6.5 Wetlands Programs

Wetlands are important to the Nation's environment. Wetlands can store floodwater, trap nutrients and sediment, help recharge ground water, provide habitat for fish and wildlife, and buffer shorelines from wave damage. Wetlands also provide outdoor recreation, produce timber, provide grazing for livestock, and support educational and scientific activities. Despite these public values, conserving land as wetland forecloses more intensive economic uses for landowners. The current 124 million acres of wetlands in the continental United States is 55 percent of the original extent, but the rate of wetland loss has greatly diminished. A variety of policy instruments have been used in wetland programs to make progress toward the national goal of eventual net gains in wetlands.

Contents

Wetland Status and Trends

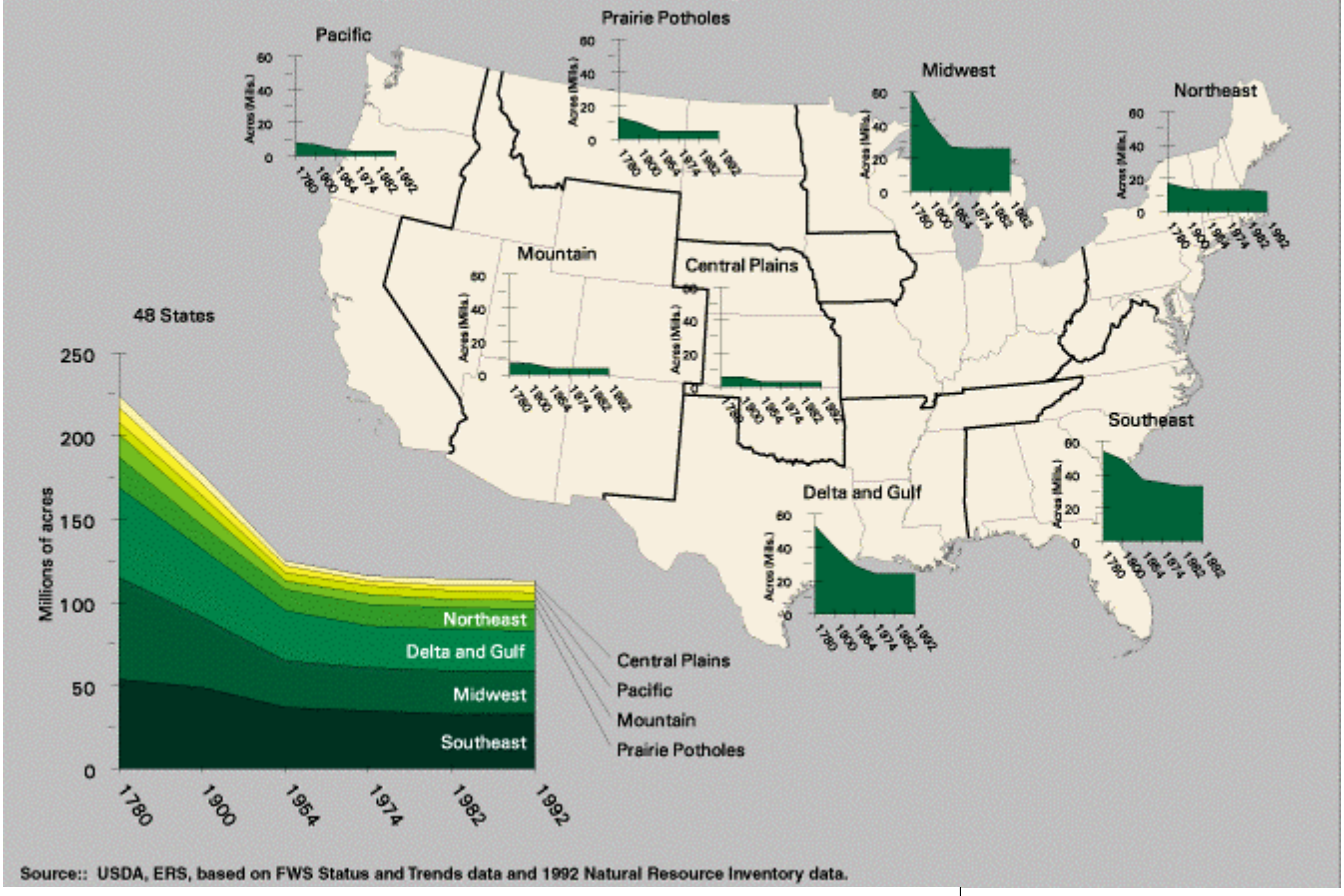
Wetland status involves both the extent, or quantity of wetlands, and the functions, or quality, of wetlands (see "What is a Wetland?"). Most policy interest has focused on the extent of wetlands remaining and the rate of conversion from wetlands to other uses. Discerning trends in wetland conversion is difficult because different agencies, using different definitions and methods, collect data useful for examining broad trends. The President's Clean Water Action Plan, led by the interagency White House Wetlands Working Group, plans to develop a single, improved wetland status and trends report by 2000 (USDA/EPA, 1998). Data reported here were adjusted from available data on wetland conversion from three studies, each using different statistical sampling techniques on slightly different wetland universes (Heimlich and others, 1998).

Long-term Trends

When colonists first set foot in America, there were 221-224 million acres of wetlands in what was to become the continental United States (Dahl, 1990). (Alaska and Hawaii had another 175 million acres.) Most of those wetlands were in three regions: the Midwestern States (27 percent), the Southeastern States (24 percent), and the Delta and Gulf States (24 percent) (fig. 6.5.1). By 1992, estimated wetlands were down to 124 million acres in the contiguous 48 States (including an estimated 12 million acres of Federal wetlands), 55 percent of the wetlands present in 1780. Almost half (45 percent) of U.S. wetlands had been converted to other uses since 1780, most to agricultural uses (fig. 6.5.2). The greatest loss of wetlands occurred between colonial times and the early decades of this century, with most occurring since 1885 (Pavelis, 1987).

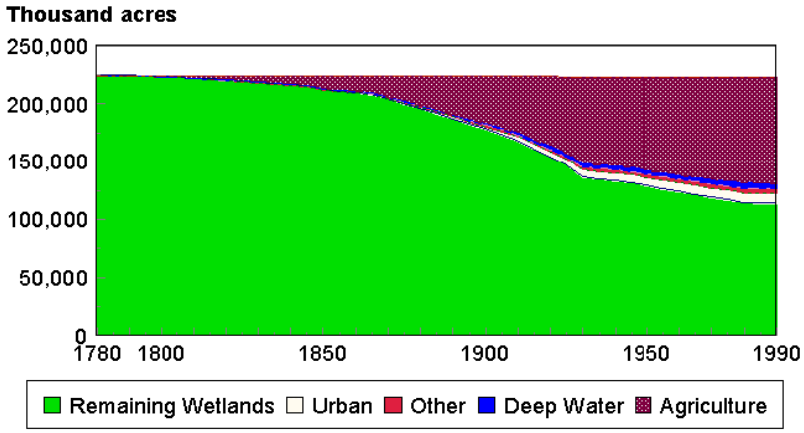
Figure **6.5.1**

Wetlands remaining, by year and wetland region, 1780 - 1992



Source:: USDA, ERS, based on FWS Status and Trends data and 1992 Natural Resource Inventory data.

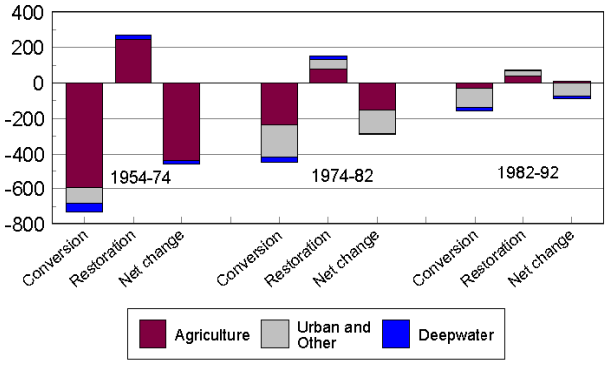
Figure 6.5.2 --Wetland conversion to other uses, contiguous States, 1780-1990



Sources: USDA, ERS analysis of National Resources Inventory and Fish and Wildlife Service Status and Trends data.

Remaining wetlands are concentrated in Florida, along the southeastern and Gulf coasts, and in the northern Lake and Plains States. The previous policy of "no net loss" attempted to balance unavoidable wetland losses with wetland restoration. The President's Clean Water Action Plan now seeks to reverse the historic pattern of wetland losses and achieve a net increase of 100,000 acres of wetlands each year, beginning in 2005 (USDA/EPA, 1998).

Figure 6.5.3 Wetland conversion, restoration, and net change, contiguous States, 1954-92



Sources: USDA, ERS analysis of National Resources Inventory and Fish and Wildlife Service Status and Trends data.

Recent Trends

Average annual rates of wetland conversion have generally been falling since the first reliable scientific inventories were taken in the mid-1950s. Between 1954 and 1974, the net rate of wetland conversion averaged about 458,000 acres per year, with 81 percent of wetlands converted to agricultural uses and 8 percent to urban (table 6.5.1; fig.6.5.3).

