to restore drained wetlands: once wetlands are converted to cropland, farm-level economics precludes reversion to wetland.
- A combination of changes in landownership and the cyclical nature of agricultural prices makes it highly likely that most unprotected wetlands will eventually be vulnerable to conversion. However, it is also likely that many of the remaining wetlands will be more costly to drain than those already converted.
- Swampbuster will be effective in protecting some wetlands and slowing the rate of conversion in the Prairies if its provisions are vigorously enforced. Swampbuster may, however, lead to strategic avoidance tactics, such as increased acreage of nonprogram crops, illegal drainage, or creative real estate transfers. Further, even without such manipulative strategies, there will be cases where drainage will be profitable despite Swampbuster's sanctions.

APPENDIX TABLE IV-1: FARM TYPES FOR DESCRIPTIVE STUDY

Farm Type	Size	Assumed Income Tax Liability	Assumed Machinery Complement	Livestock
Small, strictly cash crop <sup>a</sup>	less than 1,280 acres	zero to very low	small-scale	no
Diversified <sup>b</sup>	about 1,290 acres	zero to very low	small-scale	yes
Commercial <sup>c</sup>	more than 1,280 acres	medium to high	large-scale	no

<sup>a</sup> Similar to farm types 3 and 4 in Table IV-2.

<sup>b</sup> Similar to farm types 5 and 6 in Table IV-2.

<sup>c</sup> Similar to farm types 1 and 2 in Table IV-2.

APPENDIX TABLE IV-2: DATA REQUIREMENTS AND SOURCES USED

<u>Data Required</u>	<u>Sources Used</u>
1. Acres of cropland and pastureland owned and leased	U.S. Census, State Statistical Series
2. Market value of owned cropland, pastureland and buildings	U.S. Census, State Statistical Series, <u>Farm Real Estate Market Development</u>
3. Depreciation a) Salvage value of buildings and other depreciable items b) Purchase price of depreciable items c) Economic life to depreciable items	<u>Economic Indicators of Farm Sector (EIFS), Farm Equipment Blue Book</u>
4. Outstanding debt on long-term assets; or current debt ratio	EIFS, State Statistical Series
5. Current intermediate-term and short-term debt	EIFS
6. Terms for new loans	State Banks, Production Credit Association (PCA), Federal Land Bank (FLB), Local Banks
7. Terms for financing cash flow deficits	State Banks, PCA, FLB, Local Banks
8. Family consumption information a) Age of operation b) Family size c) Average annual off-farm income d) Maximum family living expenses e) Minimum family living expenses	U.S. Census, EIFS Local Banks
9. Labor available and rate (both family and hired)	U.S. Census, EIFS
10. Cropland and pastureland cash lease charges	EIFS, State Statistical Series
11. Annual interest rates	PCA, FLB, Federal Reserve Bulletins
12. Crop enterprise information a) Seed cost b) Fertilizer and lime c) Chemical d) Fuel and lube e) Machinery repair f) Other	Federal Enterprise Data System Budget Series (FEDS), University Budget Series (UBS), and EIFS
13. Crop mix	U.S. Census, State Statistical Series
14. Crop labor requirements (monthly)	FEDS, UBS
15. Crop yields (average yield each year)	State Statistical Series
16. Crop prices each year	State Statistical Series
17. Drainage costs	Leith and Kerestes (1981) Nelson et al. (1982) Farmer (1981) local ASCS officials
18. Policy guidelines and benefits	See Chapter II and McColloch and Wissman (1986)

APPENDIX TABLE IV-3: REPRESENTATIVE FARMS<sup>a</sup> FOR FLIPSIM SIMULATION

Region <sup>b</sup> and Farm Type <sup>c</sup>	Description of Representative Farm <sup>d</sup>	Representative County
1	Large Montana Wheat Farms	Roosevelt, MT
2	Large North Dakota and South Dakota Wheat and Mixed Crop Farms	Edmund, SD
3	Medium North Dakota Wheat and Sunflower Farms	Foster, ND
4	Medium South Dakota and Minnesota Wheat and Mixed Crop Farms	Stevens, MN
5	Small South Dakota Diversified Farms	Hutchinson, SD
6	Small Minnesota Diversified Farms	McLeod, MN

