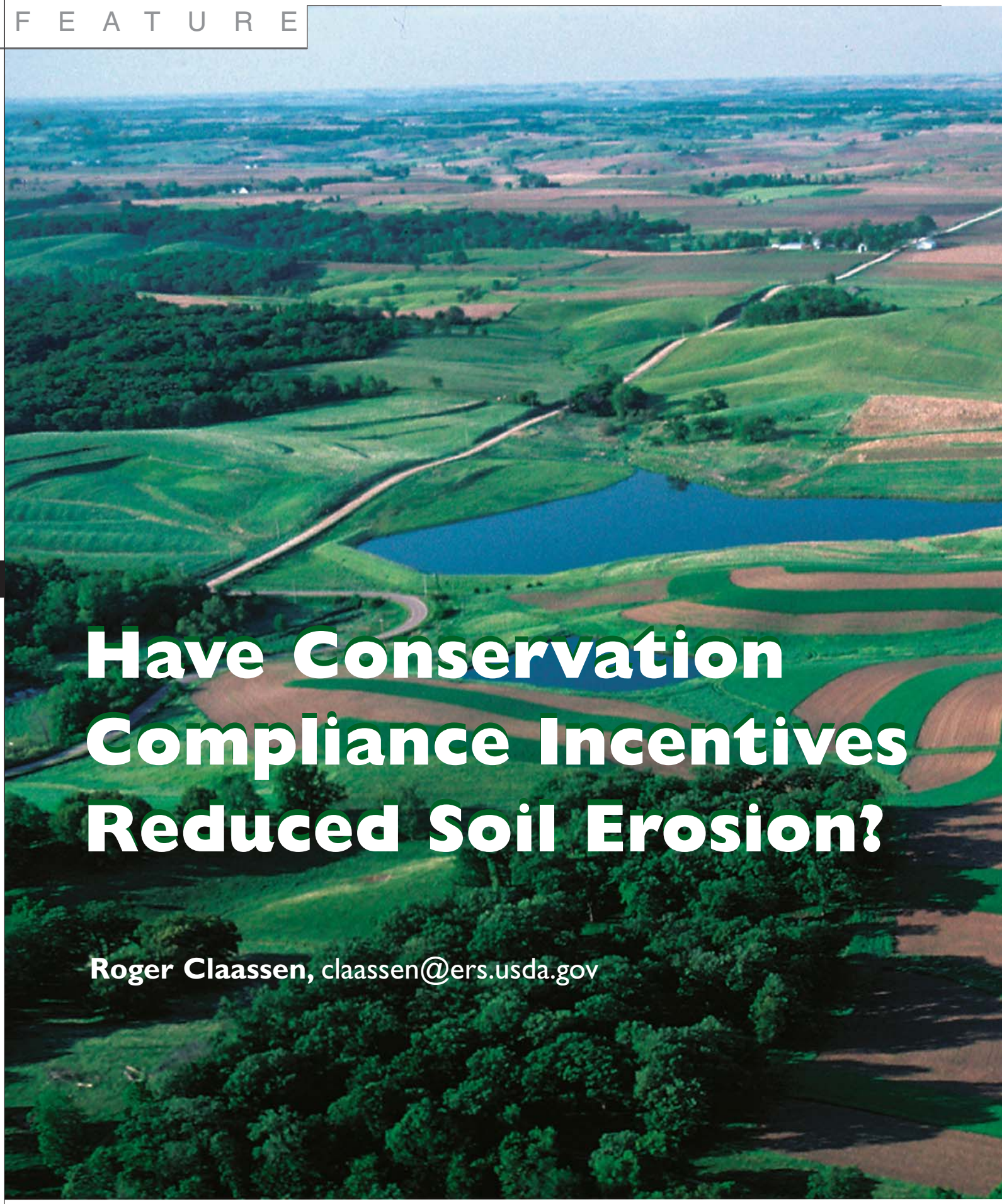


Have Conservation Compliance Incentives Reduced Soil Erosion?