Between 1974 and 1983, net wetland conversion dropped to about 290,000 acres per year; gross conversions to agricultural use accounted for 53 percent and urban uses for 3 percent (an additional 38 percent converted to "other" uses was cleared and drained, possibly intended for agricultural use). Between 1982 and 1992, the net rate of wetland conversion further dropped to 70-90,000 acres per year, with agriculture accounting for only 20 percent of gross wetland conversions and urban uses for 57 percent. Over half of all wetland losses between 1982 and 1992 were from forested wetlands or wetlands on forestland.

Conversion back to wetlands has increased from 1 acre for every 3 lost in 1954-74 to 1 acre for every 2 in 1982-92. Conversion from deepwater provided two-thirds of wetland gains in 1982-92 and former agricultural land provided 10 percent. In addition to abandonment, natural reversion and private activity, wetland gains resulted from restoration programs such as the Wetland Reserve Program (WRP), the Conservation Reserve Program (CRP), the joint ventures sponsored under the North American Waterfowl Management Plan, the Fish and Wildlife Service Partners for Fish and Wildlife program, and the efforts of private groups such as Ducks Unlimited. Mitigation required under Section 404 of the Clean Water Act is not strictly a gain of wetlands, but offsets losses permitted to occur.

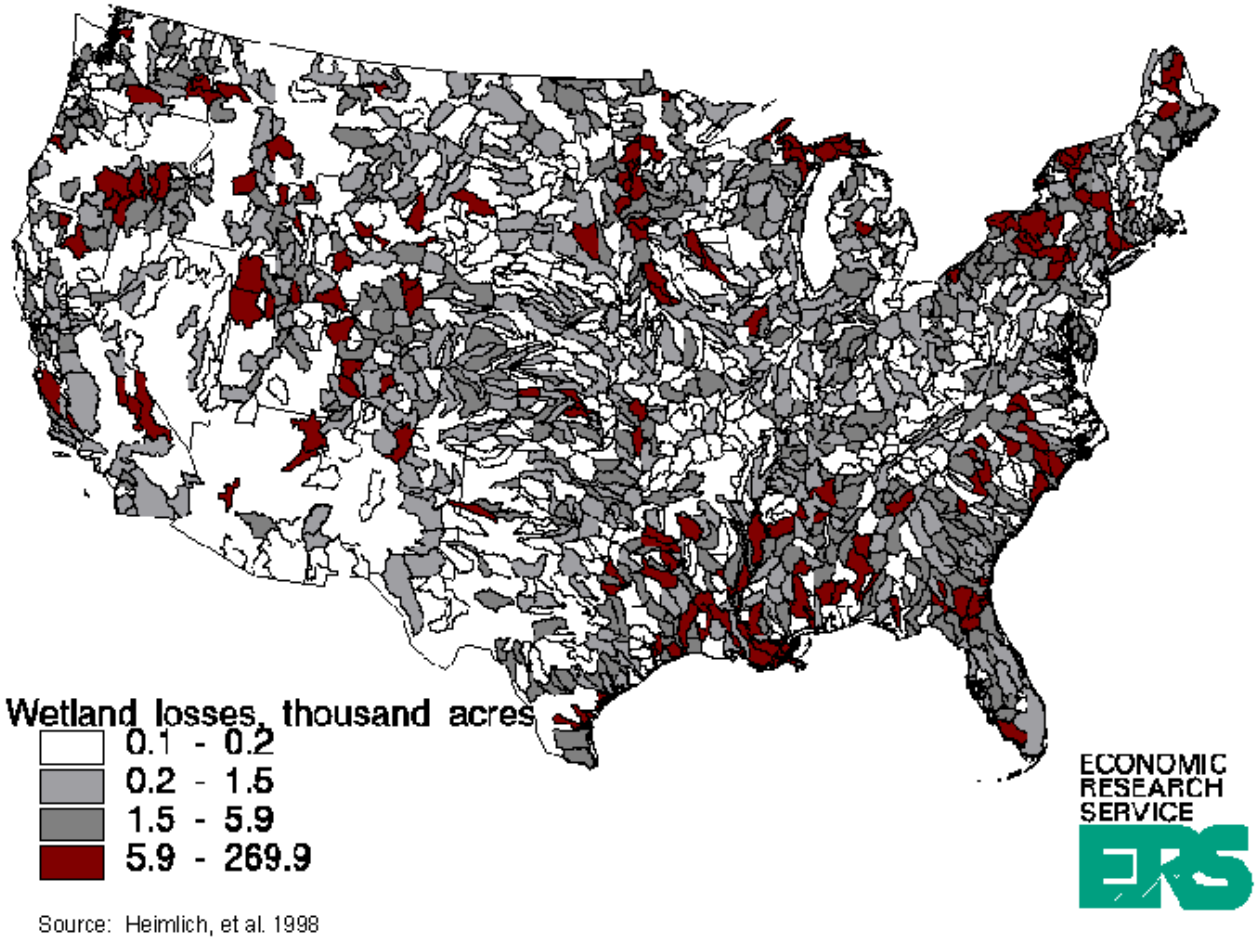
Wetlands are a significant landscape element, making up more than 5 percent of the total area in almost a third of the 2,123 watersheds in the contiguous States (fig. 6.5.4). Wetland losses vary throughout the country. Gross wetland losses from 1982 to 1992 were greatest along the east coast, Great Lakes, and Gulf Atlantic States, especially Louisiana, Florida, and North Carolina. Losses were more moderate in the Pacific Northwest. Thus, while net losses of wetlands are greatly reduced, certain areas of the country and certain wetland types are still experiencing significant losses.

Table 6.5.1—Average annual wetland conversion, contiguous States, 1954 to 1992

Item	USDI, Fish and Wildlife Service estimates[1] (includes Federal lands)				USDA, NRCS estimates [2] (excludes Federal and urban lands)	
	1954-74 change		1974-83 change		1982-92 change	
Wetlands converted to:	*1,000 acres/yr.*	*Percent*	*1,000 acres/yr.*	*Percent*	*1,000 acres/yr.*	*Percent*
Agriculture	592.8	81	234.8	53	30.9	20
Urban development	54.4	8	14.0	3	88.6	57
Other	34.6	5	168.1	38	16.4	10
Deepwater	47.8	6	29.0	6	20.2	13
Total	729.6	100	445.9	100	156.1	100
Converted to wetlands from:						
Agriculture	247.3 includes ag, urban and other	na	81.5	53	7.8	10
Urban development		na	.4	0	1.6	2
Other		91	53.4	34	18.3	24
Deepwater	24.7	9	20.4	13	49.2	64
Total	271.9	100	155.7	100	76.9	100
Net change in wetlands: [3]						
Agriculture	-434.5 includes ag, urban and other	na	-153.3	53	-23.1	29
Urban development		na	-13.6	5	-87.0	110
Other		95	-114.7	40	+1.9	-2
Deepwater	-23.2	5	-8.6	2	+29.0	-37
Total	-457.7	100	-290.2	100	-79.3	100

[1] U.S. Fish and Wildlife Service, National Wetland Status and Trends Analysis, mid-1950's to mid-1970's and mid-1970's to mid-1980's. Excludes Alaska and Hawaii. Excludes deepwater habitats.
[2] Soil Conservation Service, USDA, National Resources Inventories, 1982 and 1992. Includes only rural, nonfederal land. Excludes Alaska; includes Hawaii and Caribbean. Excludes estimated acreage of deepwater habitats.
[3] Conversion of wetland to nonwetland uses, plus increases in wetlands due to restoration, abandonment, and flooding. Excludes change to or from Federal ownership.
Source: USDA, ERS compilation of available data, see footnotes.

Figure **6.5.4 –Gross wetland losses, 1982-92**



Source: Heimlich, et al. 1998

Agriculture's Contribution to "No Net Loss"

Progress toward "no net loss" has been more rapid than many anticipated when the goal was first enunciated in the late 1980's. Lack of a data on wetland conversion since 1992 and problems in accounting for restoration activity make a precise calculation impossible, but the United States is undoubtedly approaching "no net loss," at least in terms of acreage (Tolman, 1997; Smith, 1997; Wilen, 1995).

If the average rate of gross wetland conversion to other uses observed over 1982-92 continued during 1992-98, 156,000 acres of wetlands per year would have been converted, requiring double the rate of restoration or replacement observed in 1982-92 (table 6.5.2). The conversion rate may have declined, consistent with the long-term trend observed since the mid-1950's, or may have increased because of the improved economic conditions, particularly in the agricultural economy. However, restoration activity more than doubled, rising from 77,000 acres per year in 1982-92 to an average of 263,301 acres per year in 1992-98. While some of the efforts under the North American Waterfowl Management Plan (NAWMP) and the North American Wetlands Conservation Act (NAWCA) include State and local government and private activities, purely private efforts at restoration-- such as those of Ducks Unlimited, the Izaak Walton League, and The Nature Conservancy -- are not included in the estimates. The 77,000 acres represents wetlands reestablished on previously drained sites, while the 263,000 acre includes restoration of degraded wetlands in addition to reestablishment of former wetlands. Degraded wetlands still count in the wetland inventory, so while restoring them increases their value, it does not make up for wetland losses. Adjustments for upland acres included in the figures, restoration versus reestablishment, and double counting among programs were made to the data to reflect these factors. Even with the adjustments, it appears that the United States may well have achieved "no net loss" of wetland acreage. More restoration would need to be done to meet the new goal of eventual net gains in wetland acreage.