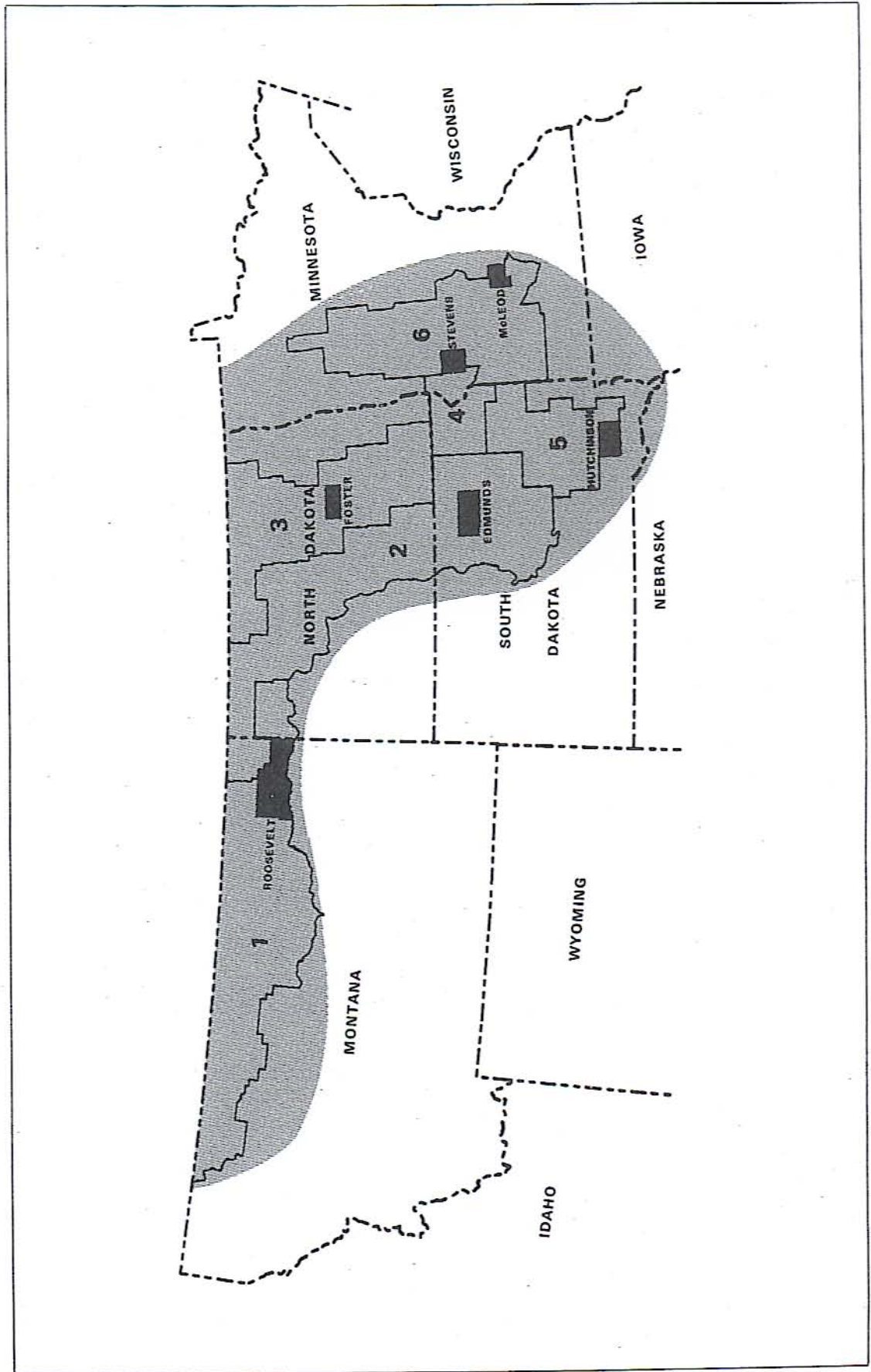
<sup>a</sup> A statistical sampling procedure (clustering) was used to select the original framework of the individual farms. Cluster analysis identifies groups of observations that have similar attributes. Variables used included farm size, cropping patterns, percent pasture land, and rainfall. All variables were given equal weight. In this exercise the observations were counties in the Prairies.

<sup>b</sup> A map of the representative regions follows Appendix Table IV-3.

<sup>c</sup> Refer to Appendix Table IV-1 for the relationship between these farm types and those used in the descriptive study.

<sup>d</sup> A detailed description of each representative farm follows in Appendix Table IV-4.