Roger Claassen, claassen@ers.usda.gov

Tim McCabe, USDA/NRCS

Since its inception in the 1930s, U.S. agricultural policy has been designed to support farmers' incomes while promoting soil conservation practices. By the 1970s, however, policymakers recognized that existing farm price and income support programs were not always consistent with soil conservation efforts. An unintended effect of these programs was to encourage producers to maintain or expand production of relatively erosive crops, such as row crops (corn, cotton, soybeans), sometimes on highly erosion-prone soils. At the same time, the Government was helping farmers reduce soil erosion and related damages through conservation cost-sharing programs. Policymakers further recognized—aside from concerns about consistency—that farm program payments could be used as incentives to encourage better conservation behavior.

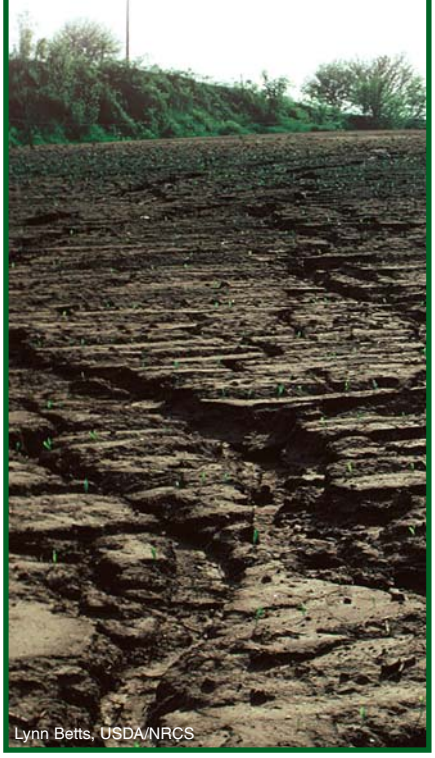
In the 1985 Food Security Act, policymakers required farmers to engage in conservation activities in order to receive government payments, in an effort to improve consistency among policy objectives while reducing soil erosion. These mechanisms apply to the just over 100 million acres of U.S. cropland—about 25 percent of all cropland—that are considered highly erodible land (HEL, see box, "Highly Erodible Land"). "Conservation compliance" requires producers to apply and maintain conservation systems on HEL cropland that was already in crop production in 1985 or risk losing farm income support, price support, and conservation payments from voluntary programs. "Sodbuster" requires similar (albeit more stringent) plans on HEL brought into crop production after 1985. (The 1985 Act also introduced a mechanism to preserve wetlands. See box, "Conservation of Wetlands.") This article focuses primarily on the effect of conservation compliance.

Following implementation of conservation compliance and other conservation policy changes, soil erosion on U.S. cropland was significantly reduced. Between 1982 and 1997, annual cropland soil erosion fell by almost 40 percent. Of course, farmers respond to a range of economic and policy stimuli, making it difficult to determine how much of the decline is the result of conservation compliance alone. Some reductions cannot be attributed to the compliance policy because they occurred on land not subject to conservation compliance. Even for land that is subject to compliance, there are questions about the role of conservation compliance in helping to achieve erosion reductions. Critics charge that weak conservation standards and inadequate enforcement have undermined conservation compliance. Moreover, other factors, such as changing technology, may also have played a role in achieving the observed reductions.

Given the range of economic and policy forces influencing farmers' production decisions, how much erosion reduction can be reasonably attributed to the national policy of conservation compliance? A careful analysis of relationships among erosion reduction data, compliance requirements, production trends and other factors that influence farmer behavior yields useful insights into possible answers.

Highly Erodible Land

Highly erodible land has an erodibility index (EI) of 8 or larger. The erodibility index is the ratio of inherent erodibility to the soil loss tolerance. Inherent erodibility for a given soil is the rate of erosion (tons per acre per year) that would occur on land that was continuously clean tilled throughout the year. The soil loss tolerance, or T value, is an estimate of the rate of soil erosion that can occur on a given soil without significant long-term productivity loss. Thus, the erodibility index captures both the propensity of a soil to erode and the potential for damage from erosion. Land can be highly erodible based on potential for water-borne erosion, wind erosion, or both. Just over 100 million acres of U.S. cropland are highly erodible, about 25 percent of all cropland.



