6.3 Compliance Provisions for Soil and Wetland Conservation

Compliance provisions, first introduced in the 1985 Food Security Act, require certain resource conservation activities in return for benefits from selected Federal agricultural programs. Producers can lose Federal farm program benefits if they produce crops on highly erodible land without applying an approved conservation system or if they convert wetlands for agricultural production. In 1997, approved conservation systems were in effect for more than 95 percent of highly erodible land subject to conservation compliance, reducing erosion by two-thirds on such lands. More than 50 percent of all conservation systems involve conservation cropping sequences, conservation tillage, crop residue use, or a combination of these practices. Given reasonable assumptions about future commodity prices and production costs, compliance mechanisms may also be keeping 6-10 million acres of wetlands and highly erodible land out of crop production.

Contents *Page*

Conservation provisions affecting wetlands and highly erodible land (HEL see Glossary for definitions) were enacted as part of the Food Security Act of 1985 (1985 Farm Act) and amended by the Farm Acts of 1990 and 1996 (Hyberg). Producers who violate these conservation provisions may be denied price and income support benefits, Conservation Reserve Program (CRP) payments, Wetland Reserve Program (WRP) payments, eligibility for Federal agriculture-related loans or loan guarantees, and other benefits from agriculture-related Federal programs (7 CFR 12, 61 FR 47019).

Under wetland conservation provisions, widely known as "swampbuster," agricultural producers can lose Federal farm program benefits if they convert wetlands to make agricultural production possible. Producers may also lose benefits if they produce crops on highly erodible land without applying an approved conservation system. For HEL that was cropped during 1981-85, producers must be actively applying conservation systems designed to "substantially" reduce soil erosion. An erosion reduction of 75 percent is currently defined as "substantial," although plans approved prior to July 1996 may require lesser reductions (*National Food Security Act Manual*, third edition, 1996). These provisions are widely referred to as "conservation compliance." For HEL not cropped during 1981-85, conservation systems must hold soil erosion to no more than the soil loss tolerance level (T) *and* prevent a "substantial increase" in erosion, defined as 25 percent of potential erodibility (*National Food Security Act Manual*, third ed.). These provisions are widely referred to as "sodbuster."

The 1996 Act mandated a variety of changes in compliance provisions (7 CFR 12, 61 FR 47019; Osborn). Notably, Federal crop insurance indemnities can no longer be withheld for violation of wetland or highly erodible land conservation provisions. The 1996 Act also modified HEL conservation provisions to allow more flexibility in developing and implementing conservation systems, to allow self-certification of compliance, expedite approval of variances to solve problems affecting application of specific plans, and to allow producers a grace period to remedy compliance problems that arise despite "good faith" efforts to apply conservation systems. Under new wetland conservation provisions, producers have more flexibility to offset wetland losses through mitigation (creation or restoration of wetlands to offset any unavoidable wetland losses). Also, some activities causing minimal effect on wetlands can be approved under expedited procedures.

Status of Compliance: 1997

Compliance with HEL provisions

To comply with conservation provisions for highly erodible land, producers must be actively applying an approved conservation system. Most producers who farm HEL are complying with HEL conservation provisions. Based on the 1997 Conservation Compliance Status Review data (the most recent review data available), less than 0.1 percent of operators subject to conservation compliance were not actively applying conservation systems in 1997. In the Heartland, Eastern Uplands, Southern Seaboard, Fruitful Rim, and Basin and Range regions roughly 0.1 percent of producers subject to conservation compliance were not actively applying conservation systems, while fewer than 0.1 percent were not actively applying systems in other regions (table 6.3.1). Variances are offered to producers when climatic conditions prevent implementation of the full conservation system. For example, drought may prevent the establishment of a cover crop. Hardship variances are offered when circumstances such as family illness or crop failure prevent a farm from implementing the conservation system. Because drought or floods can be widespread, variances can be important, not only for individual farmers, but also for broader production regions. In 1997, the Heartland, Basin and Range, and Southern Seaboard regions had the highest percentages of units receiving climatic and hardship variances.

Since 1986, violations of HEL conservation provisions have resulted in $15.9 million in benefits being denied on over 280,000 acres of cropland (table 6.3.2). Prior to 1990, violations occurred only when HEL was brought into production without an approved conservation system. Since 1990, persons without approved conservation systems on previously cropped HEL could be found in violation of conservation compliance provisions. Since 1995, producers *failing to implement* approved conservation systems could be found in violation of conservation compliance. Land in violation peaked in 1990 (the first year plans were required) at 60,295 acres and declined until 1996 (the first year producers were required to fully implement conservation systems), when violations again increased to 45,540 acres.

Compliance with wetland provisions

To comply with wetland conservation provisions, producers must refrain from wetland conversion except in the context of an explicitly permitted activity, which generally requires replacement (mitigation) of wetlands converted to agricultural production. Since 1986, a total of 26,597 acres of wetland have been drained in violation of swampbuster by 1,136 producers resulting in the loss of $12.3 million in Federal farm program benefits (table 6.3.2). Swampbuster violations increased from 12 in 1987 to 165 in 1991, but have dropped since then and have been below 100 in every year since 1993. Benefits denied also peaked in 1991 at $2.0 million and have been below $0.5 million in every year since 1993. However, the amount of wetland found in violation, by year, has been more erratic. Acreage in violation peaked in 1996 at 13,920 acres. The next highest years were

1992 (3,221 acres) and 1993 (2,225 acres). See Wetland Programs (chapter 6.5) for more information on overall wetland conversion and possible effects of the swampbuster progam.