Table 6.5.2--Average annual wetland losses and gains compared with recent restoration activity, 1992-98

	Restoration activity								Adjusted [5] Average annual restoration
Program	1992	1993	1994	1995	1996	1997	1998	Total	1992-98
					Acres				
USDA-WRP/EWRP[1]	43,354	46,257	105,734	159,569	48,857	129,255	211,917	744,943	63,852
FWS-NAWMP[2]	88,000	51,000	50,000	71,275	104,046?	71,033	na	435,354	14,512
FWS-NAWCA[3]	41,008	42,866	11,700	14,234	77,344	40,124	17,147	244,425	6,984
ACE-Section 404[4]	na	15,200	38,000	45,925	47,864	53,400	46,630	247,019	46,934
Total	172,364	155,323	205,434	291,003	278,111	293,812	275,694	1,671,741	132,282

[1] Wetland Reserve and Emergency Wetlands Reserve Programs, assumes 60 percent is actual restoration.
[2] Fish and Wildlife Service-North American Waterfowl Management Plan, assumes 20percent is reestablishment of wetlands.
[3] Fish and Wildlife Service-North American Wetland Conservation Act, assumes 20 percent is establishment or reestablishment of wetlands. Fish and Wildlife Service-Partners for Fish and Wildlife is assumed included in NAWMP and NAWCA.
[4] Robertson (1998), includes mitigation banking and assumes 95 percent is restoration.
[5] Adjusted for the proportion of wetland versus upland acres, restoration versus enhancement, and for double-counting, as noted above.
Source: USDA, ERS analysis of U.S. Fish and Wildlife Service, Army Corps of Engineers and other data.

Whether the low rate of gross wetland conversion in 1982-92, the high rate of wetland restoration in 1992-98, or both, can be sustained over the long term remains unclear. Increased demand for land in the agricultural and nonagricultural economy, proposals to exempt wetlands from current conservation and regulatory programs, phasing out of farm program benefits that motivate the Swampbuster provisions, and continuing budgeting issues could increase wetland conversion from the low rates observed in 1982-92, reduce restoration activity, or both, moving us away from "no net loss".

Costs and Benefits of "No Net Loss"

Estimating both the costs of avoiding wetland conversion (such as foregone uses of former wetlands) and the benefits of conserving or restoring wetlands requires detailed, site-specific knowledge of exactly which wetlands are proposed for development in a given year. While this kind of information is not available, a rough picture of the costs and benefits of achieving "no net loss" can be gleaned from available data. Average costs of acquiring property rights in wetlands range from several hundred dollars per acre for wetlands in their natural state that have little potential for conversion up to hundreds of thousands of dollars per acre for wetlands with potential value for urban development (table 6.5.3). Acquiring rights to former wetlands and restoring them to wetland condition can be less expensive than wetland conservation because there is a large supply of former wetlands that are marginally suited to economic uses and relatively easily restored. Wetlands that are profitable to develop have good agricultural productivity, or are well located with respect to urban development, increasing their market value. For both conservation and restoration purposes, costs range widely depending on the potential for economic uses, location, and the difficulty of converting from or restoring to wetland condition. On the benefits side, wetland valuation studies show that average values per acre generally match or exceed conservation or restoration costs (table 6.5.3). Not all wetlands generate all the functions valued by people. Nonuse benefits may greatly exceed wetland costs because relatively low values per acre are shared by millions of individuals who appreciate the environmental values represented in wetlands. The extremely wide range of benefit estimates causes some concern. Such variation can be caused by flaws in estimation methods (Anderson and Rockel, 1991; Shaman and Batie, 1985; Scodari, 1997), by instability in respondents underlying perceptions of the functions, services, and values of wetlands (Novitski, and others, 1996), or by real variation in the physical attributes and locational characteristics of wetlands that underlie the valuations. While estimated benefits appear to justify the costs of reestablishing wetlands, an aggregate assessment based on the current information is impossible because both the costs and the benefits vary to such a large degree and on such a site-specific basis.

Present policy combines an overarching goal of "no net loss", and eventual net gain, with a regulatory review process that deals with minimal impacts through general permits and conducts more thorough reviews of the environmental effects of major proposals impacting wetlands. Unnecessary impacts are avoided, minimized, and, as a last resort, compensated through wetland establishment or reestablishment through the Section 404 permit process to replace lost values.

Table 6.5.3--Costs and benefits of wetlands

Costs of conserving or restoring wetlands					Benefits of wetland functions			
Program	Number	Acres	Cost per acre		Wetland function valued	Number of studies	Benefits per acre	
			Average	Range			Average	Range
Acquisition of property rights for conserving existing wetlands					**Marketed goods**			
Water bank (capitalized @ 6%)	6,000 (contracts)	671,446	$250	na	Fish and shellfish support	8	$6,132	$7-$43,928
					Fur bearing animals	2	$137	$13-$261
The Nature Conservancy	1,343	501,504	$1,306	$1-$968,423	**Nonmarketed goods**			
Swampbuster	na	13,165,800	$2,215	$519-$4,136	General-nonusers	12	$83,159	$115-$347,548
					General-users	6	$2,512	$105-$9,859
Acquisition of property rights for restoring or reestablishing former wetlands					Fishing-users	7	$6,571	$95-$28,845
North American Wetlands Conservation Fund	202 (projects)	940,723	$382	$40-$422	Hunting-users	11	$1,019	$18-$3,101
Wetlands Reserve Program	2,139	341,259	$620	$97-2,313	Recreation-users	8	$1,139	$91-$4,287
Emergency Wetlands Reserve Program	719	94,181	$799	$598-$1,283	Ecological functions	17	$32,149	$1-$200,994
					Amenity and cultural	4	$2,722	$83-$9,910

Source: Heimlich and others, 1998, table 12.

Wetland Programs

Landowners respond to a variety of economic and public policy factors that influence wetland conversion. The recent reduction in wetland losses is likely the cumulative effect of several important trends: (1) decline in the profitability of converting wetlands for agricultural production; (2) passage and continuation of the Swampbuster provisions in the 1985, 1990, and 1996 farm bills; (3) continued implementation of the Clean Water Act Section 404 program, as well as growth in State regulatory programs; (4) greater public interest and support for wetland protection and restoration; and (5) implementation of wetland restoration programs at the Federal, State, local, and nongovernmental levels.

Protection Programs

Until 1978, some government programs encouraged conversion of wetlands to other uses by providing financial and technical assistance (see box, "Evolution of Agricultural Wetland Policy"). A policy change toward preservation began in the late 1970's, using disincentives and regulation to reduce conversion.

Table 6.5.4-Permit actions under section 404 of the Clean Water Act, FY 1998

Action	Number	Percent
General permits issued	64,520	87.8
Standard permits issued	4,931	6.7
Applications withdrawn	3,841	5.3
Permits denied	158	0.2
Total applications	73,450	100.0

Source: USDA, ERS, based on U.S. Army Corps of Engineers, 1998 (unpublished data).

Swampbuster. Indirect Federal assistance for wetland conversion was eliminated by the wetland conservation provision (Title XII C. P.L. 99-198) of the Food Security Act of 1985. Popularly known as the Swampbuster provision, it made a farm operator ineligible for price support payments, farm storage facility loans, crop insurance, disaster payments, and insured or guaranteed loans for any year in which an annual crop was planted on converted wetlands. Persons sanctioned for Swampbuster violations increased from only 12 in 1987 to 165 in 1991, but have dropped since then (table 6.3.2, in chapter 6.3). Despite intensive debate, few changes were made to wetland conservation provisions in the 1996 Federal Agricultural Improvement Act.

Section 404. Under Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers regulates the discharge of dredged or fill material into waters and wetlands of the United States. The U.S. Environmental Protection Agency has oversight of Section 404. Few permit applications are actually denied. In fiscal year 1998, the Corps received 73,450 permit applications (table 6.5.4). Of these, 69,451 (95 percent) were authorized through general permits, standard permits, or letters of permission, 3,841 (5 percent) were withdrawn, and only 158 (less than 1 percent) were denied. EPA's Section 404(b)(1) Guidelines (40 CFR Part 230) require that no activity can be permitted unless appropriate and practicable steps have been taken to minimize all adverse impacts. The Guidelines establish a mitigation sequence that requires applicants to avoid, minimize, and mitigate for wetland losses. During fiscal year 1998, the Corps required applicants to establish or reestablish 46,360 acres wetlands as compensatory mitigation to offset losses of 31,090 acres permitted. The Corps required a ratio of 1.5 acres for every acre lost, down from 2.2 acres in fiscal year 1994 (table 6.5.5).

Evolution of Agricultural Wetland Policy

Encouraging Wetland Drainage, 1780-1977

Early Encouragement, 1780-1940--For the first 200 years of U.S. history, the Federal Government approved of and assisted with wetland drainage to further public health and economic development goals. Between 1849 and 1860, the **Swampland Acts** granted 64.9 million acres of wetlands to 15 States on the condition that proceeds of wetlands sold to individuals be used for reclamation projects.