APPENDIX FIGURE IV-1: REPRESENTATIVE COUNTIES FOR FLIPSIM SIMULATION



APPENDIX TABLE IV-4: ACREAGE AND ENTERPRISES WITH AND WITHOUT DRAINAGE

	No Drainage		With Drainage	
	Acres	Enterprise	Acres	Enterprise
Large Montana Wheat Farm (50% pothole density)	1,024	Wheat	1,280	Wheat
	192	Cropland under easement	1,920	Pasture and potholes to rent <sup>1</sup>
	64	Potholes on cropland under easement		
	96	Potholes on pastureland under easement		
	288	Pastureland under easement		
	<u>1,536</u>	Pastureland to rent		
Total Acres	3,200		3,200	
2. Large North and South Dakota Wheat and Mixed Crop Farm (10% pothole density)	515	Wheat	858	Wheat
	164	Oats	273	Oats
	101	Corn (1975-1979)	169	Corn (1975-1979)
	101	Sunflower (1980-1984)	169	Sunflower (1980-1984)
	390	Cropland under easement	700	Pasture and potholes to rent
	130	Potholes on cropland under easement		
	70	Potholes on pastureland under easement		
	210	Pastureland under easement		
	<u>410</u>	Pastureland to rent		
Total Acres	2,000	2,000		
3. Medium North Dakota Wheat and Sunflower Farm (10% pothole density)	412	Wheat	689	Wheat
	212	Barley (1974-1979)	355	Barley (1975-1979)
	212	Sunflower (1980-1984)	355	Sunflower (1980-1984)
	315	Cropland under easement	156	Pasture and potholes to rent
	105	Potholes on cropland under easement		
	15	Potholes on pastureland under easement		
	45	Pastureland under easement		
	<u>96</u>	Pasture to rent		
Total Acres	1,200	1,200		
4. Medium South Dakota and Minnesota Wheat and Mixed Crop Farm (10% pothole density)	300	Wheat	501	Wheat
	123	Corn	204	Corn
	87	Soybeans	145	Soybeans
	255	Cropland under easement	150	Pasture and potholes to rent
	85	Potholes on cropland under easement		
	15	Potholes on pastureland under easement		
	45	Pastureland under easement		
<u>90</u>	Pastureland to rent			
Total Acres	1,000	1,000		
5. Small South Dakota Diversified Farm (10% pothole density)	126	Corn	210	Corn
	91	Oats	152	Oats
	51	Soybeans	86	Soybeans
	135	Cropland under easement	192	Pasture and potholes to rent
	45	Potholes on cropland under easement		
	19	Potholes on pastureland under easement		
	57	Pastureland under easement		
	<u>116</u>	Pastureland under rent		
Total Acres	640	640		
6. Small Minnesota Diversified Farm (10% pothole density)	118	Corn	198	Corn
	27	Soybeans	45	Soybeans
	27	Oats	45	Oats
	87	Cropland under easement		
	29	Potholes on cropland under easement	32	Pasture and potholes to rent
	3	Potholes on pastureland under easement		
	9	Pastureland under easement		
	<u>20</u>	Pastureland to rent		
Total Acres	300	320		

1. Potholes are included when estimating pasture leases.

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# SWAMPBUSTER AND THE PROSPECTS FOR REDUCED RATES OF CONVERSION

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Since this study was requested in 1984, there has been a significant change in agricultural policies affecting wetlands. The Wetland Conservation (Swampbuster) provision of the Food Security Act of 1985 denies farm program benefits to persons who produce agricultural commodities on wetlands converted after December 23, 1985. The intent is to reduce Federal subsidies which provide financial incentives to convert wetland to cropland. Depending upon how it is implemented and enforced, this provision could be an important deterrent to wetlands conversion.

The effectiveness of the Swampbuster provision in slowing the rate of wetlands conversion is yet to be determined. However, preliminary studies conducted at USDA's Economic Research Service (ERS) indicate that Swampbuster will be effective in preventing conversion of wetlands to cropland on only about 35 percent of the wetlands which have some potential for conversion. Although denying farm program benefits to operators who plant on converted wetlands will forestall conversions in many areas, implementation and enforcement will not be easy. The impact of the sanctions will vary greatly from region to region, being most effective in areas where participation in farm programs is high. Exemptions provided in the law and regulations will limit the application of Swampbuster sanctions, apparently to a greater extent than was originally anticipated. Farm operators have already found loopholes unanticipated by the authors of the law or the regulations.

In this chapter, we review the major features of the Swampbuster provision, discuss conditions under which the sanctions are most likely to be effective, and describe those situations where the intent of the law may not be realized.

## The Swampbuster Provision of P.L. 99-198

Title XII of the Act contains the Sodbuster (Highly Erodible Land) and Swampbuster conservation provisions, which are intended to promote consistency between national goals for agricultural production and resource conservation. The substantive portions of the Swampbuster provision are very brief. The provision says that any person who in any crop year produces an (annual) agricultural commodity on converted wetland shall be ineligible for certain farm program benefits during that year. The list of programs consists of price and income support payments, farm storage facility loans, grain storage payments, FMHA loans, crop insurance, disaster payments, and loans used to convert wetlands. Exemptions are included to make the law workable.