Table 6.3.1--Conservation compliance status, 1997

Region	Actively applying approved plan	Actively applying plan with variances	Conditionally applying	Not actively applying (potential violation)	Other[2]
			Percent of operating units [3]		
Heartland	94.3	3.7	0.1	0.1	1.8
Northern Crescent	93.5	1.7	0.1	*	4.7
Northern Great Plains	97.8	*	*	*	2.2
Prairie Gateway	96.9	0.1	*	*	3.0
Eastern Uplands	98.2	0.1	*	0.1	1.6
Southern Seaboard	96.2	2.2	*	0.1	1.5
Fruitful Rim	96.9	1.3	0.3	0.1	0.5
Basin and Range	95.8	2.9	*	0.1	1.8
Mississippi Portal	95.7	1.8	*	*	2.5
Total/average	95.9	2.0	0.1	*	2.0

[1] Acreage total excludes HEL in the CRP.
[2] Other includes wetlands on HEL or acres not required to apply plans.
[3] Determination based on operating units, not acreage.
* less than 0.1 percent.
Source: USDA-ERS analysis of NRCS 1997 Status Review of Conservation Compliance data.

Table 6.3.2--Violations of conservation compliance provisions, 1986-98[1]

Year	HEL provisions				Wetland provisions		
	Producers in violation	Land in violation	Benefits denied	Producers losing all benefits	Producers in violation	Land in violation	Benefits denied
	Number	*Acres*	*Million Dollars*	*Number*	*Number*	*Acres*	*Million dollars*
1986	2	10	*	2	na	na	na
1987	66	3,289	0.2	66	12	100	0.1
1988	174	3,745	0.5	174	127	1,490	1.2
1989	83	2,957	0.2	83	121	693	1.1
1990	342	60,295	1.6	342	105	560	1.3
1991	584	42,675	2.9	na	165	1,428	2.0
1992	693	38,503	1.8	na	156	3,221	1.6
1993[2]	859	36,252	3.2	341	86	2,225	0.4
1994	632[3]	25,933	2.1	261	43	674	0.3
1995	118[4]	3,266	1.0	40	11	105	*
1996	677	45,540	1.6	238	154	13,920	1.3
1997	125	10,012	0.6	66	99	907	1.2
1998[4]	49	8,115	0.2	26	57	1,274	1.8
Total[5]	11,159	280,582	15.9	1,639	1,136	26,597	12.3

[1]Includes producers and violating land for which price support or disaster benefits were denied. Benefits denied include price support payments, farm storage facility loans, crop insurance (through 1996), and insured or guaranteed loans, but do not include a value for price support loans or disaster payments.
[2] Benefits denied under Swampbuster are before appeals and reinstatements prior to 1993, and after such adjustments in 1993 and later years.
[3] Preliminary.
[4] As of December 1998.
[5] Totals incomplete where detailed data are not available.
na=data not available.
* Less than $100,000.
Source: USDA-ERS analysis of FSA program data files.

HEL Conservation Plans and Systems

Conservation compliance plans specify the use of economically viable conservation systems that substantially reduce erosion. Conservation systems are composed of one or more conservation practices. Although the 1997 Status Review found over 1,674 different conservation systems (combinations of practices) applied nationwide, conservation systems involving *only* conservation cropping sequences, conservation tillage, crop residue use, or a combination of these practices were used on 54 percent of HEL cropland (table 6.3.3). Conservation cropping sequences *alone* were included in conservation systems applied to 81 percent of HEL cropland, while crop residue use and conservation tillage were applied to 51 and 33 percent, respectively (table 6.3.3). Terraces, which require a significant capital investment, were used in 13 percent of conservation systems. Grassed waterways and field borders, which take land out of crop production, are included in plans covering 9.2 and 3 percent of HEL cropland, respectively.