Lynn Betts, USDA/NRCS

Conservation Compliance: A Brief Primer

Conservation compliance requires the application of approved conservation systems on HEL cropland as a condition of eligibility for most farm commodity and conservation programs. A conservation system is a collection of conservation practices applied together. For example, a producer may adopt conservation tillage, shift to less erosive crops (also called "conservation cropping"), and install grass waterways to move water off fields. The effectiveness of conservation compliance in reducing soil erosion depends largely on

Conservation of Wetlands

In addition to conservation compliance and sodbuster, another mechanism was introduced in the Food Security Act of 1985 to encourage preservation of wetlands. Under "swampbuster," as this mechanism is known, producers who drain wetlands to produce crops can also lose farm program payments. Together, the mechanisms created in 1985 help ensure that U.S. farm support and farm conservation policies work together.

three factors: (1) conservation system design requirements, which determine conservation costs, (2) the strength of the compliance incentive, and (3) the level of enforcement effort.

Initially, USDA considered requiring that conservation systems reduce erosion to the soil loss tolerance ("T") level, an estimate of the rate of soil erosion that can occur on a given soil without significant long-term productivity loss. Before conservation compliance plans could be devised or implemented, however, USDA dropped the strict T standard. Unresolved questions about the scientific validity of the T value as well as increasing recognition of the importance of the damage that sediment from soil erosion can bring to adjacent water bodies prompted questions about the appropriateness of T as a basis for compliance requirements. USDA also determined that reducing erosion to T (or even twice the level of T, a higher rate of erosion) might be so costly that crop production would no longer be profitable on a great deal of highly erodible land.

Three conservation practices make up conservation systems used on more than 50 percent of highly erodible cropland, 1997

Conservation system	Highly erodible cropland subject to compliance
	Percent
Conservation cropping/crop residue use	27.5
Conservation cropping/conservation tillage	10.8
Conservation cropping only	7.8
Crop residue use only	4.9
Total	51.0

Source: ERS analysis of USDA compliance review data.

Ultimately, conservation compliance was implemented for all HEL land using a flexible approach that accounted for both soil erosion and the cost of erosion reduction, without imposing a fixed erosion standard. Where erosion can be reduced to the T level without making crop production unprofitable, producers are required to develop "basic" conservation plans, designed to reduce erosion to T. Where reducing erosion to T is more costly, producers are allowed to develop "alternative" conservation systems. Alternative conservation systems require the application of technically and economically feasible practices that result in "significant" erosion reduction. Under alternative systems, producers are not required to reduce erosion to any specific level.

In the end, most producers have been able to meet conservation compliance requirements by adopting relatively inexpensive management practices. Because HEL cropland varies widely in terms of soils, topography, climate, and cropping patterns, more than 1,600 conservation systems have been approved for use. However, more than 50 percent of acres with conservation systems in place have systems that are made up of one or more of just three conservation practices: conservation cropping, conservation tillage, and crop residue use.

The incentive for producers to meet conservation compliance requirements depends on the level of program benefits that can be withheld. Producers who fail to meet compliance requirements on HEL cropland may be denied benefits from most

Conservation tillage in Maryland.