Although the provisions are brief, some of the implications are subtle and may not be apparent to the casual reader. Among the more important implications are:

1. *Any person* is defined in the regulations to include immediate family members as well as landlords, tenants, corporations, partnerships, joint ventures, and other business arrangements in which the individual has a significant interest, in order to limit the opportunity to transfer ownership of converted wetlands and thereby evade the statute's sanctions.

2. *Any crop year* means that the determination of eligibility will be made annually. A farmer can convert wetlands to cropland, and still be eligible for benefits in any year in which he does not plant annual crops on the converted acreage.
3. A person is determined to have *produced annual crops* if such crops are planted, since planting activities can destroy the wetland's natural values. However, perennial crops (such as alfalfa or pasture) can be planted without sanction.
4. Anyone who *plants annual crops on wetlands converted after the date of enactment* is ineligible for farm program benefits, not only on the crops grown on the converted wetlands, but on all crops the producer grows during the crop year.<sup>1</sup> This means that although farmers are not prevented from draining wetlands by this statute, if annual crops are planted on any of the drained areas, the farmer loses farm program benefits on all his operations.

If strictly enforced, the Swampbuster provision has great potential for reducing incentives to convert wetlands to cropland in situations where denial of farm program benefits will have a significant impact on a farm operator's income. Where denial of benefits has only limited impact on farm operator income, the provision will be much less effective. In states where farm program participation is low, such as Florida and North Carolina, Swampbuster will do little to deter wetland conversions. (See Table V.1.) Participation in farm programs varies not only by region and crop, but also according to market conditions. Lower rates of participation are expected during periods when prices are high. For example, USDA statistics indicate that 34 percent of wheat production was in the loan program in 1985 when prices were low, but only 2.0 percent was enrolled in 1974 when prices were high.

A final consideration in analyzing the statute's potential effectiveness is that even in areas where program participation is high, enforcement of the Swampbuster sanctions will not be easy. Provisions exist in the law and regulations which permit crop production on converted wetland, and seem at variance with the underlying conservation purpose of Swampbuster. These issues are discussed in the following section.

## **Features of the Statute and Implementing Regulations Which May Reduce Swampbuster's Effectiveness**

The previous section discussed Swampbuster's probable effectiveness in deterring conversions based on the underlying philosophy of the provision. Clearly, this segment of the Act will not prohibit wetlands conversions. It denies farm program subsidies to farm operators when converted acres are cropped, substantially increasing opportunity costs if the farmer participates in subsidy programs. Farm operators who grow crops that are not eligible for deficiency payments (e.g., soybeans) or for price supports (e.g., fresh vegetables), who convert wetlands for agricultural purposes other than planting annual crops (e.g., pasture), or who elect not to participate in agricultural programs<sup>2</sup> are essentially unaffected. Denial of benefits is the law's only sanction.

Swampbuster's effectiveness in deterring wetlands conversions is further compromised by specific language in the Act and by the way the regulations are being implemented. Three features of the provision which can undermine its effectiveness are discussed below.

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<sup>1</sup> A participant in a joint operation (e.g., a partnership, a corporation, a family enterprise) can trigger the Swampbuster sanctions for that operation by producing an annual, agricultural commodity not just on the farm held by the joint operation, but also by producing on a converted wetland located elsewhere and not owned by the joint operation.

<sup>2</sup> There are many reasons why a farm operator might decide not to participate in farm programs. One of the more common is that if the market price for the producer's commodity is sufficiently high, avoiding the programs with their attendant constraints may be economically advantageous.

### Annual Determinations of Eligibility:

When a farm operator applies for farm program benefits, a determination must be made by a USDA official as to whether wetlands were present when the law went into effect on any of the land which the applicant owns, rents, operates, or has an interest in. If wetlands existed on any of these lands at the time of enactment, the applicant must certify that he will not plant annual crops during the current crop year on any wetlands which have been converted since the law was enacted or which he converts during the crop year.<sup>3</sup> The statute provides no sanctions for conversion of wetlands, as such. For example, a farm operator may destroy wetlands for non-agricultural purposes, such as roads, building sites, or storage areas, without sanctions. He may convert wetlands to perennial crops with impunity. The sanctions are triggered only for planting annual crops on converted wetlands in the current year. A farmer may plant annual crops on converted wetlands in one year (say, a year in which commodity prices are expected to be high enough to offset the loss of farm program benefits) without jeopardizing his program eligibility in future years.