Agricultural Conservation Program (ACP), Great Plains Conservation Program (GPCP), and Conservation Technical Assistance (CTA), 1940-77--Cost-sharing and technical assistance for open ditch and tile drainage were used on some 57 million acres of wet farmland, including many wetlands. However, in response to Executive Order 11990 in 1977, USDA prohibited furhter use of ACP and GPCP cost-sharing for tile or surface drainage, except under limited circumstances.

Small Watershed Program, 1944-1977--Funds for flood control and drainage structures were provided under PL-566 and the PL-534 Flood Control Act. Construction of outlet channels under PL-566 provided drainage outlets for increased farm drainage in wetland areas. In 1977, USDA changed the programs in response to Executive Order 11990 to limit direct impacts on wetlands.

Encouraging Wetland Preservation, 1970 to present

Water Bank Program, 1970--In return for annual per-acre payments, landowners agreed not to burn, drain, fill, or otherwise destroy the character of enrolled wetland areas. Existing Water Bank contracts were terminated after 1990, but landowners could enroll in the Wetland Reserve Program.

Section 404, Federal Water Pollution Control Act Amendments, 1972--The only Federal program regulating wetland conversion is Section 404 dredge and fill permit requirements enacted in the 1972 Federal Pollution Control Act amendments, now called the Clean Water Act.

Food Security Act (FSA), 1985--Indirect Federal assistance for agricultural wetland conversion was eliminated by the wetland conservation provisions (**Swampbuster**) of the 1985 FSA. The Swampbuster provision was a quasi-regulatory policy that made a farm operator ineligible for price support payments, farm storage facility loans, crop insurance, disaster payments, and insured or guaranteed loans for any year in which an annual crop was planted on wetlands converted after 1985. In 1989, **Conservation Reserve Program (CRP)** eligibility was expanded to include wetland that had been cropped for at least 2 years between 1981 and 1985, but had not been drained.

Tax Reform Act, 1986--This Act restricted or eliminated many provisions that indirectly subsidized agricultural wetland conversion. Among these were deductions for land clearing expenses, deductions for soil and water conservation expenses, and preferential treatment of capital gains, including capital gains realized from draining wetlands.

Food, Agriculture, Conservation, and Trade Act (FACTA), 1990--In addition to some adjustments to the Swampbuster provision, this act authorized a **Wetland Reserve Program (WRP)**. The Act called for restoration of 1 million acres of cropland to wetlands, requiring permanent or long-term easements with the landowner to restrict agricultural use of restored wetlands.

Bush Administration Wetlands Plan, 1991--Plan for accelerated regulatory reform, followed shortly by the 1991 interagency wetland delineation manual, substantially revised the 1989 manual. Little progress was made in implementing the Bush plan.

Clinton Administration Wetlands Plan, 1993--An interagency task force led by the new Council on Environmental Quality crafted their own wetland regulatory reform package that embraced the “no net loss” of wetlands goal, streamlined Section 404 permit processing, gave NRCS authority for wetland delineation on agricultural land, and supported wetland restoration through a variety of programs, including WRP.

Federal Agriculture Improvement and Reform Act, 1996 (1996 Farm act)--Continued the Wetland Reserve Program with a goal of 975,000 acres and required that, beginning October 1, 1996, one-third of total program acres be enrolled in permanent easements, one-third in 30-year easements, and one-third in restoration-only cost-share agreements. Made changes to give farmers more flexibility, including expanding areas where mitigation can be used, providing more options for mitigation, and encouraging effective and timely use of "minimal effect" determinations. Wetland conversion activities, authorized by a permit issued under Section 404 of the Clean Water Act, that make agriculture production possible, will be accepted for farm bill purposes if they are adequately mitigated. The concept of "abandonment " was revised to ensure that "prior converted" designations remain as long as land is used for agriculture. Wetlands are once again eligible for enrollment in CRP.

The low rate of permit denial does not necessarily mean that Section 404 is ineffective in reducing wetland losses. Many of the permit applications are substantially modified during the review process because of the avoidance and minimization requirements, or are withdrawn. More important, developers have learned to avoid wetland sites requiring lengthy or risky permit approval processes (Albrecht and Goode, 1994).

Table 6.5.5--Wetlands permitted and mitigated under Section 404 of the Clean Water Act, 1993-98

Year	Permitted	Mitigated
	Acres	
1993	11,600	15,200
1994	17,200	38,000
1995	26,300	45,925
1996	24,987	47,864
1997	34,700	53,400
1998	31,090	46,630

Source: USDA, ERS, based on U.S. Army Corps of Engineers, 1995 and Robertson, 1998.

Permits for agricultural activities were only 6.7 percent (3,430) of total permits considered in FY 1994. Of these, 87.5 percent were general permits, 11.7 percent were individual permits, and 0.9 percent (30 permits) were denied. More than half of the agricultural activities that do require permits involve conversion of wetlands to developed uses. Section 404 (f) exemptions preclude permits for "normal" farm activities such as plowing, seeding, cultivating, and harvesting. Most other activities associated with farming are also exempt as long as woody vegetation over 5 years old is not removed.

The Corps has been working to reduce permit evaluation time. While the number of permit actions increased 34 percent in 1994-98, average permit evaluation times dropped by 28 percent. General permit applications took an average of 16 days to process in FY 1998, and the average time to process a standard permit dropped from 115 days to 87. The overall average processing time dropped from 27 days to 21.

Changes to Nationwide Permits. Not every proposal to convert a wetland requires that an individual permit application be filed. In order to streamline processing for activities that are similar in nature and result in minimal impact on the environment, the Army Corps of Engineers uses a system of 39 nationwide general permits for activities ranging from scientific measuring devices to road crossings.

The most controversial of these is nationwide permit 26 (NWP 26), which regulates discharges into headwaters and isolated wetlands. NWP 26 was first developed in 1977, when the Corps Section 404 jurisdiction was extended from traditional navigable waters to all waters of the U.S. At that time, the blanket authorization of work above headwaters and in isolated waters was a practical means of managing the suddenly increased workload. In 1984, when it had become apparent that very large tracts of wetlands were being adversely impacted, NWP 26 was capped at 10 acres, later reduced to 3 acres in 1996.

Some 42,000 acres of headwaters and isolated wetlands were impacted by NWP 26 from 1991-95. These waters play a critical role in reducing flooding, maintaining water quality, and providing valuation habitat. In addition, the National Academy of Science recognized the critical value of these waters by concluding that there is little scientific basis for attributing less importance to headwater and isolated wetlands than other wetlands (NRC, 1995). According to a Corps analysis, between May and December 1997, about 40 percent of NWP 26 activities authorized were for developed uses (residential, retail, industrial, and institutional), 19 percent for transportation projects, 7 percent for agriculture, and the remainder for mining, impoundments, and stormwater management activities. NWP 26 authorized 317 agricultural projects, resulting in the loss of 85 acres of wetlands and 20,860 linear feet of streambed. Wetland restoration on 151 acres was provided as compensatory

mitigation by operators granted these permits.

Concerns were raised that the nationwide general permits covered too broad an array of activities that were dissimilar and were not authorized in Section 404's statute. In June 1996, the Corps sought public comment on a proposal to modify the system of nationwide permits. In December 1996, the Corps proposed to phase out the existing NWP 26 over 2 years and replace it with activity-based nationwide permits (61 FR 65874 - 65922). In July 1998, the Corps proposed 5 new nationwide permits and modification to 6 existing permits. On October 14, 1998, the Corps published a subsequent notice withdrawing one of the proposed new activity-based nationwide permits (dealing with master planned developments). The new notice also proposed prohibiting use of the new and modified nationwide permits in floodplains, designated critical resource waters, and impaired waters, and provided for additional public comment (63 FR 55095-55099). Because of this extended comment period, the phase-out of nationwide permit 26 was also extended to September 15, 1999.

A final draft was released for public comment in March 2000 (65 FR 12886-12899). As part of the notice, the Corps proposed changes to NWP 40 for the purpose of improving production on existing agricultural lands. The modified nationwide general permit would apply to conversions that:

- Qualify for a minimal effects or mitigation exemption under Swampbuster and has an NRCS- or Corps-approved mitigation plan fully offsetting wetland losses, if required;
- Cause a loss of no more than 1/2 acre of nontidal wetlands;
- For construction of farm buildings, cause loss of no more than 1/2 acre of nontidal farmed wetlands; and
- Require pre-discharge notification to the Corps (65 FR 12890-12891).

Because more than 1,700 public comments were received, the Corps delayed issuing the new permits until March 2000, with the effective date of the new permits delayed to June 2000.

Tulloch Rule. Section 404 regulates discharge of dredge and fill material in wetlands, but does not specifically regulate wetland drainage or clearing. Regulation of wetland drainage under Section 404 has been incidental to discharge of small amounts of dredged material into a wetland during ditching or drainage installation, called "fallback." Regulation expanding Section 404 to cover activities such as drainage, land clearing, and construction on pilings were developed as a result of a settlement in a 1990 lawsuit brought against the Army Corps of Engineers (North Carolina Wildlife Federation v. Tulloch, Civil number c90-713-CIV-5-BO, EDNC 1992). Such activities were previously exempted as *de minimis* fills. The rule governing these activities was proposed on June 16, 1992 (33 C.F.R. 323.2(d), 40 C.F.R. 232.2(3)), and included in the Clinton administration's 1993 wetland plan.