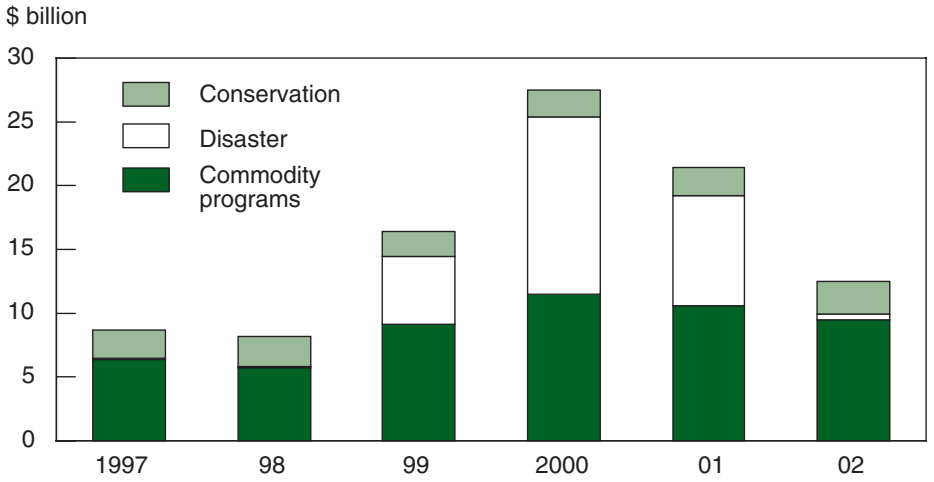
Tim McCabe, USDA

Federal agricultural programs on their whole farm—even if it includes non-HEL cropland. Ongoing commodity and disaster relief programs make up most of the direct payments subject to compliance. Conservation payments are also significant, including those provided under land retirement programs, such as the Conservation Reserve Program (CRP) and the Wetland Reserve Program (WRP), and conservation programs for working lands, such as the Environmental Quality Incentives Program (EQIP). Annual spending on these programs has ranged from about $8 billion to more than $27 billion in recent years.

Eligibility for Federal agriculture-related loans or loan guarantees (such as price support loans and farm credit loans) can also be denied, though this analysis does not address these particular incentives. Subsidized crop insurance, which could be withheld under the original compliance provisions enacted in 1985, was removed from the list of programs subject to compliance in the 1996 Federal Agricultural Investment and Reform (FAIR) Act.

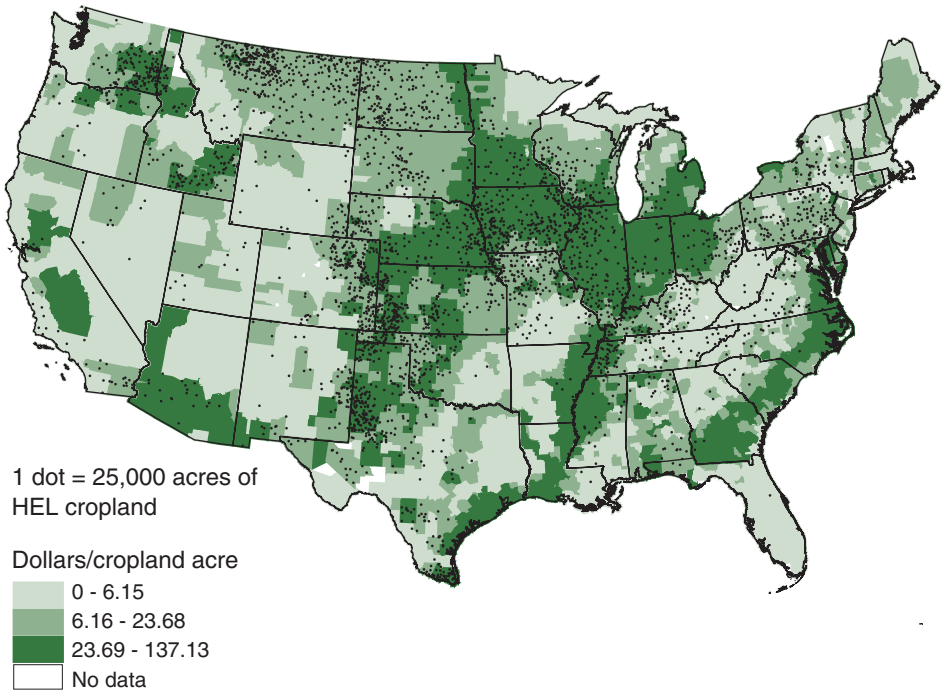
The effectiveness of conservation compliance depends critically on the geographic distribution of payments that could be denied, relative to the environmental problems addressed through compliance mechanisms. A comparison of 1998 commodity program payments—the lion's share of payments received by producers—with the geographic distribution of HEL cropland shows that most areas of the U.S. that have HEL cropland are receiving government payments. Although the overall level of commodity program payments fluctuates over time, the geographic distribution of these payments has been stable from year to year because the distribution of payments depends largely on the geographic distribution of program-eligible base acres, which depends, in turn, on historical plantings, not current crop acres.

Commodity, disaster relief, and conservation program payments can be withheld under conservation compliance



Source: USDA's Office of Budget and Policy Analysis.

Most of the areas that have highly erodible cropland received farm program payments in 1998



Sources: USDA's Farm Service Agency and 1997 National Resources Inventory.