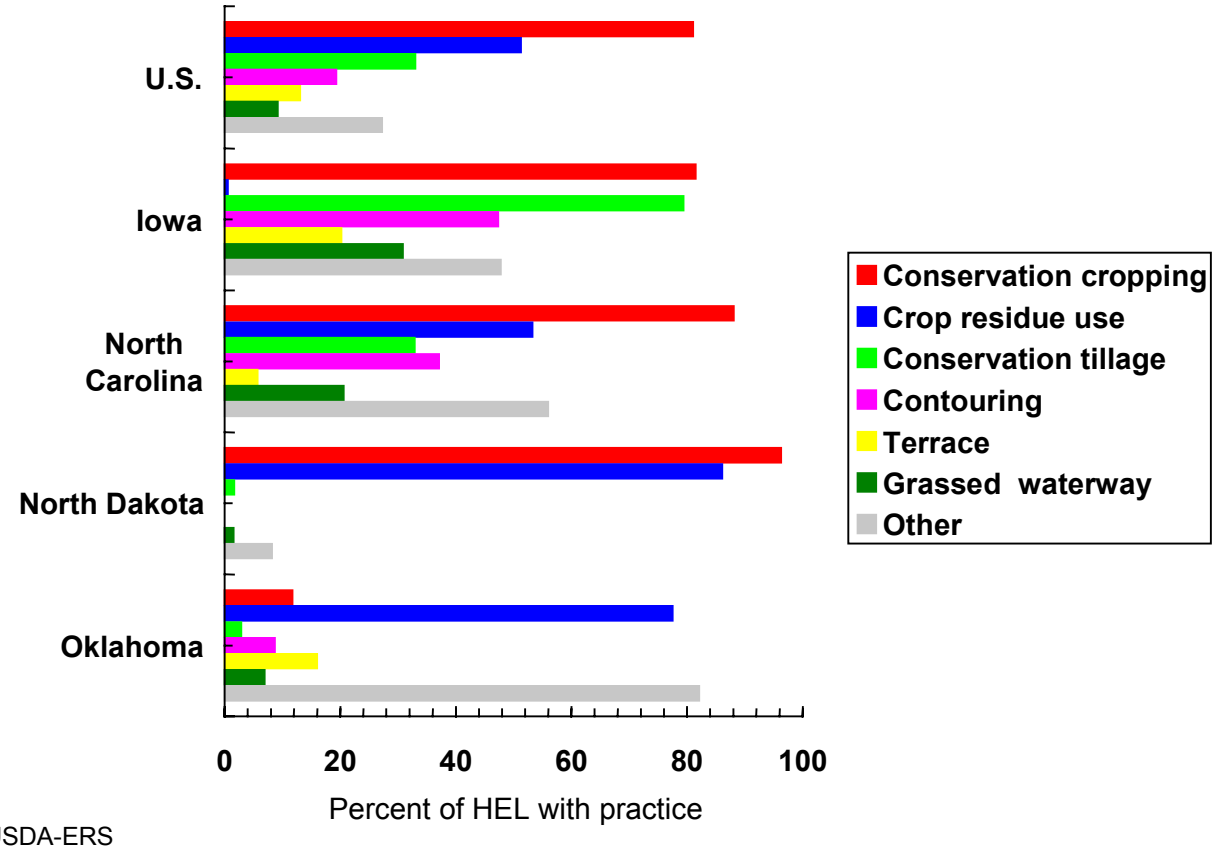
Conservation systems vary with climate, topography, soils, major crops, and pre-existing production practices. A system or practice acceptable in one location may be infeasible in another. The effectiveness of a system in controlling erosion depends on several factors, including the frequency, timing, or severity of wind and precipitation; the exposure of land forms to weather; the ability of exposed soil to withstand erosive forces; the plant material available to shelter soils; and the propensity of production practices to reduce or extenuate erosive forces.

A comparison of Iowa, North Carolina, North Dakota, and Oklahoma illustrates how local conditions affect farmers' adoption of particular conservation systems (figure 6.3.1). In North Dakota, where there are few economically viable alternatives to a wheat/fallow rotation, the conservation crop sequence/crop residue management system is part of nearly all conservation systems on HEL cropland. Wheat is also the major crop in Oklahoma, where most conservation systems consist of a single technical practice—crop residue use. Both the number of feasible conservation systems and the number of systems required to control erosion are greater in areas with greater climatic and geographic variability. In Iowa, where rainfall is greater and cropping patterns are more varied than in North Dakota or Oklahoma, a larger number of conservation systems, incorporating a greater variety of conservation practices are used. Conservation cropping sequences and conservation tillage are widely used, but contouring, terraces, grassed waterways, and field borders are also used on 20 percent or more of land. In North Carolina, where topography, soils, and cropping patterns are diverse, conservation systems are even more varied.

Erosion Reductions on HEL

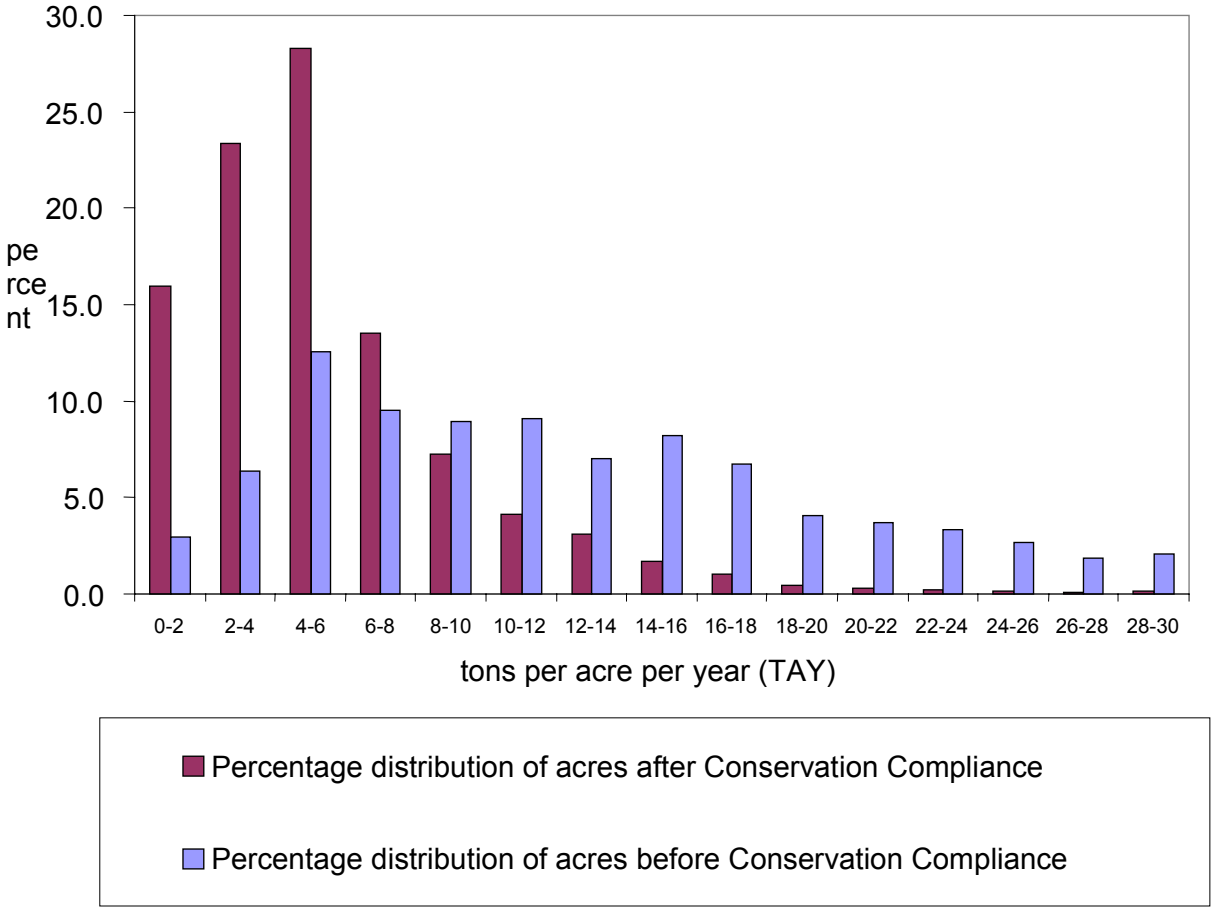
Large reductions in total soil erosion have occurred on land subject to conservation compliance. Figure 6.3.2 shows the distribution of land subject to conservation compliance by erosion rate (tons per acre per year or TAY) before and after conservation compliance. After conservation compliance, the proportion of land with erosion rates of 0-8 TAY is significantly increased, particularly for erosion rates of 0-6 TAY. The proportion of land with erosion rates above 8 TAY declined significantly, particularly for erosion rates above 10 TAY. The proportion of land subject to conservation compliance with erosion rates above 20 TAY dropped almost to negligible levels.