In January 1997, the Tulloch rule was invalidated because it exceeded the Corp's authority under the Clean Water Act, and the decision was subsequently affirmed on appeal in June 1998 (American Mining Congress v. U.S. Army Corps of Engineers, 951 F. Supp. 267 (D.D.C.1997), aff'd sub nom, National Mining Association v. U.S. Army Corps of Engineers, 145F.3d 1339 (D.C. Cir. 1998)). The Corps and EPA amended their regulations in May 1999 to conform with the court ruling.

Swampbuster sanctions are not limited to dredge and fill, but apply to all activities that would substantially alter the hydrology of wetlands or completely remove woody vegetation in order to make them suitable for crop production. Swampbuster remains one of the few Federal legal impediments to wetland conversion in many agricultural contexts.

Areas in North Carolina and Virginia have had substantial wetland conversion since the Tulloch rule was invalidated, losing in excess of 10,000 acres. As many as 30,000 acres may have been ditched (Peck, 1999). In March 1999, The North Carolina Division of Water Quality implemented rules to stop wetland loss from drainage, but drainage goes on in other States (Carter, 1999).

State Wetland Programs. The Association of State Wetland Managers polled States regarding their wetland laws in 1992 and 1996 (Kusler and others, 1994; Kusler, 1996). Forty-four States have wetland statutes or laws, including 18 that regulate both coastal and freshwater wetlands, 7 that regulate only coastal wetlands, and 4 that regulate coastal and part of their freshwater wetlands (table 6.5.6). Forty-six States relate wetland policies to water quality policies, such as Clean Water Act Section 401 water quality certification programs or other State water quality standards. Forty-six States have wetland definitions that are comparable with those used in Federal programs. However, enforcement of these policies is less widespread: 40 States staff their programs, 33 States track and enforce wetland permits, and only 26 States penalize violators of their wetland laws.

State agencies participate in wetland-related management, regulation, restoration and creation, and delineation and inventory with Federal and local governments and private organizations (USDI-USGS, 1996). However, it is difficult to determine what powers of coordination are exercised and what financial resources are available to carry out concerted programs with Federal agencies and, within the State, with local governments. One of the most important avenues for State involvement in wetlands policy is through joint participation with Federal agencies, particularly through programmatic general permits developed in conjunction with the Army Corps of Engineers based on strong State, local, or regional programs (Studt, 1995, p. 77).

Sections 404(g) and (h) of the Clean Water Act authorize States to assume administration of the Section 404 program in lieu of the Corps if States permit programs are as stringent as the Federal wetlands program. To date, only two States—Michigan and New Jersey—have assumed responsibility for the Section 404 program. States may take responsibility for parts of the Section 404 program without assuming complete responsibility. Twenty-one States have investigated assuming some Section 404 powers, and 13 have carried out detailed technical reviews (Kusler, 1994).

States can also exercise their authority under Section 401 to grant or deny water quality certification for individual or general Federal Section 404 permits (Kusler, 1994, p. 45; Studt, 1995). States may adopt stringent surface water quality standards and wetlands water quality standards to protect their waters. States can review and approve, deny, or put conditions on all Federal permits or licenses that might result in discharges to State waters that would fail to meet State water quality standards (USEPA, 1993).

Some States participate in Federal wetland regulation through State program general permits (SPGPs; Kusler, 1994, p. 50). The Clean Water Act does not specifically authorize the Army Corps of Engineers to issue SPGPs. However, the Corps relies upon its general permit authority in Section 404(e) to issue statewide permits that are "piggy-backed" onto the existing State wetlands permitting programs. The Corps has also issued programmatic permits on a local basis. As of 1997, the Corps of had issued approximately 60 SPGPs and local programmatic permits, including permits in New Hampshire, Maine, Wisconsin, North Carolina, and Maryland.

Wetland Tax Credit. Existing Federal programs, including WRP, CRP, and the Small Wetland Acquisition Program (SWAP), are straight forward acquisitions of partial interests in wetlands intended to protect them from

conversion (Wiebe and others, 1996). Another proposal to compensate owners for wetland protection would operate through the Internal Revenue Code (McLaury, 1998; Senate Bill 1907). Under this mechanism, eligible taxpayers with eligible wetlands could claim a refundable tax credit equal to the cost of restoring or enhancing the wetland, plus a portion of the soil-specific CRP rental rate or the value of a conservation easement. Owners would agree either to continue to protect the wetland for 10 years, under the annual program, or to negotiate a permanent easement with a qualifying conservation organization. Recapture provisions would reclaim some of the tax advantage if taxpayers fail to live up to the terms within specific time periods. A refundable credit means that the Treasury would issue a check for the credit even if no taxes were owed, a situation typical of many farm taxpayers filing Schedule F (Refundable Credits, Sections 31-35, IRC). About 80 percent of farmers have income of less than $60,000 and pay an average effective Federal income tax rate of less than 10 percent (Durst and Monke, 1998).

Investment tax credits have been used to provide incentives for desirable capital investments since at least the 1960's. Deductions for soil and water conservation expenses, including drainage and other expenses relating to wetland conversion, provided incentives for converting wetlands until requirements were tightened in the 1986 Tax Reform Act (Heimlich, 1986; Daugherty, 1987). Donation of a conservation easement, valued as the difference in market value of a property with and without the easement in place, has been deductible on Federal income taxes under Section 170(h) since 1964 (Ward and others, 1989).

If eligibility for tax credits were limited to prior converted (PC in the NRCS classification) and farmed wetlands (FW), wetlands farmed under natural conditions (W), and wetlands adjacent to cropland (also W), 64.2 million acres of wetlands would be eligible, about 60 percent of all wetlands in the contiguous 48 States (table 6.5.7). More than half of the eligible acreage (34.5 million acres) would find it profitable to enroll, with three-quarters of this in annual conservation agreements. While conservation agreements would attract most of the acreage, almost 60 percent of the 5-year tax expenditure would be for easements, mostly on prior converted wetlands restored to full function. This is because both restoration costs and easement payments are incurred in the early years of the program, while conservation credits are paid each year of the agreement. Easements and restoration, while they contribute the most to "no net loss" of wetlands, are very expensive (almost $25 billion). Worse, from the viewpoint of congressional budget scoring, the costs are frontloaded in the early years of the proposal. Costs per acre for easements, including restoration at 75 percent cost-share, would be $1,221 (including 2 upland buffer acres per wetland acre). The 5-year costs of restoration and the annual conservation credit would average only $260 per acre. However, the costs of the annual conservation credit over 30 years would average $765 per acre. Current WRP easements average $860 per acre.

Restricting the program to annual conservation credits and associated restoration credits (the "conservation" column in table 6.5.7) would reduce enrollment by only about 8 million acres, but would reduce 5-year budget costs to $12.4 billion (including $4.3 billion in restoration costs). Most of the acreage profitable to enroll is natural wetland (W), with little potential for cropland or developed uses. In other words, by allowing natural wetlands to be enrolled, much of the tax expenditure would go to protect wetlands that have little actual conversion pressure. However, even restricting the program in this way results in 5-year costs higher than the much larger CRP program.

Further restricting eligibility to only cropped wetlands would reduce the risk of giving tax credits where there is no conversion pressure, enhance wetlands that may be degraded because of agricultural production, and reduce the cost of the program. Some 5.4 million acres of cropped wetlands would be eligible (5 percent of U.S.

wetlands), and 3.5 million acres would find it profitable to enroll in annual conservation agreements. Five-year budget costs would fall to $1.6 billion, 42 percent for restoration at a 75 percent cost-share. Per-acre costs for this restricted acreage of higher value wetlands would average $282 for 5 years, slightly more than under the larger program. However, average costs over 30 years would total $731 per acre.

Using tax credits to fund easement and restoration of former wetlands is expensive and requires upfront funding that does not score well in the congressional budget process. Targeting tax credits to conserving limited categories of existing wetlands is less expensive and continuing annual expenditures fare better in budget scoring. However, conserving existing wetlands duplicates Section 404 and Swampbuster protection, thus not contributing to "no net loss." Tax credits cannot be targeted as well as discretionary programs like the Wetland Reserve Program. Anyone qualifying for a tax credit can claim it, while WRP's administrators have more discretion over acceptance. Administrative burdens on wetland technicians are higher for WRP, but Internal Revenue Service auditors administering a tax credit would require technical certification that wetlands meet eligibility criteria. Once enacted, tax credits escape the annual appropriations process that hampers direct acquisition. While a wetland tax credit might be a useful addition to the arsenal of tools for conserving wetlands, it is not a "magic bullet" that can reduce the costs of compensating landowners.

Restoration Programs

Conserving wetlands is at the heart of the "no net loss" policy. However, since some losses are unavoidable, programs to restore wetlands must also contribute to "no net loss." Restoration has recently gotten attention in the Clinton administration's Water Quality Action Plan, which called for a net increase in wetland acreage of 100,000 acres per year by 2005 (USDA/EPA, 1998). The plan assumes a baseline current annual net loss of wetlands of 100,000 acres, which will require a gross increase of 200,000 wetland acres established or reestablished annually. Existing Federal programs, as well as community-based efforts, are being coordinated to achieve the goal.