In addition to financial incentives, enforcement also plays a role in the effectiveness of the compliance mechanisms. USDA's primary enforcement mechanism is the annual Compliance Status Review (CSR). Each year, compliance status is assessed on a sample of "tracts" subject to conservation compliance requirements (and other compliance mechanisms). In 2001, for example, 17,723 tracts were

reviewed, including about 4.9 million acres. The CSR summary prepared by USDA's Natural Resources Conservation Service (NRCS) shows that 98.0 percent of reviewed tracts and 98.9 percent of reviewed acres were meeting compliance requirements.

A recent General Accounting Office (GAO) report, however, identified a variety of deficiencies in the CSR that, in their view, "make questionable USDA's claim that 98 percent of the Nation's cropland tracts subject to the conservation provisions are in compliance." GAO criticized the CSR on a number of issues, including methods used to select the sample for review, consistency and clarity of guidance provided to local offices, data handling and analysis, failure to cite producers for significant deficiencies, and inadequate justification for waiver of penalties.

A Systematic Estimation Is Needed

Because of the concerns raised by the GAO, we used other data and information on soil erosion, farm program payments, and program requirements to estimate the contribution of compliance to overall erosion reduction.

According to data from the National Resources Inventory (NRI), maintained by NRCS, overall (HEL and non-HEL) annual cropland erosion fell from 3.07 billion tons in 1982 to about 1.90 billion tons in 1997, a reduction of 1.17 billion tons, or about 40 percent. Because conservation compliance was enacted in 1985 and producers were required to have conservation systems fully operational by 1995, the NRI provides estimates of cropland erosion "before" (1982) and "after" (1997) implementation of conservation compliance. Using this estimate of erosion reduction as a starting point, we systematically determined how much of that erosion is attributable to conservation compliance by examining several factors:

- To what extent did erosion reduction occur on HEL land?
- Did these erosion reductions result from specific actions that could have reasonably been required by or prompted by conservation compliance? Or could they have resulted from actions, such as changes in land use, that are not typically associated with conservation compliance?
- Did erosion decline on farms that received program payments and were subject to conservation compliance?

Of the 1.17-billion-ton drop in annual cropland soil erosion, 442 millions tons occurred on non-HEL cropland that was not subject to conservation compliance. (Some non-HEL erosion reduction could be indirectly attributed to compliance if conservation systems were also adopted on non-HEL cropland within the complying farm. For example, conservation tillage may have reduced costs for some producers, prompting its use on non-HEL cropland as well.)

The balance of the reduction, 732 million tons, occurred on HEL cropland. But not all of this reduction can be attributed to conservation compliance, either. About 365 million tons—about 50 percent—of erosion reduction on HEL cropland occurred on land that was cropped in 1982 but not in 1997. This land use change, and its associated erosion reduction, was not likely to be the result of conservation compliance, as compliance focuses on implementing conservation systems that allow HEL cropland to stay in production.

HEL cropland that was cropped in both 1982 and 1997 accounts for 367 million tons of erosion reduction. For this cropland, conservation compliance applied only to "excess" erosion, or erosion in excess of the T level. "Nonexcess" erosion, or erosion reduction below the T level, cannot generally be attributed to compliance, though some conservation compliance systems may result in reduction of erosion to rates less than T. Of the 367 million tons, 36 million tons repre-

Topsoil as well as farm fertilizers and other potential pollutants run off unprotected farm fields when heavy rains occur.