**TABLE V-1: FARM PROGRAM PARTICIPATION IN CRITICAL WETLAND STATES, 1984**

Area	Enrolled in ARP* (million acres)	Enrollment as a Percentage of	
		Base Acreage	Used for Crops**
Florida	0.1	19.2	3.5
Prairie potholes			
North Dakota	13.5	74.7	47.4
South Dakota	6.3	52.5	35.7
Minnesota	7.6	57.0	35.7
Subtotal	27.4	63.2	40.7
Nebraska	9.3	65.2	43.9
Lower Mississippi			
Mississippi	1.8	55.6	28.5
Louisiana	1.3	60.0	26.5
Arkansas	2.5	50.0	31.3
Subtotal	5.7	53.8	29.2
North Carolina	0.6	21.1	11.9

\*ARP = acreage reduction programs.

\*\*Includes cropland harvested, crop failure, and cultivated summer fallow. Data are for 1982.

Source: Ralph E. Heimlich and Linda L. Langner, "Swampbusting in Perspective," *Journal of Soil and Water Conservation*, July/Aug., 1986.

<sup>3</sup> This determination and certification must be made every time that an individual applies for benefits.

Further, Swampbuster imposes no real harm on a farm operator who violates his certification that he will not plant on a converted wetland during the year. If detected, the operator loses his program benefits for the year, the same economic sanction he would have experienced had he been truthful about his intentions.<sup>4</sup>

#### **Limitation to Annual Crops:**

The statute defines "agricultural commodity" as crops planted and produced by annual tilling of the soil and sugarcane. Consequently, there are no sanctions for the conversion of wetlands to produce perennial crops (such as alfalfa or pasture grasses) or for the planting of trees.

The Swampbuster provision parallels the Highly Erodible Land conservation provision (Section 1211), the so-called Sodbuster provision. Since perennial crops provide good soil protection, the exemption for the conversion of uplands to perennial crops was consistent with the conservation of highly erodible land. However, it is not compatible with wetlands conservation.

#### **Determination of Commencement of Conversion:**

In an effort to make the application of Swampbuster as equitable as possible, Congress provided for some exemptions from the Swampbuster sanctions. Notable among these is the exemption for converted wetlands whose conversion was begun before the date of enactment of the statute (Dec. 23, 1985). Congress apparently intended to permit farmers who had invested "substantial funds" in ongoing or imminent projects to complete the projects and thereby recoup their investments. The final rule reflects this intent.

Under the final rule the ASCS is responsible for making commencement determinations, and must consult with the Fish and Wildlife Service on each determination. The ASCS has delegated this authority to the county committees. County committees are composed of local residents, usually farmers, who may find it difficult to make decisions which will adversely affect their neighbors. Consequently, the objectivity of the exemption process may have been compromised by allowing the county committees to make the commencement determinations. In particular, Fish and Wildlife Service field offices report that the county committees do not apply a consistent definition of a substantial commitment of funds when making commenced determinations, and do not provide timely notification of commenced hearings (sometimes providing notification after the hearing has occurred).

Clearly, the statutory language is consistent with a number of instances in which wetlands can be lost, but there are no sanctions. The impact on wetlands of these limitations is being evaluated, and will be brought up for discussion during consideration of the 1990 Farm Bill.

## **Limited Evidence of Effectiveness**

There is no firm empirical evidence yet on the extent to which the Swampbuster provisions have reduced wetland conversions to agriculture. Fish and Wildlife Service personnel continue to observe such conversions, however, especially in the Prairies. Indeed, in 1987 drainage rates in North Dakota and Minnesota were the highest in a decade. Simulation analyses conducted by the Department on the Delta and the Prairies indicate that Swampbuster has great potential for reducing the incentives to convert wetlands to agriculture. However, a study conducted at the Economic Research Service, USDA estimates that for almost two-thirds of wetlands vulnerable to conversion nationally, Swampbuster will be ineffective, either because the crops likely to be grown on these wetlands are not program crops or because farm operators in those regions do not rely heavily on government payments (Heimlich 1988).

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<sup>4</sup> Submitting a false claim to the Government is, of course, a prosecutable offense, and could be pursued through the courts or administratively under the Program Fraud Civil Remedies Act.

## Summary and Conclusions

The "Swampbuster" provision of the Food Security Act of 1985 denies farm program benefits to persons who produce agricultural commodities on wetlands converted after December 23, 1985. The statute does not provide sanctions for converting wetlands to agriculture or any other function. The sanctions are only for planting annual crops during the current year on wetlands converted after enactment. As a result there are numerous instances in which wetlands can be lost, but the law provides no penalties.

The intent of the law is to reduce Federal subsidies which provide financial incentives to convert wetland to cropland. Depending upon how it is implemented and enforced, this provision could be an important deterrent to wetlands conversion. However, Swampbuster cannot be expected to eliminate the conversion of wetlands to agriculture; at best, it will only reduce the rate of conversion.