Fig. 6.3.1--Practices included in conservation management systems for HEL, U.S. and selected States, 1997



Source: USDA-ERS

Fig. 6.3.2--Distribution of land subject to conservation compliance, by erosion rate, before and after compliance



Source: USDA, Economics Research

Table 6.3.3--Conservation management systems and technical practices applied on cultivated HEL subject to compliance, 1997

Item	Percent of cultivated HEL
Conservation magement systems	
Conservation cropping/crop residue use	27.5
Conservation cropping/conservation tillage	10.8
Conservation cropping only	7.8
Crop residue use only	4.9
Cons. cropping/conservation tillage/contouring/grassed waterway/terrace	2.4
Conservation cropping/contouring/crop residue use/terrace	2.2
Conservation cropping/conservation tillage/crop residue use	1.6
Conservation cropping/crop residue use/surface roughening	1.5
Conservation tillage only	1.5
Conservation cropping/conservation tillage/contouring	1.5
Conservation cropping/contouring/crop residue use/grassed waterway/terrace	1.5
Conservation cropping/conservation tillage/contouring/terrace	1.4
Conservation cropping/crop residue use/wind stripcropping	1.4
Conservation cropping/conservation tillage/grassed waterway	1.2
Total, 15 most frequently used systems	65.9
Conservation Technical Practices[1]	
Total with conservation cropping	81.1
Total with crop residue use	51.3
Total with conservation tillage	33.0
Total with contour farming	19.3
Total with terrace	13.0
Total with grassed waterway	9.2
Total with surface roughening	4.6
Total with cover/green manure	3.4
Total with field border	3.0

[1]Percentages sum to more than 100 because of multiple practices being applied to same land.
Source: USDA, ERS, compiled from NRCS 1997 Status Review of Conservation Compliance data.

Future Effectiveness of Compliance

The future effectiveness of compliance mechanisms in reducing erosion from highly erodible cropland or deterring the conversion of wetland for agricultural production depends on: (1) the value of program benefits that can be withheld; (2) the extent to which producers with highly erodible land or wetland on their farms participate in these programs; and (3) the direct and indirect (opportunity) costs to the farm of complying with highly erodible land or wetland conservation requirements. The future value of payments is critical to the continued success of compliance mechanisms, but is difficult to predict. The 1996 FAIR Act is widely

considered to be a transitional policy, but there is no clear consensus on what policy will emerge to replace FAIR when it expires at the end of 2002. The cost of compliance depends on the type of land involved. On highly erodible cropland, the cost of maintaining conservation practices may be quite low and can be offset by modest farm program benefits. Some producers have even reduced per-unit production costs through adoption of conservation tillage. On HEL and wetland that is not cropped, the key question is whether the value of farm program benefits will exceed the value of production forgone if the land is not converted to cropland use. An important and related question is the extent to which conversion of HEL and wetland for crop production would be profitable in the absence of sodbuster and swampbuster disincentives.

Value of Benefits

The value of farm commodity program benefits has fluctuated significantly since 1986, but commodity program design changes in the FAIR Act made payments more stable and predictable. Between 1986 and 1995, farm income support payments fluctuated, peaking at $11.7 billion in 1988 and declining to $4.0 billion by 1995 (Young and Westcott). Over this period, overall commodity program participation varied but remained quite high. For the seven major program commodities combined, producers enrolled between 77-87 percent of all eligible acres, although participation rates for individual commodities varied more widely. If participation is calculated as the ratio of participating acres (both planted and set-aside) to total acreage devoted to a particular crop (all planted acres plus program set-aside), program participation rates are slightly lower for wheat, and somewhat lower for feed grains. On this basis, they are 70-77 percent for all feed grains for the 1986-93 period. FAIR mandated fixed income support payments, which are independent of commodity price or production decisions. Basic income support payments peaked in 1997 at $6.4 billion (for all seven major commodities) and are scheduled to decline to $4.0 billion in 2002 (Young and Westcott). However, basic income support has been supplemented by disaster payments approved by Congress for fiscal year 1999 and by marketing loans and loan deficiency payments triggered by low commodity prices in 1998 and 1999 (Shields and Westcott; USDA-FSA).