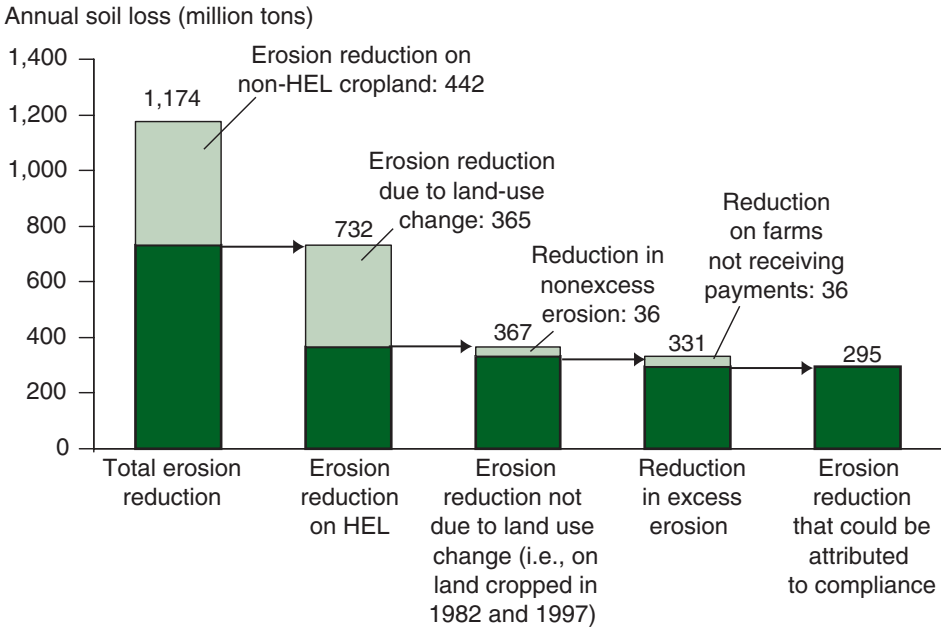
Lynn Betts, USDA/NRCS

Estimating HEL and Erosion on Farms Receiving Payments

Data on erodibility and soil erosion from the National Resources Inventory (NRI), maintained by USDA's Natural Resources Conservation Service, were combined with ARMS data on crop acreage and government payments received to estimate the extent of HEL cropland and related erosion on farms receiving government payments and subject to conservation compliance. For the purpose of the analysis, government payments were defined as farm commodity program payments, disaster payments, and conservation payments from the Conservation Reserve Program (CRP), Wetlands Reserve Program (WRP), and the Environmental Quality Incentives Program (EQIP). Payments from these commodity and conservation programs account for roughly 98 percent of direct payments subject to compliance mechanisms.

Jack Dykinga, USDA/NRCS

Erosion reduction from 1982 to 1997 has many components



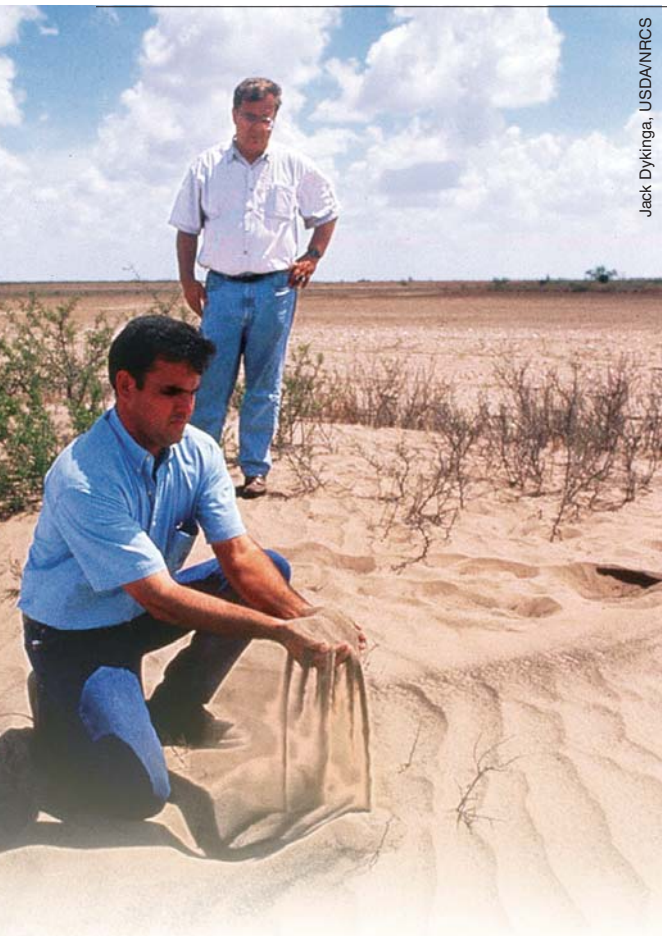
Source: ERS analysis of 1997 National Resources Inventory and 1997 Agricultural Resource Management Survey data.

sent reductions that were less than the T level, and, therefore, cannot be directly attributed to conservation compliance. Excluding the 36 million tons of nonexcess erosion leaves 331 million tons of reduction in excess erosion that could be attributed directly to conservation compliance *if* reductions occurred on the farm of a producer who participates in government programs subject to compliance *and* reductions would not have been realized without compliance.