The effectiveness of the Swampbuster provision in slowing the rate of wetlands conversion is still uncertain. Although the Department's simulation analyses in the Delta and the Prairies indicate that Swampbuster has great potential for reducing the incentives to convert wetlands to agriculture, a study conducted at the ERS, USDA estimates that nationally, Swampbuster may be effective on only one-third of wetland acres vulnerable to conversion to cropland. Denying farm program benefits to operators who plant on converted wetlands will forestall conversions in some areas, but the impact of the sanctions will vary greatly from region to region, being most effective in areas where participation in farm programs is high. Further analysis of the effectiveness of Swampbuster is necessary in order to assess the likely protection offered by current conservation provisions and to evaluate potential changes in the provisions for the 1990 Farm Bill.

## RECOMMENDATIONS

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Efforts to offset the environmental effects of Government programs which promote development of wetlands have a long history, but until recently they were confined primarily to special provisions in the tax code or mitigation expenditures. As an instrument for social policy, the tax code can be unwieldy and imprecise, and attempts at mitigation can be costly, technically difficult, and frequently ineffective. Although directly restricting those programs and subsidies which encourage undesired development would seem to be a preferable approach, it is an approach which often encounters insurmountable opposition. Typically, such programs become entrenched and difficult to restrain because the beneficiaries come to view the benefits as entitlements. However, in 1981 with passage of the Omnibus Budget Reconciliation Act (OBRA), the Federal Government adopted a bolder, more direct course of action.

OBRA directed the Secretary of the Interior to identify unprotected and undeveloped coastal barriers, and prohibited the issuance of new Federal flood insurance coverage in such areas. Subsequently, the Coastal Barrier Resources Act (CBRA) made any new development projects in the areas designated by the Secretary ineligible for most Federally financed assistance programs. These changes eliminated an inherent contradiction in Government policy: programs designed to protect fragile coastal barriers existing simultaneously with programs which countered the protective efforts by promoting commercial development. At least some of this commercial development would have been financially unattractive in the absence of Federal subsidies.

In 1983, the Secretary of the Interior suggested that Congress consider expanding the application of the CBRA concept and establishing subsidy-free wetland zones in which most Federal programs would be ineligible to function. The proposal had a number of objectives:

- Discourage economically inefficient and environmentally unsound development;
- Promote a stronger, more competitive economy by restricting Federal programs which distort market signals and destroy initiative;
- Foster Federal budgetary savings at a time of growing deficits; and
- Conserve environmentally significant wetlands with a minimum of Federal involvement and economic disruption.

Although this proposal was received favorably and enjoyed considerable support, Congress decided that before adopting such sweeping legislation, a study should be conducted to identify those Federal programs which have a significant impact of wetlands. In this way it was hoped that whatever efforts were ultimately undertaken to conserve wetlands could be crafted and tailored more precisely to the problem.

Thus, when this study began, it was thought that the recommendations which would emerge from it would likely be along the lines of CBRA. Since the study was initiated, however, Congress has enacted three significant pieces of legislation which affect wetlands:

- The Food Security Act of 1985 with its Swampbuster provisions;
- The Water Resources Development Act of 1986 with its provisions for increased cost sharing and emphasis on the benefit principle for financing government programs; and

- The Tax Reform Act of 1986 which eliminated those provisions of the tax code which encouraged conversion of wetlands to farmland at a time of agricultural surplus.

These new laws have the potential for solving many of the economic and environmental problems which were identified during this study. As a result, there seems little need to recommend comprehensive legislation similar to CBRA. Instead, the recommendations below build on the foundation established by these landmark statutes. It should be kept in mind, however, that for some wetland areas, development is so profitable that eliminating Government subsidies will not significantly reduce the rate of wetland conversion and degradation.

In developing these recommendations, the Department considered: first, ways of improving the administration of existing programs so that they would be more compatible with conservation of wetlands; secondly, promulgating new regulations under existing authorities; and finally, suggesting new statutory language.

**1. Flood control, drainage, and other water projects:**

- a. Require that new Federal water projects affecting wetlands be financed in accordance with the benefit principle of public finance, i.e., each beneficiary should bear the cost (including interest costs and any wetland opportunity costs) of generating his benefits.**

The Water Resources Development Act of 1986 (WRDA) constitutes an important step toward equitably allocating responsibility for financing water projects. The WRDA establishes a minimum cost-sharing contribution of 25 percent for non-Federal sponsors of flood control and drainage projects constructed by the Corps of Engineers. It initiates cash contributions by non-Federal sponsors, requiring that the cash contribution be at least equal to five percent of the construction cost. (Although many of the benefits of past projects have accrued locally, historically there have been no cash [only in-kind] contributions by the non-Federal sponsors.) The Act makes the non-Federal sponsors responsible for all operations and maintenance costs and half the cost of development and design studies. Further, by prohibiting the use of certain calculation techniques which have been used previously to artificially inflate benefit-cost ratios, the WRDA lends support to the efforts for standardized, objective evaluation criteria for public projects.