To meet the goal, unavoidable wetland losses that are authorized by Section 404 must be offset fully by gains achieved through successful compensatory mitigation in 2005 and each succeeding year. Federal programs key to achieving a net gain in wetlands include USDA's Wetland Reserve and Conservation Reserve programs, the Corps environmental restoration programs, the Department of the Interior's Partners for Fish and Wildlife program, and the North American Wetlands Conservation Act. Agriculture programs are expected to yield an estimated gain of 125,000 to 150,000 acres of wetlands per year by the year 2005, while other Federal programs are counted on for an additional gain of at least 40,000 to 60,000 acres per year. Nonfederal programs are expected to contribute approximately 35,000 acres per year by the year 2005.

Table 6.5.6--State wetland laws and programs, 1996

Item	Number of State laws with provision	
	Yes	No
1. State wetland laws	44	4
2. Wetlands and water quality	46	4
Regulated only in coastal wetlands	7	0
Regulated in coastal and some freshwater wetlands	4	0
Regulated in both coastal and freshwater wetlands	18	0
3. Staffing for wetland regulation	40	0
4. Definitions/delineation comparable with Federal definitions	46	2
5. Regulated and exempted activities defined	44	0
6. Special provisions for agriculture and forestry	25	9
7. Wetland classification	28	9
8. Regulated wetlands mapped	44	1
9. Mitigation policy	39	6
10. Mitigation banks allowed	37	9
11. Role of local governments defined	34	5
12. Evaluation methodology specified	21	9
13. State general permit for 404 defined	17	12
14. Investigated assumption of Section 404 powers	21	21
15. Joint permitting with Section 404	30	6
16. Penalties specified for violation	26	5
17. Permit tracking and enforcement procedures	33	5
18. Special area management and advanced identification	36	5
19. State Wetland conservation plan	30	6
20. No net loss goal	33	8
21. Wetland training and education	31	5
22. Nonregulatory incentives for private landowners	29	4
23. Special problem situations defined	23	3
24. Contacts specified	50	0
25. Guidebooks, brochures, other educational materials	37	0

Source: Kusler and others (1994) and personal communication for 1996 update.

WRP, CRP, WHIP, and other USDA Programs. Restoration of wetlands gained momentum in 1990 with establishment of the Wetlands Reserve Program (WRP) and reauthorization of the program in the 1996 Farm act. WRP is well on the way to achieving its goal of restoring 975,000 acres to wetlands by 2000, having enrolled nearly 745,000 acres as of FY 1998. Not all of the acreage enrolled reestablishes wetlands where they were previously lost because some of the land protected is currently wetland or is upland buffer area. The Administration plans to work with Congress to expand WRP by 250,000 acres of wetlands each year (see chapter 6.2).

Table 6.5.7-Wetland tax credit program: All wetlands, easements, and conservation agreements

Wetland type	Acreage[1]			Program Costs[2]		
	Eligible	Enrolled				
		Conservation	Easements	Conservation	Easement	Total
	All wetlands, easements and conservation agreements:					
	million acres			million $		
Prior converted cropland (PC)	42.0	7.0	6.0	5,811	18,933	26,534
Cropped wetlands (FW, W)	5.4	3.5	1.6	1,610	3,546	5,156
Natural wetlands not farmed (W)	16.8	16.1	0.3	4,945	549	5,494
Total	64.2	26.6	7.9	12,366	24,818	37,184
	Cropped wetlands, conservation agreements only:					
Farmed wetlands (FW)	2.5	1.5	0.0	850	0	850
Wetlands farmed under natural conditions (W)	3.0	2.0	0.0	760	0	760
Total cropped	5.4	3.5	0.0	1,610	0	1,610

[1] Wetland acreage only; costs include 2 acres of upland for each wetland acre.
[2] Budget costs for the first 5 years of the program, including 75 percent cost-share on restoration.

While the Conservation Reserve Program (CRP) was originally targeted at highly erodible land and soil erosion problems, later signups focused on other environmental problems. In the 8th and 9th signup periods (1989-90), cropped wetlands became eligible for enrollment under 10-year contracts. More than 410,000 acres of wetlands and associated uplands were enrolled under this eligibility criteria, with more than half enrolled in North and South Dakota (table 6.5.8). Simply retiring cropland from production may be enough to restore wetland function to many prairie pothole wetlands in the Northern Plains because hydrology in these seasonal wetlands has not usually been drastically altered and wetland plant seeds remain dormant in the soil (Kantrud, Krapu and Swanson, 1989). If the land was classed as farmed wetland, however, this is merely an improvement in wetland function, not an addition to the wetland inventory. Early CRP wetland enrollment also emphasized restoration of wetland trees (CP-14). More than 81,000 acres were enrolled in CP-14, principally in Louisiana, Mississippi, and other Delta and Southeastern States.

After the 1990 Farm act, wetland eligibility for CRP was revoked, partly to avoid competition with the new WRP, and partly due to a misunderstanding with environmental community leaders. Wetlands remained ineligible for the 13th signup in 1995, but trees established on wetlands and shallow water areas for wildlife were not granted early release opportunities in 1995 and 1996 to ensure that environmentally sensitive acreage remained under contract. In 1997, cropped wetland restoration once again became an eligibility criterion. More significantly, all acreage in the Prairie Pothole National Conservation Priority Area became eligible for enrollment, subject to scoring high on the Environmental Benefits Index, which now included wetland factors in its terms. More than 790,000 acres were enrolled, 90 percent in North and South Dakota (table 6.5.8). CRP also picked up 42,000 acres of land in expiring Water Bank contracts, also focused in North Dakota. Wetlands

remained eligible for CRP enrollment in 1998. More than 300,000 acres were enrolled in signup 16, 90 percent in North and South Dakota and Minnesota (table 6.5.8). As of October 1998, almost 1.3 million acres of wetlands and associated uplands were enrolled in the CRP, 88 percent in the Dakotas and Minnesota.

In addition to direct enrollment of wetlands, CRP has also focused on practices related to wetlands. Filter strips and riparian buffers along streams accounted for more than 52,000 acres of land enrolled in the first 12 signup periods between 1986 and 1992. The 1996 farm act allowed strips and buffers to be enrolled continuously on a preferential basis. More than 289,000 acres of filter strips and 73,000 acres of riparian buffers were enrolled in the 14th and 17th continuous signups and in the Conservation Reserve Enhancement Program (CREP). Most of this enrollment was in the Corn Belt. Shallow water areas for wildlife (CP-9) are also related to wildlife, and included 14,000 acres enrolled in the first 12 signups, and almost 5,000 acres enrolled in continuous signups.

The Wildlife Habitat Improvement Program (WHIP), newly authorized in the 1996 farm act, also concentrates on wetlands and riparian buffers. Of 672,000 acres put under contract in 1998, 13 percent are to enhance or create wetland habitat. Another 3 percent are devoted to riparian wildlife habitat improvement.

Everglades and Corps Programs. The U.S. Army Corps of Engineers has long been responsible for flood control and other water resource development projects that directly or indirectly resulted in wetland loss (USDI, 1988; Hunt and Huser, 1988). The President's Clean Water Action Plan calls for the Corps to increase by at least 50 percent the wetlands restored and enhanced through its programs, including wetlands restored as part of riverine ecosystem and flood hazard mitigation programs (USDA/EPA, 1998). Section 1135 of the Water Resources Development Act of 1986 authorized the Corps to modify structures and operations of previously constructed projects to improve the quality of the environment in the public interest. In many cases, this authority is being used to restore wetlands previously converted by the projects.

One of the most significant applications of Section 1135 is the restoration of the Everglades and the South Florida ecosystem. Water flowing from the Kissimmee River to Florida Bay traverses an ecosystem shaped and reshaped over the last 100 years to accommodate the ever-growing needs of agriculture and the population of South Florida. Although the physical changes began in the 1880's, the most profound alterations to the natural flow of water through the system were from the Central and Southern Florida (C&SF) Project.

Disastrous hurricanes and flooding in 1926, 1928, and 1947, and successive dry spells from 1931 to 1945 led to political pressure for a water project in South Florida. Congress approved the C&SF Project in the Flood Control Act of June 30, 1948, for the purposes of flood control, water level control, water conservation, prevention of saltwater intrusion, and preservation of fish and wildlife by delivering water to Everglades National Park according to a set schedule. The primary flood control and water delivery system now comprises about 1,000 miles of levees and canals, 150 water control structures, and 16 major pump stations.