Data from USDA's Agricultural Resource Management Survey (ARMS) indicate that 86 percent of all U.S. cropland is located on farms that receive government payments, indicating that a large proportion of HEL cropland is likely to be included in farms with government payments. NRI data on erodibility and soil erosion, along with ARMS data on farm operator participation in government programs, indicate that roughly 83 percent of HEL cropland, about 92 million acres, is located on farms that receive at least some commodity program, disaster, or conservation payments.

While excess erosion has declined both on farms that receive government payments and on those that do not, erosion reductions appear to have been larger on farms that receive farm program payments. For wind erosion, the difference is large. Excess wind erosion declined by 30.7 percent on farms receiving payments, but by only 14.2 percent on farms not receiving payments. For water erosion, the difference is somewhat smaller. Excess water erosion dropped by 46.7 percent on farms receiving payments and by 40.5 percent on farms not receiving payments.

Overall, an estimated 295 million tons of erosion reduction per year could be directly attributed to implementation of conservation compliance policy. This amount is roughly 89 percent of the 331 million tons of excess erosion reduction on HEL cropped in 1982 and 1997 and 25 percent of all erosion reduction. (See box,



Jack Dykinga, USDA/NRCS

Soil scientist and farmer assess the effects of wind erosion, which can be reduced if conservation tillage is adopted.

"Estimating HEL and Erosion on Farms Receiving Payments.")

Finally, some erosion reduction that could be directly attributed to compliance may have occurred even without the compliance requirements. For example, conservation tillage can preserve soil moisture where rainfall is limited and can also reduce machinery, fuel, and labor costs, making it profitable for some producers, regardless of its effect of soil erosion. Tillage and planting machinery needed to practice conservation tillage became widely available only in the mid- to late 1970s. Because widespread adoption of new practices often occurs over a long period of time, producers who included conservation tillage in compliance plans may have eventually adopted the practice for economic reasons even without the compliance requirement. Unfortunately, existing data provide little insight on this possibility.

Are Farmers Responding to Conservation Compliance Incentives?

We find considerable evidence to suggest that that the answer is "yes." Highly erodible land is likely to be located on farms that receive Federal farm program payments. Between 1982 and 1997, excess erosion dropped sharply on these farms, and the reduction in erosion appears to have been larger on farms receiving payments than on farms not receiving payments, particularly on farms with wind-erodible soils. Overall, a significant share of erosion reduction between 1982 and 1997 is likely to have occurred on land directly subject to conservation compliance requirements.

On the other hand, NRI data show that soil erosion was sharply reduced on all types of land, including land not subject to compliance requirements. Moreover, the difference in reduction of water-caused erosion between farms receiving payments and farms not receiving payments is small.

These results are consistent with more than one hypothesis about the role of conservation compliance in reducing soil erosion. Compliance could have led farmers to apply inexpensive practices on HEL that quickly spread to other land types once their value was demonstrated. Such could be the case with practices like conservation tillage or crop residue use, to the extent that these practices reduce costs or conserve moisture in areas that receive limited rainfall. Changes in cropping practices on HEL cropland may have subsequently prompted changes in production practices on non-HEL cropping in the same farm.

One could also argue that practices like conservation tillage would eventually have been adopted where they are cost effective regardless of conservation compliance. In other words, the compliance requirement happened to coincide with a period during which better equipment became available, making conservation tillage practices much easier to implement. Even if these practices eventually would have been adopted, however, it is not clear that the same level of erosion reduction would have occurred between 1982 and 1997. The compliance requirement, structured to focus on inexpensive practices, may have accelerated the adoption process on all types of land.

This article is drawn from . . .

Environmental Compliance in U.S. Agricultural Policy: Past Performance and Future Potential, by Roger Claassen, AER-832, USDA/ERS, June 2004, available at: www.ers.usda.gov/publications/aer832/