With passage of the WRDA, Congress has made substantial progress toward eliminating the subsidization of flood control, drainage, and navigation projects as well as reducing the construction of inefficient projects. However, the WRDA applies only to projects constructed by the Army Corps of Engineers. The concepts of efficiency and equitable cost sharing based on allocation of benefits are well-established. They should be extended to all new water projects affecting wetlands.

To this end, all Federal water resource development agencies are operating under a Presidential directive to seek new cost sharing arrangements with non-Federal project sponsors. The directive specifies that project beneficiaries should bear a substantial part of the costs of all project development. Pursuant to this policy, the Bureau of Reclamation has recently negotiated a 38 percent share of construction costs for the non-Federal sponsors of a water development project.

The cost shares specified in the WRDA reflect a clear goal, and both equity and efficiency will be served better if only those activities which reflect legitimate national objectives receive Federal financing, and non-Federal benefits are paid for by non-Federal sponsors.

- b. **Require that any agricultural benefits of new Federal water projects affecting wetlands be evaluated using commodity prices which reflect resource scarcity and are free of effects of agricultural programs and subsidies.**

Traditionally, prices which include the effects of agricultural programs and subsidies have been used to evaluate the new agricultural output attributable to a water project. These artificially maintained prices consistently overvalue the agricultural output, and may have resulted in some projects being undertaken which were economically unjustifiable, but which appeared (erroneously) to be worthwhile investments.

2. **Tax code provisions favoring conversion:**

**Extend the provisions of Section 403 of the Tax Reform Act of 1986 to gains from the sale of all converted wetlands.**

As a precaution against the possible future reinstatement of differential tax treatment for capital gains, Congress singled out gains from the sale of wetlands converted for farming and specified that such gains be treated as ordinary income (P.L. 99-514, Sec. 403). In order to extend fuller protection to wetlands, the Department recommends that this provision be amended to apply to the sale of all converted wetlands, independent of the purpose for which they were converted.

3. **Federally aided highways:**

- a. **Establish appropriate penalties for encroachment into drainage ditches for federally aided roadways or Federal highways.**

Much past drainage into road ditches appears to have been in violation of Federal-aid highway regulations, and existing road ditches continue to offer an incentive to drain adjacent farmlands. At current levels of enforcement of existing regulations against encroachment (23 CFR 1.23 and 645.2091), wetland drainage into the rights-of-way on federally aided roadways can be expected to continue.

FHWA regulations in effect since 1960 state that highway rights-of-way shall be devoted exclusively to public highway purposes unless the Administrator finds that some other use is in the public interest and will not impair the highway or interfere with traffic. No such finding has ever been made.

Enforcement is costly and infrequent and the penalty for violation is not particularly punitive. Although offenders are occasionally forced to plug drains, current enforcement practices provide little disincentive to use highway ditches for wetland drainage. An enforcement/penalty system, which does not pose much of a threat to violators, cannot be self-enforcing. The system needs to be redesigned in order to discourage violators and reduce enforcement costs.

- b. **Require that States and the Fish and Wildlife Service engage in pre-development consultation for highway or roadway projects receiving Federal Highway Administration funding.**

Despite the existence of a framework for early coordination, the Service sometimes has been unable (due to resource limitations) to participate fully in the planning for federally aided highways. In such cases, the Service may not get involved until after State agencies have applied to the Corps for 404 permits. Thus, opportunities have been foregone to alert State highway planners and local entities to the presence of wetlands and other environmentally sensitive resources and to advise them about avoiding adverse project effects. With participation by the Service coming late in the planning period, options for changing the design of projects have been foreclosed or limited.

The FHWA has just issued a report (prepared jointly with the Corps, EPA, FWS, and NMFS), identifying a variety of practices and techniques for making the early coordination process for federally aided highway projects more effective. Adoption of the procedures identified in the report will go a long way toward solving many of the inadequacies in the consultation process. Congress should encourage the States to implement the proposed procedures, and the Service will make every effort to utilize these procedures to resolve early on any differences with Federal and State highway agencies.

**4. Conservation initiatives:**

- a. To the extent permitted by budgetary constraints, encourage the development and implementation of projects for the creation, protection, and restoration of wetlands in conjunction with authorized projects for navigation, flood control, and drainage in the Lower Mississippi Valley.