Table 6.5.8-Wetlands enrolled in CRP, 1989-98

State	Signups 8/9 1989-90 wetland eligibility criteria	Signups 8/9 1989-90 wetland trees practice (CP-14)	Signup 15 1997 wetland restoration	Signup 15 1997 expired Water Bank	Signup 16 1998 wetland restoration	Active contracts as of October 1, 1998
			Acres			
Total	410,053	81,702	790,310	42,208	303,052	1,299,323
North Dakota	111,612	72	499,504	25,084	130,099	693,549
South Dakota	135,646		215,084	3,732	79,040	339,216
Minnesota	4,609	735	37,729	3,739	65,701	104,231
Wisconsin	29,429	375	1,995	325	4,186	28,053
Louisiana	30,481	25,958	2,607		3,611	22,931
Mississippi	16,002	15,002	3,765		791	14,218
Iowa	14,619	605	2,347		3,731	14,086
Nebraska	2,730	269	6,415	551	2,760	13,028
Arkansas	11,601	9,597	2,842	2,058	2,014	12,079
Illinois	13,630	6,280	1,253		3,388	11,142
California	144		4,807	5,825		4,807
Texas	486	238	881	217	3,277	4,664
Indiana	2,702	824	1,499	1	2,148	4,464
Kansas	1,706	459	3,306		99	4,220
Missouri	3,390	848	1,970		317	4,193
Ohio	4,758	242	947		733	4,172
North Carolina	1,800	1,636				2,611
Tennessee	5,135	4,581			302	2,454
Alabama	5,304	6,572	78		5	2,381
Georgia	1,774	1,906	334	4	4	1,790
Idaho	3,272	1,307	127		81	1,771
Maryland	1,823	59	9		7	1,769
South Carolina	1,345	1,640	82	77		1,560
Montana	1,128		974	596	256	1,285
Michigan	1,314	95	213		347	1,123
Oklahoma	596		596		72	1,013
Oregon	1,145	1,954	174		10	808
Washington	557		199		41	565
Colorado	52		508			552
New York	305	70	47		8	214
Virginia	201	100				126
Pennsylvania	212	67				116
Kentucky	283	206			24	65
Florida	78					45
Vermont			13			12
Maine	82		5			11
New Jersey	36	5	1			1
West Virginia						0
Arizona						0
Utah	14					0
Alaska						0
Connecticut						0
Delaware	52					0
Rhode Island						0
Massachusetts						0
New Mexico						0
New Hampshire						0
Nevada						0
Wyoming						0

Blank indicates no enrollment in state in that period.

Source: USDA, ERS analysis of FSA data.

The C&SF Project solved one set of problems, but contributed to a new set of problems that threaten what remains of the natural system, affecting the population and economy of the region. In early 1993, the Clinton administration directed the Corps to initiate a comprehensive review of the project, and convened a Federal Interagency Task Force chaired by the Department of the Interior (USDI) to coordinate ongoing restoration efforts. Also in 1993, USDI and the Department of Justice reached a tentative agreement with the sugar industry to resolve ongoing litigation over contamination of the Everglades by polluted runoff from sugar fields in the Everglades Agricultural Area (EAA) between Lake Okeechobee and the Everglades. The settlement provided for land acquisition and construction of Stormwater Treatment Areas over a 10-year period at an estimated cost of $700 million, with the sugar industry contributing up to $312 million. The settlement was ratified and given added legal force by the Everglades Forever Act, enacted by the Florida Legislature and signed by Governor Lawton Chiles in April 1994.

Section 528 of the Water Resources Development Act of 1996 authorized the Everglades and South Florida Ecosystem Restoration project and established an interagency (Federal, State, and tribal) task force to advise the Corps on plan development. The restoration plan is due to Congress in July 1999, and will recommend a complete package of water flow and wetland restoration actions. The plan will integrate other ongoing restoration projects under separate congressional authority from the Upper Kissimmee chain of lakes to Florida Bay. These studies include the Biscayne Bay Feasibility Study, the C-111 Project, the Kissimmee River Restoration Project, the Lake Okeechobee Regulation Schedule, Modified Water Deliveries to Everglades National Park Project, and various projects authorized under Section 1135.

Mitigation Banking. Section 404 of the Clean Water Act requires compensatory mitigation through restoring, creating, enhancing, or in exceptional circumstances preserving wetlands to offset unavoidable wetland losses. Amendments to the Swampbuster provisions in 1990 farm legislation allow continued program participation if the wetland conversion is mitigated through restoration of a prior-converted wetland in the same general area of the local watershed (16 U.S.C. 3822).

Compensatory mitigation has historically required creation, restoration, or enhancement of replacement wetlands of the same type, on or adjacent to the site of the wetland conversion. This onsite, project-specific focus has resulted in small-scale, high-cost compensation. Wetland mitigation banking attempts to provide greater flexibility in meeting the wetland mitigation requirements of the Section 404 permit program. Rather than creating or restoring wetlands at the site of wetland losses, public works agencies, private developers, or other parties involved in wetland conversion may be able to mitigate those losses by purchasing "compensation credits" in larger, centralized wetland mitigation projects. Credits are issued to those who seek to convert wetlands based on the acreage of wetlands they pay to create or restore. Mitigation ratios typically require more than 1 acre of wetlands to be created or restored for each wetland acre converted, and may be further adjusted to account for differences in the type and timing of wetland restoration. The wetland mitigation bank itself may be operated for the exclusive use of a particular developer or public agency, or it may also serve other parties, or it may be altogether independent of conversion activities. On November 28, 1995, four Federal published final policy guidance for the establishment, use, and operation of mitigation banks (60 FR 58605-58614).
The Environmental Law Institute (ELI), as part of the National Wetland Mitigation Banking Study conducted by the Corps, identified 46 existing wetland mitigation banks in the United States as of July 31, 1992 (ELI, 1993). Banks were located in 17 States, but concentrated in California (with 11 banks) and Florida (with 8). State highway departments, port authorities, or local governments operated nearly 75 percent of the 46 banks to provide mitigation for public works projects. Private developers controlled six more banks for advance

mitigation of their own projects. Only four banks offered compensation credits for commercial sale to the general public, one of them a privately owned bank and the other three owned by public agencies or nonprofit organizations. ELI also identified 64 proposed mitigation banks at various stages of review and authorization, with half intending to offer credits for commercial sale to the general public. By 1995, private sector entrepreneurs had established 12 banks for sale of credits to the general public (Scodari and Brumbaugh, 1996). By March 1998, another Corps survey identified 160 operating wetland mitigation banks, with 80 established for general sale of credits. The latest survey identified 130 more banks in various stages of development (Brumbaugh, 1998).

Department of the Interior Programs. The U.S. Fish and Wildlife Service's Partners for Fish and Wildlife negotiated voluntary, nonbinding agreements with landowners to share the cost of restoring wetlands. Related programs of joint ventures with State and local governments and private organizations such as Ducks Unlimited and the Isaak Walton League under the North American Waterfowl Management Plan and the North American Wetlands Conservation Act have protected, restored, and enhanced more than 18 million acres since the late 1980's. Because these joint projects involve the efforts of several Federal agencies, State and local government, and private organizations, it is difficult to separate each entity's contributions. Program reporting of achievements in protection, restoration, enhancement, and creation also makes it difficult to account for additions to the wetland inventory in a "no net loss" context.

Hypoxia. A zone of hypoxic (< 2.0 mg/l of dissolved oxygen) and anoxic (0.0 mg/l of dissolved oxygen) waters dominates 5,000-7,000 square miles of the northern Gulf of Mexico. Hypoxia is a deficiency in breathable oxygen sufficient to cause damage to living tissue; anoxia is a deficiency in oxygen sufficient to cause death. Sediment cores from the Louisiana Shelf indicate that the increased eutrophication and hypoxia in the northern gulf are the result of increased nitrogen loadings from the Mississippi River (Rabalais and others, 1996). A team of scientists convened to assess the hypoxia problem by the Committee on Environment and Natural Resources of the White House Office of Science and Technology Policy recommended restoring wetlands as one option to trap and denitrify surface and groundwater flows into the gulf. The team calculated that 9.6 million acres of additional wetlands in the Mississippi Basin would effectively deal with nitrogen loads. Nitrogen reductions would occur from reductions in cropped acreage in the basin, changes in crops and practices, and from increased denitrification in the restored wetlands. Regardless, nitrogen reductions from changing cropping practices and reducing fertilizer applications were shown to be more cost-effective than restoring wetlands (see Chapter 2.2 and Doering and others, 1999). A strategy that combined wetland restoration with fertilizer reduction was nearly as cost-effective, and had additional benefits associated with wetland restoration, such as wildlife habitat and recreational use.

Doering and others (1999) analyzed the costs and impacts of alternative approaches to reducing nitrogen loss to the Mississippi Basin, including restoring wetlands. In the absence of explicit criteria for enrolling restorable cropland to maximize nitrogen reduction, two scenarios were assumed: (1) acreage enrolled is proportional to total nitrogen yield by hydrologic unit and (2) acreage is enrolled at least cost from hydrologic units that yield some nitrogen. Enrolling proportional to nitrogen yield produces a more uniform geographic distribution of restored wetlands than when enrollment is done at least cost. Enrollment at least cost is concentrated in watersheds with cropland on wetland soils, with poor drainage, or low productivity.