Producer participation is very high under the 1996 Farm Act (more than 98 percent all eligible acres were enrolled for all seven major commodities) largely because producer costs of participation are low. Participating producers are no longer required to comply with costly annual acreage reduction requirements. With the exception of conservation provisions regarding highly erodible land and wetlands, producers are free to expand or contract cropland acreage and allocate acreage among crops in response to market factors.

Future programs to support farm income may be difficult to leverage for conservation compliance, because payments are indirect and thus not easy to tie to individual producers, or because other program goals take priority. An example of indirect payments is dairy supports, which are paid to dairy processors to support the price of fluid milk. As another example, compliance provisions were considered, but not adopted, for crop insurance under the recently enacted Agricultural Risk Protection Act of 2000. Congressional goals to increase crop insurance participation may have overridden compliance goals.

Costs of Compliance

HEL cropland. The cost of highly erodible land conservation on existing cropland is the cost of applying a conservation system. As noted above, more than half of all conservation systems are some combination of *only* conservation cropping practices, conservation tillage, and crop residue use. The cost of conservation cropping practices may include production of less profitable crops or the cost of establishing cover crops for a particular portion of the season. With crop residue use, producers plant into a clean tilled seed bed, but allow previous crop

residue to remain on the surface for a longer period of time to protect the soil from erosion. With conservation tillage, residue cover must be at least 30 percent year-round.

To date, the evidence on costs and benefits of conservation tillage is somewhat mixed (Sandretto). Producers who switch to conservation tillage may save on labor, fuel, and net capital investment in equipment. Other costs, such as those for herbicides or fertilizer may rise (Siemens and Doster, 1992). Some studies have found that conservation tillage systems produce modest yield advantages, particularly on well-drained to moderately well-drained or sloping soils (Hudson and Bradley, 1995; Conservation Tillage Information Center, 1996). In less humid regions, retaining crop residue on the surface may help retain soil moisture and increase yields (Clark and others, 1994). However, increased crop residue has been blamed for delayed plantings, uneven stands, and lower corn yields when planting conditions are cool and wet (Griffith and others, 1988). Recent research (McBride, 1999; see box "Costs and Yields with Conservation Tillage") suggests that corn producers who use conservation tillage methods generally have lower *per bushel* costs of production than producers who use conventional tillage methods. This research suggests that producers who have reduced production costs using conservation tillage methods might continue to use them even if they were not required to do so to comply with conservation requirements.

Non-cropland. For highly erodible land that was not cropped in any year in the 1981-85 period, the costs of compliance are the lower of (1) the net return forgone from not converting highly erodible land to crop production or (2) the cost of applying an approved conservation system. Non-cropped HEL that cannot be profitably converted to crop production has no conservation compliance opportunity cost. Conservation systems on land converted from "native vegetation" are acceptable only if soil erosion is held to no more than the soil loss tolerance (T) and crop production will not result in a "substantial increase" in erosion *(National Food Security Act Manual*, Third Edition, 1996). These plans may be different and, potentially, more costly than conservation systems on previously farmed highly erodible cropland.

For wetlands, compliance cost will generally be the net return lost in forgoing conversion of wetlands to crop production or zero, whichever is larger. Under the 1996 farm bill, producers may convert land for crop production without violating swampbuster if wetland losses are fully mitigated. In those instances where mitigation is feasible, compliance costs are mitigation costs.

Cropland Potential without Compliance

Looking to the future, a key question is how many acres of non-cropped HEL and wetland could be profitably converted to crop production *in the absence of sodbuster and swampbuster*. Analysis of this type helps determine how much HEL and wetland may be at risk for conversion *if* there is a significant reduction or restructuring of Federal farm program benefits. A number of authors have suggested that wetland conversion for crop production is no longer profitable (Kramer and Shabman; Tolman), pointing to a long-term decline in real commodity prices and the fact that many easily convertible wetlands are already drained. Similar arguments could be made with respect to conversion of HEL, but little formal research has been carried out on HEL conversion in recent years. The analysis presented below reaches a significantly different conclusion: that there is substantial acreage of both HEL and wetland that could be profitably converted to crop production if economic conditions are favorable and compliance provisions are ineffective.

To estimate potential wetland and HEL conversion without compliance requirements, we use site-specific data on more than 170,000 points from the National Resources Inventory (NRI) point data files. Unlike

representative farm models (e.g., Kramer and Shabman), the use of this data allows (1) full recognition of the variation in the underlying productive potential of wetland and highly erodible land and (2) estimation of cropland potential on a nationwide, rather than single-site, basis. Nationwide acreage change estimates also allow estimation of associated economic effects including changes in production, commodity prices, and farm income (See box "Estimating Cropland Potential and Economic Consequences," for details).