Activities of this nature have been authorized by Congress with the intention of mitigating the environmental effects of past projects and providing mitigation concurrently with construction of present projects. Of course, authorization to undertake an activity does not ensure that a budget request will be forthcoming (especially when the activity is not the principal mission of the agency) nor does it guarantee an appropriation by Congress with or without such a request. No request has been made for the above wetland conservation activities, and no funds have been appropriated. Higher priority could be given to these activities within existing funding levels in order not to add to the Federal deficit.

- b. Extend the mitigation requirements of the Water Resources Development Act of 1986 to all projects which affect wetlands.

Section 906 of the WRDA requires that mitigation for the fish and wildlife effects of any new water projects constructed by the Corps (including projects previously authorized, but not yet under construction) be conducted either prior to or concurrently with construction; authorizes mitigation for fish and wildlife damages resulting from past, present, or future projects; and requires that a mitigation plan accompany any proposal for authorization of a new project. The Act also initiates cost sharing for mitigation, thus recognizing mitigation as a legitimate responsibility for non-Federal sponsors.

As noted previously, the WRDA applies only to projects constructed by the Corps. If mitigation is a desirable Federal objective, then it is appropriate no matter which agency undertakes the project.

- c. To the extent permitted by budgetary constraints, take advantage of temporarily depressed prices for wetlands by accelerating planned acquisition and easements and encourage State, local, and private organizations to do the same.

The reduction of economic returns to agricultural development of wetlands due to the current economic climate and the recent legislative reforms creates a low-cost (perhaps temporary) opportunity for conservation of priority wetlands. Current economic conditions in the agriculture sector have depressed the market value of some wetlands. Tax reform together with the Swampbuster sanctions have complemented this trend in land values. As a result, landowners are willing to sell their land or grant conservation easements at prices significantly below those which prevailed during recent years.

The Federal Government has a well-developed wetland priority system and an active acquisition/easement program. But the Federal Government has insufficient resources to resolve the problem of wetland conservation by itself and legitimately should not be so relied upon. Congress should seek ways of encouraging greater State, local, and private conservation efforts.

- d. Encourage State and local agencies and private conservation organizations to participate in cost sharing for wetland restoration projects with landowners enrolled in the Conservation Reserve Program.

The Conservation Reserve Program (CRP) provides annual rental payments to farmers who enroll their highly erodible cropland in the CRP for 10 years. The program also pays for half of the cost of conducting required conservation control measures. Many eligible properties contain existing or drained wetlands, and one of the approved conservation practices is the establishment of shallow water areas for wildlife, e.g., restoration of wetlands.

As of March, 1988, only 1,467 acres of the approximately 23 million acres enrolled in the CRP involved the establishment of shallow water areas for wildlife. In part this is because the cost to the landowner of restoring wetlands is higher than the cost of planting grass and because landowners fear that they may not be allowed unrestricted use of restored wetlands following the 10 year enrollment period. There is evidence that many more CRP participants would engage in wetland restoration if they were relieved of the higher costs and assured that at the end of their enrollment period their use of the land would not be restricted.

Estimates by the Service suggest that there are a significant number of wetland basins in the CRP and that they could be reestablished at modest cost, e.g., 10 percent of CRP lands in the glaciated portions of Illinois, Indiana, Iowa, Minnesota, and Wisconsin could be restored for \$100-\$250 per wetland basin. Iowa already has a cost-sharing program for restoring wetlands on CRP enrolled lands. Other States and private conservation organizations should be encouraged to follow their lead.

#### 5. Tailoring existing 404 regulatory program:

Recognize the special importance of Prairie Pothole wetlands by encouraging the Secretaries of the Army and Interior and the Administrator of EPA to closely monitor and coordinate the interagency review of this region's wetlands.

The Corps of Engineers' program implementing section 404 of the Clean Water Act is one of the most important Federal processes for regulating activities affecting wetlands. Normally, persons seeking to conduct activities that would result in the discharge of dredged or fill material onto wetlands must obtain a permit from the Corps. In an effort to manage the workload and administer the program, the Corps has issued several nationwide permits (general authorizations to proceed with the proposed activities without full review by the Corps or the resource agencies). One of these nationwide permits allows for filling of less than 1 acre in isolated wetlands. It also places some reporting requirements on fills of 1 to 10 acres, but these larger fills do not all receive full review by the Corps or the resource agencies. This program notwithstanding, extensive loss and degradation continue to occur to small wetlands (1-10 acres) in the Prairie Pothole Region.

Small wetlands in this region are known to be functionally important, especially to migratory and nesting waterfowl. Approximately 36 percent of all Prairie wetlands are smaller than 10 acres. By closely monitoring the interagency review of this region's wetlands, the agency heads can determine whether the regulatory program needs to be revised and greater protection extended to the small wetlands in the Prairies.

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