Table 6.5.9-Costs of restoring wetlands to reduce nitrogen losses to the Gulf of Mexico, Mississippi Basin

Wetlands restored[1]	Program costs			Unit costs		
	Easement cost[2]	Restoration cost	Total cost	Easement (including upland)	Restoration / wetland area	Total/ wetland area
Million acres	million dollars			dollars/acre		
Enrollment proportional to nitrogen yields:						
1	2,514	438	2,952	798	418	2,813
5	16,984	2,142	19,126	1,126	426	3,803
10	42,889	4,350	47,239	1,416	431	4,679
18	95,019	7,803	102,823	1,758	433	5,706
Enrollment at least cost						
1	379	369	748	126	369	748
5	7,593	2,163	9,756	506	433	1,951
10	27,070	4,709	31,779	902	471	3,178
18	73,803	7,760	81,563	1,367	431	4,531

[1]Actual areas are 1.05, 5.03, 10.01, and 18.02 million acres.
[2]Includes 2 hectares of upland buffer for each hectare of wetland restored.
Source: USDA, ERS analysis in Doering, et al. (1999).

Total (easement and restoration) costs under the proportional scenario range from $2.9 billion for 1 million acres of restored wetlands to $102.8 billion for 18 million acres (table 6.5.9). Restoration costs decrease from 15 percent of total costs to 8 percent as enrollment increases. Costs per wetland acre restored, including upland buffers, increase from $2,813 to $5,706 as enrolled lands increase (figure 6.5.5). Easement costs per acre double as land enrolled under the proportional scenario increases, while restoration costs remain nearly constant at about $400 per acre.

Under the least-cost scenario, total costs for easements and restoration are 25 to 80 percent of costs under the proportional scenario, ranging from $748 million to $81.6 (table 6.5.9). Total program costs are significantly higher when restored land is drawn in proportion to nitrogen yields versus at least cost. Nitrogen yields tend to be high in areas where cropland is more productive, leading to higher opportunity costs. The difference in program costs per acre narrows as enrollment increases. As enrolled land rises, the least-cost alternative draws increasingly from areas with higher opportunity costs and higher restoration costs.
Nitrogen losses are reduced more than 5,000 metric tons by restoring 1 million acres of cropland, net of increased losses from new acres brought into production. More important is the estimated 40,000-61,000 metric tons in annual denitrification of surface and ground waters flowing through the restored wetlands. Adjustments

within the basin also result in decreases in phosphorus losses and soil erosion, increasing water quality benefits. However, the increases in crop prices result in more intensive production on existing acreage outside the basin and in an increase in acreage in production. Without any environmental constraints, soil erosion increases in the rest of the United States, to the probable detriment of water quality. In the United States overall, nutrient loss reductions and reductions in soil erosion are greater for the proportional enrollment pattern.

Assuming that the sum of edge-of-field and bottom-of-root-zone nitrogen loss reductions and denitrification indicate the total nitrogen reduction achievable through wetland restoration, it is possible to examine the cost-effectiveness of alternative restoration levels and enrollment strategies (fig. 6.5.5). Total nitrogen reductions from acreage and cropping adjustments and denitrification are similar for both least-cost and proportional enrollment strategies. Reductions in nitrogen loss are greater per wetland area restored between 1 and 5 million acres than for the higher restoration levels. Direct costs of wetland easements and restoration are higher for the proportional strategy than for the least-cost strategy, but converge as more wetland area is restored. The cost per metric ton of nitrogen reduction is everywhere higher for the proportional strategy than for the least-cost strategy, ranging from $55,000-$109,000 dollars, compared to $16,000-$90,000. Costs per ton converge with larger wetland area enrolled.

Thus, the reduction in nitrogen loss from wetland restoration is more cost-effective under least-cost enrollment than from proportional enrollment. This result depends on the assumption that denitrification per acre of wetlands is the same no matter where enrollment is targeted. If wetland restoration in areas with higher nitrogen loss proves to have higher denitrification rates, this result could change. *Authors: Ralph Heimlich, (202) 694-5504 [heimlich@ers.usda.gov], Dwight Gadsby, Roger Claassen, and Keith Wiebe.*

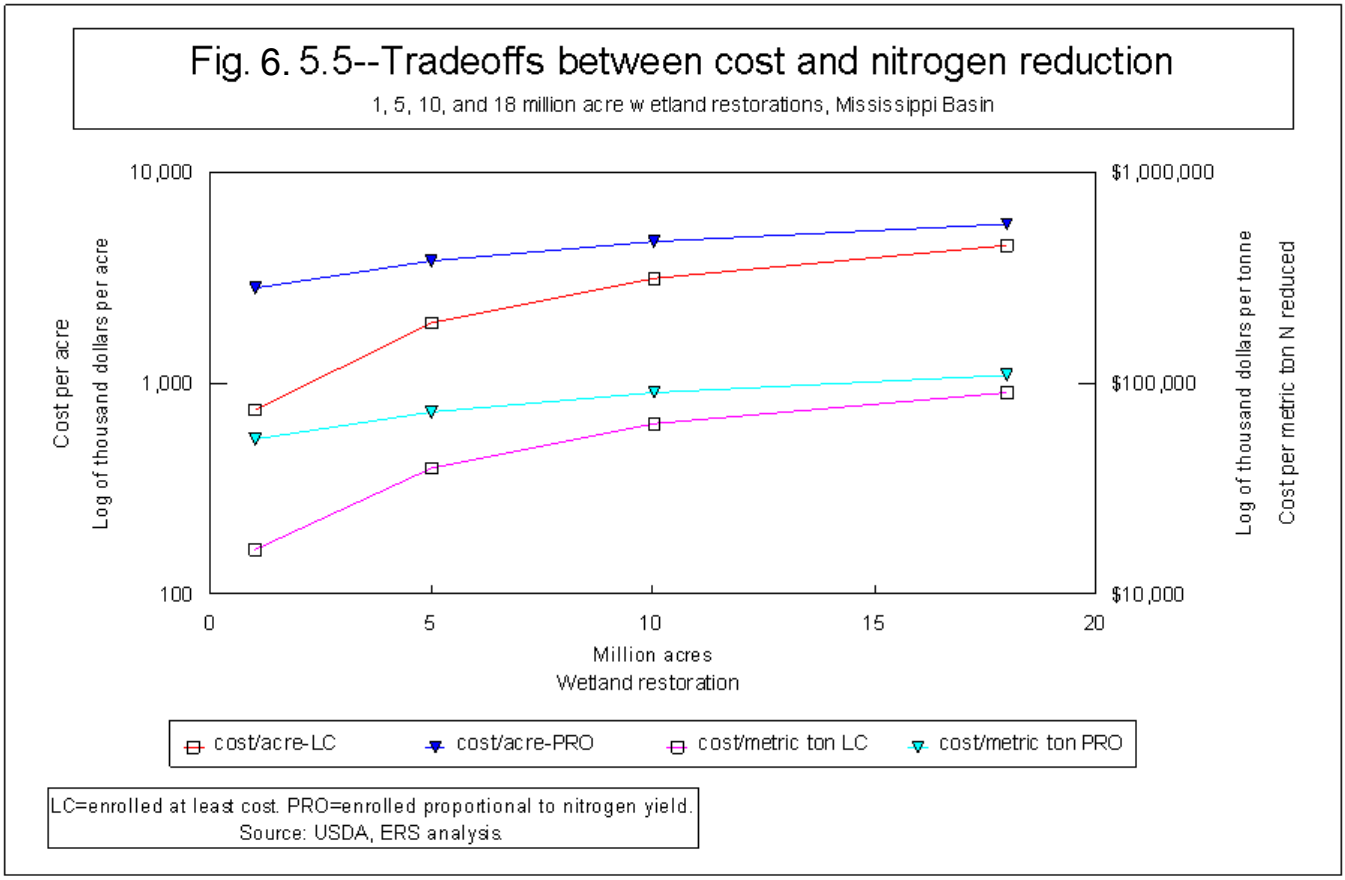


Fig. 6. 5.5--Tradeoffs between cost and nitrogen reduction
1, 5, 10, and 18 million acre w etland restorations, Mississippi Basin
10,000
1,000
100
Cost per acre
Log of thousand dollars per acre
$1,000,000
$100,000
$10,000
Log of thousand dollars per tonne
Cost per metric ton N reduced
0
5
10
15
20
Million acres
Wetland restoration
cost/acre-LC
cost/acre-PRO
cost/metric ton LC
cost/metric ton PRO
LC=enrolled at least cost. PRO=enrolled proportional to nitrogen yield.
Source: USDA, ERS analysis.

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What Is a Wetland?

Since 1977, the Federal Government has used a three-part wetland definition involving soils, vegetation, and hydrology. According to the U.S. Army Corps of Engineers, wetlands are "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." While the definition of wetlands has not changed over time, the precise guidelines for deciding what land meets that definition, called delineation criteria, have been controversial because of conflicts between landowners who want to use and develop wetland areas and environmentalists who want to preserve them.

After interagency attempts to develop a manual for delineating wetlands in 1979, 1987, 1989, and 1991, a National Research Council committee was convened in 1994. Its report rejected the idea that all three indicators (soil, water, vegetation) must be present and defended the use of one or two of the indicators to infer the presence of the third (NRC, 1995). It urged development of regional standards and protocols for delineation that recognize the diversity of wetlands and stressed the need for functional assessment in regulatory delineation.

Field tests of the latest manuals indicated that 30 to 80 percent of wetlands delineated in the 1989 manual would be excluded by the 1991 manual. Field evaluations in the fall of 1995 indicated that wetlands would be reduced 60 to 75 percent if proposed congressional revisions to wetland delineation are enacted.