Nationwide, total wetland and highly erodible land that could be profitably converted to crop production in the absence of compliance requirements ranges from 7.1 million acres in the low-price scenario to 14.1 million acres in the high-price scenario (fig. 6.3.3). Potentially convertible wetland acreage ranges from 1.5 million acres to 3.3 million acres, while potentially convertible HEL ranges from 5.6 million acres to 10.9 million acres. The cropland potential of HEL is based solely on the productive potential of the soil. However, farmers may be less likely to farm steeply sloping or highly erodible land because of additional wear and tear on equipment, restrictions on equipment size, or larger loss of applied inputs (e.g., fertilizers or pesticides) with eroding soil or runoff. If so, potential conversion may be overestimated.

At medium prices, total crop acreage could rise by 6.6 million acres, in the absence of conservation compliance, roughly 60 percent of the 10.8 million acres that are potentially convertible at baseline prices (table 6.3.4). Potentially convertible acreage and estimated land use conversion would be largest in the Appalachian, Corn Belt, and Northern Plains farm production regions. Increased crop acreage would increase production of all major crops, except sorghum, while the prices of all eight crops would fall (table 6.3.5). Production changes range from a 3.1-percent decrease for sorghum to a 3.3-percent increase for soybeans. Sorghum production would fall because it is grown on a relatively small acreage and the price of close substitutes -- particularly corn -- would fall significantly. Price declines would range from 3.2 percent for wheat to 7.6 percent for corn and 10.0 percent for oats.

If compliance provisions were ineffective, producers who successfully convert wetland or HEL to crop production may see increased returns. For the agriculture sector, however, increased crop production and decreased crop prices would result in an aggregate decline in net farm income of roughly $3.5 billion from baseline projections, about 3.5 percent (table 6.3.4). While acreage and production rise in most farm production regions, price declines more than offset increased production resulting in lower overall farm income. Declines in farm income would be largest in the Corn Belt, Northern Plains, and Lake States farm production regions. Although crop acreage increases would be relatively large in the Corn Belt and Northern Plains, these changes would be minor when compared with overall acreage in these regions, so the effect of declining prices would outweigh the effect of increased crop acreage in determining farm income. In the Appalachian region, on the other hand, where the potential change in crop acreage is large relative to the existing cropland base, aggregate farm income would increase.

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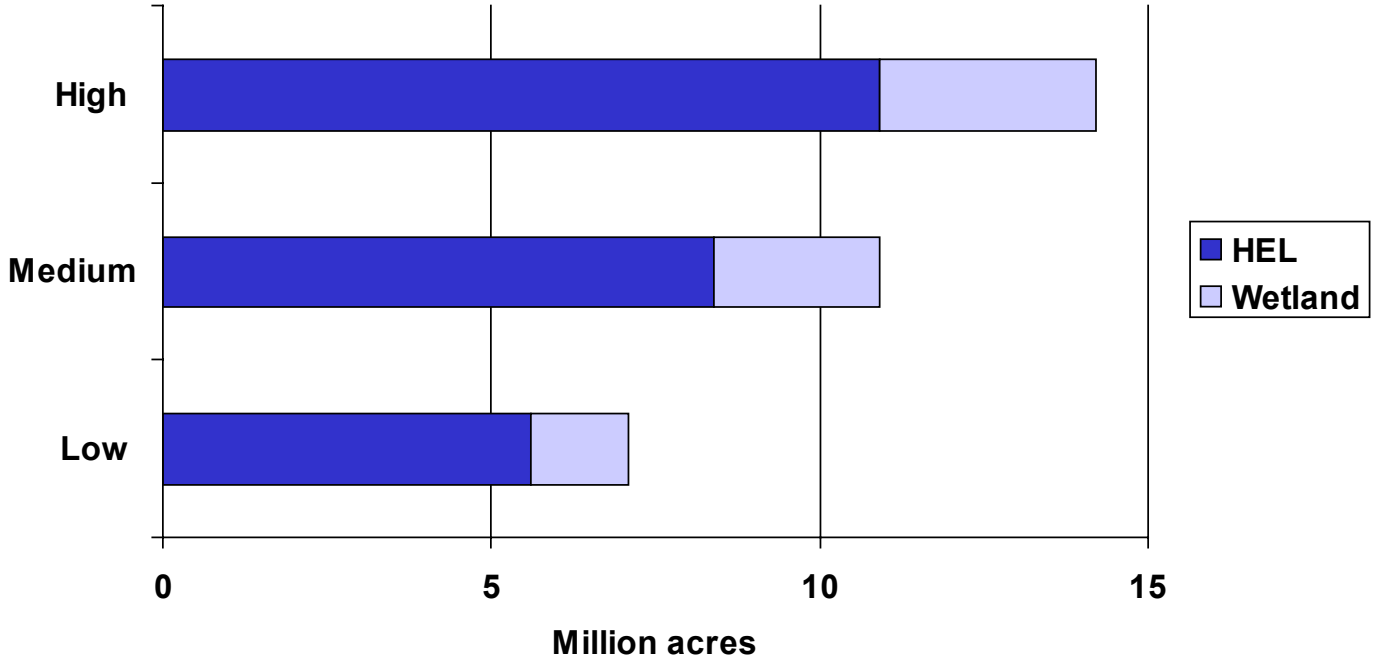
Fig. 6.3.3--Potentially convertible acreage of wetland and highly erodible land (HEL) High-, medium-, and low- price scenarios*



*High-, medium-, and low-price scenarios correspond to projections for 2004, 2001, and 1999, respectively, from *USDA Agricultural Baseline to 2007*, February 1998.

Source: USDA, Economic Research Service

Table 6.3.4--Estimated acreage and farm income impacts if potentially convertible wetland and highly erodible land were placed into production

Farm production region	Potentially convertible acreage of Wetland and HEL	Estimated change in crop acreage[1]	Estimated change in Farm income[1]
	Million acres	Million acres	Million $
Northeast	0.7	0.6	-59.5
Lake States	0.6	0.4	-521.4
Corn Belt	2.3	1.7	-1,696.0
Northern Plains	1.9	0.6	-705.8
Appalachia	2.7	2.3	109.1
Southeast	1.2	1.2	85.6
Delta States	0.8	0.5	-153.8
Southern Plains	0.6	0.0	-249.9
Mountain States	**	-0.7	-180.7
Pacific Coast	0.1	0.1	-128.6
U.S.	10.8	6.6	-3,501.0

[1]Change from USDA baseline projections for crop acreage and farm income for 2001 (*USDA Agricultural Baseline Projections to 2007*, February 1998.)
**Fewer than 50,000 acres.
Source: USDA-ERS

Table 6.3.5--Estimated production and price changes for major crops if potentially convertible wetland and highly erodible land were placed into production

Crop	Baseline price[1]	Baseline production[1]	Estimated change in production	Estimated change in price
	Dollars/bushel	Million bushels	Percent	Percent
Corn	2.75	10,313.0	2.1	-7.6
Sorghum	2.45	659.3	-3.1	-7.1
Barley	2.50	395.0	0.5	-3.3
Oats	1.70	285.4	1.3	-10.0
Wheat	4.15	2,473.0	2.1	-3.2
Soybeans	6.30	2,743.6	3.3	-6.4
	Dollars/ cwt	Million/ cwt		
Rice	10.77	189.6	3.2	-3.6
	Dollars/ pound	Million pounds		
Cotton	[2]	8,976.0	2.7	-4.3

[1]Baseline production and prices for 2001 from *USDA Agricultural Baseline Projections to 2007*, February 1998.
[2]USDA is prohibited from publishing cotton price projections.
Source: USDA-ERS

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Glossary

Approved conservation system—A set of field-specific cropping and managerial soil conservation practices designed in cooperation with local NRCS agents to reduce soil erosion. Basic conservation systems reduce erosion to the soil tolerance level (see definition below). Alternative conservation systems provide a significant level of erosion reduction without excessive economic burden on producers for land subject to conservation compliance.

Applied conservation system—An approved conservation system that has been applied and is being maintained, based on standards contained in the NRCS field-office technical guide.

Conservation Compliance provision—Since 1985, this provision requires all farmers producing on HEL who receive or request certain USDA benefits to have an approved conservation system applied on those lands. Violations may result in disqualification from USDA programs or reduction of benefits.

Conservation cropping sequence—A crop rotation (multi-year sequence of crops) designed to improve or maintain good physical, chemical, and biological conditions of the soil; help reduce soil erosion; improve water use efficiency and water quality; improve wildlife habitat; or break reproduction cycles of plant pests.

Conservation tillage—Any tillage and planing system that covers 30 percent or more of the soil surface with crop residue, after planting, to reduce soil erosion by water. Where soil erosion by wind is the primary concern, any system that maintains at least 1,000 pounds per acre of flat, small grain residue equivalent on the surface throughout the critical wind erosion period.

Crop residue use--Managing the amount, orientation, and distribution of crop and other plant residues on the soil surface during part of the year, while growing crops in a clean tilled seedbed.

Erodibility index (EI)—The natural erosion potential of a soil divided by the soil's tolerance level.

Field—A contiguous tract of land under a single farm operation and isolated by permanent barriers, such as fences, waterways, or woodland.

Highly erodible land (HEL)—Designations made by NRCS field staff include cropland in fields that have at least one-third or 50 acres (whichever is less) of highly erodible soils. HEL soils were defined as soils with an erodibility index (EI) greater or equal to 8. An EI of 8 indicates that without any cover or conservation practices, the soil will erode at a rate 8 times the soil tolerance level. HEL designations currently total 146 million acres. This number has changed over time as more producers apply for benefits and more determinations are made.

Mitigation--Compensation through wetland restoration, enhancement, or creation for functions and values that are lost on a converted wetland. *Restoration* of a wetland means the re- establishment of wetland conditions, including hydrologic conditions or native hydrophytic vegetation, to an area where a wetland had previously existed. *Enhancement* of a wetland means the alteration of an existing wetland to increase its specific functions and values. *Creation* of a wetland means the development of the hydrologic, geochemical, and biological components necessary to support and maintain a wetland where a wetland did not previously exist.

Soil tolerance level (T)—The rate of soil erosion that can continually occur without reducing that soil's productivity.

Tract or operating unit—All fields farmed by a single operator. The entire unit is subject to the penalties of noncompliance, provided any field in the unit is determined to be highly erodible and the operator of that field has not applied or maintained the approved conservation system before receiving certain USDA program benefits.

Variances—Variances are offered to producers when **climatic** conditions such as flood or drought prevent implementation of the full conservation system. One example would be where a drought prevented the establishment of a cover crop. **Hardship** variances are offered when circumstances such as family illness or crop failure prevent a farm from implementing the conservation system. Because drought or floods can be widespread, variances can be important for not only individual farmers but also production regions.

Violations/disqualifications—Determined by FSA on recommendations of NRCS field staff, based on the guidelines of the approved conservation system. Before January 1, 1995, they occurred when an HEL field failed to have a partially applied conservation system by specified interim deadlines. After January 1, 1995, they occur when an operator requests or receives certain USDA program benefits without fully applying or maintaining an approved conservation system on HEL. Operators can request the development of a new plan or may be granted a temporary variance.

Estimating Cropland Potential and Economic Consequences

Wetlands and HEL are considered potentially convertible if (1) they are within a quarter mile of existing cropland and (2) the net present value (NPV) of returns to crop production after conversion, at expected future prices, exceeds total costs of conversion (the NPV of return to land in its pre-conversion use plus conversion costs) by at least 6 percent of the total cost of conversion. Close proximity to existing cropland ensures that wetland or HEL is located such that it could easily be incorporated into an existing farm.

Expected commodity prices are projected in the February 1998, USDA long-term agricultural baseline (USDA-WOAB). We use projections for 1999, 2001, and 2004 for low, medium, and high expected price scenarios (table 6.3.6). Net present values are defined over a finite time horizon which varies by prior land use. For forested land, the time horizon is the length of a single forestry rotation. Other wetland sites are assigned a 10-20 year time horizon, depending on the drainage technology used. Other HEL sites are assigned a 10-year time horizon. We assume a discount rate of 6 percent for all net present value calculations. A full description of data and methods is available in Claassen et. al. (1998).

Table 6.3.6--Commodity prices used to estimate potential conversion of wetlands and HEL and associated economic consequences

Crop	Low price[1]	Medium price	High price
		Dollars/ bushel	
Corn	2.55	2.75	3.00
Sorghum	2.25	2.45	2.80
Barley	2.30	2.50	2.70
Oats	1.60	1.70	1.80
Wheat	3.75	4.15	4.35
Soybeans	2.65	6.30	7.00
		Dollars/ cwt	
Rice	10.35	10.77	11.43
		Dollars/ pound	
Cotton	[2]	[2]	[2]

[1]Low, medium, and high prices correspond to USDA baseline projections for 1999, 2001, and 2004, respectively.
[2]USDA is prohibited from publishing cotton price projections
Source: Baseline production and prices for 1999, 2001, and 2004 from *USDA Agricultural Baseline Projections to 2007*, February 1998.

Costs and Yields with Conservation Tillage

McBride (1999) estimated costs per bushel of corn production under conventional and conservation tillage methods using data from a national survey of corn producers cost and yields. Per bushel costs are calculated for four tillage systems, two rotations, and four distinct regions. Pre-harvest costs for each tillage system by region were estimated from the 1996 Agricultural Resource Management Study (ARMS). Yields for each tillage system, rotation, and region were estimated using Cropping Practice Survey (CPS) data from 1990-96. Both the ARMS and CPS data were collected by the U.S. Department of Agriculture, Economic Research Service (USDA-ERS) and National Agricultural Statistical Service (USDA-NASS). The cost-to-yield ratios are reported in table 6.3.7. Tillage systems are defined according to estimated residue cover after planting as reduced tillage (15%-30% residue cover), mulch-till (>30% residue cover) and no-till (>30% residue cover and no tillage operations).

Potential benefits of conservation tillage appear to be largest for dryland corn production in the Plains States. All forms of conservation tillage result in lower costs and higher yields, probably due to moisture conservation. Under irrigated conditions, when moisture retention is not an issue, no clear economic benefit could be attributed to conservation tillage, perhaps confirming the role of moisture conservation in conservation tillage benefits for Plains producers. Corn producers in the Lake States also appear to reap economic benefits from all forms of conservation tillage. For each tillage and rotation, yields are not significantly different but production costs are significantly lower. Results are more mixed for Corn Belt producers. Despite significantly lower yields, unit costs were less than for conservation tillage for no-till systems in both the Eastern and Western Corn Belt. Reduced till and mulch till produce significantly higher yields on corn-soybean rotations in the Western Corn Belt. Both reduced and mulch tillage appear to increase yields and/or reduce costs for corn-corn and corn soybean rotations in the Eastern Corn Belt.

One caveat is particularly worth noting. Comparing the costs and yields of producers who use conservation tillage versus those who do not implies that non-users have similar resource situations and could also reap similar benefits from conservation tillage. However, it is likely that some producers have adopted conservation tillage because it is particularly suited to their specific situations. While it is not possible to say that conservation tillage methods would result in cost savings for all producers, those who are successfully using conservation tillage systems will likely continue to use them for economic reasons, even without conservation compliance requirements.

Table 6.3.7--Estimated corn production costs using conventional tillage and reduced or conservation tillage systems by region and cropping pattern

Region/ cropping pattern	Conventional tillage	Reduced tillage	Conservation tillage	
			Mulch-till	No-till
	Dollars per bushel			
Dryland:				
Eastern Corn Belt--				
Corn-corn	1.47	1.31*	1.17**	1.31
Corn-soybeans	1.37	1.16**	1.10**	1.18
Western Corn Belt--				
Corn-corn	1.26	1.22	1.22	1.27
Corn-soybeans	1.20	1.15*	1.06*	1.11
Lake States--				
Corn-corn	1.45	1.24*	1.13*	1.34*
Corn-soybeans	1.40	1.17*	1.07*	1.19*
Plains States--				
Corn-corn	1.76	1.35**	1.10**	1.10**
Corn-soybeans	1.43	1.22**	1.01**	.91**
Irrigated:				
Plains States--				
Corn-corn	1.73	1.71	1.88	1.62
Corn-soybeans	1.72	1.63	1.84	1.72

*Costs are significantly lower and yields are not significantly higher than conventional tillage or costs are not significantly different and yields are significantly higher than conventional tillage
**Costs are significantly lower and yields are also significantly higher than conventional tillage
Source: McBride, 1999.