



Building a Culture of Conservation

Farmer to Farmer: Iowan to Iowan



Grassed waterway

Water Quality and Conservation Practices



Unprotected waterway in an Iowa field.

Protecting soil and water: It begins with you

Finding the answers to questions about whether your farming practices are in line with your soil type and slope can be difficult. Have you considered one or more of these scenarios:

- You've read about fall strip-tillage that disturbs less soil. But you farm the loess soils in western Iowa. How does strip-till work there?
- Conservation publications encourage the use of grassed waterways and terraces. But the price of farmland is high in the Des Moines Lobe. What are the economic benefits of using waterways and filter strips?
- What conservation practice would be most effective on your farm to reduce soil erosion and improve water quality?
- What specific conservation practices work best on your farm? How do they affect the economics on farms in your region?

The Iowa Learning Farm has been conducting a statewide study using a soil erosion model to calculate the potential impact of specific conservation practices in terms of soil loss and potential economic costs. The study focused on corn-soybean rotations.

This publication describes the overall study and how it was designed. Results are shown in insert sheets specific to each region in Iowa.



Left: Several conservation practices are demonstrated here: terraces, contour farming and grassed waterways are working together for optimum results.

photo by USDA-NRCS

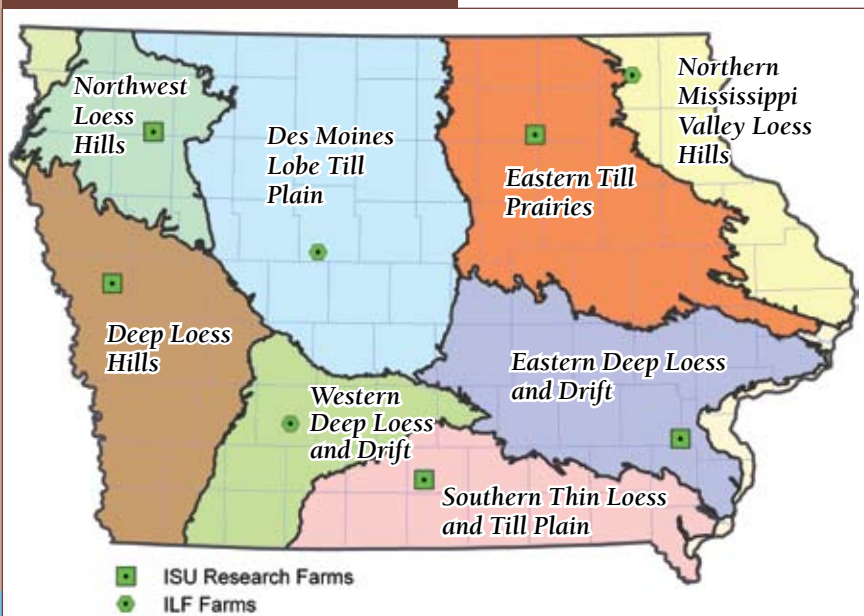
Iowa's soil regions

Iowa's landforms vary in slope, parent materials, drainage class, and rainfall distribution; and are classified into 20 major soil associations.

For this study, Iowa was divided into eight Major Land Resource Areas (MLRAs) based on soil and landscape characteristics, land use, and climate. Farms using a corn-soybean rotation were selected to represent the typical soil type and slope for each region:

- Northwest Loess Hills
- Deep Loess Hills
- Des Moines Lobe Till Plain
- Western Deep Loess and Drift
- Eastern Deep Loess and Drift
- Eastern Till Prairies
- Northern Mississippi Valley Loess Hills
- Southern Thin Loess and Till Plain

For more information on each of these MLRAs, see the corresponding supplement.



Conservation practices and water quality

Iowa has severe water-induced soil erosion and associated water quality problems. Soil erosion can be reduced through better field residue management and other conservation practices such as reduced tillage, crop rotation, contour cropping, terraces and filter strips. However, their effectiveness depends on many factors including climate, soil type, topography, cropping systems, and other existing conservation practices in the area.

In addition to protecting soil from erosion, the implementation of conservation practices may result in changes in crop yield and field operation costs. Eroded soil has economic value both on and off the farm. This study attempts to account for these costs and benefits in evaluating the effectiveness of conservation practices on Iowa farms.

Conservation tillage

This study looked at three types of commonly-used conservation tillage systems used in Iowa and their impact on soil loss and sediment export.

- **No-tillage:** Soil and crop residue are disturbed only when seeds were planted and nitrogen fertilizer was applied.
- **Strip-tillage:** Performed in the fall after harvest, resulting in disturbed soil about seven inches wide, where spring planting and fertilizer applications take place.
- **Chisel tillage:** A fall chisel plow operation after harvest and field cultivation in the spring before planting.

Conservation structures

This study looked at the environmental and economic benefits of three conservation structures: grassed waterways, grass filter strips, and terraces.

- **Grassed waterway:** A natural or constructed channel that is shaped or graded and established with suitable vegetation.
- **Grass filter strip:** A strip or area of vegetation for removing sediment, organic matter, and other pollutants from runoff and wastewater.
- **Terrace:** An earth embankment, or a combination ridge and channel, constructed across the field slope.

What's a ton of soil worth?

The impacts of soil erosion from agricultural lands occur both on and off the farm. Soil losses on the farm reduce productivity and sustainability by carrying away plant nutrients and organic matter with eroded topsoil. The off-site impacts of soil erosion include damages to water quality, air quality, and water-based recreational activities downstream.

Based on the USDA estimates, the total cost of eroded soil is estimated to be between \$6.10 and \$6.40 per ton using 2009 values. The off-site costs, which are external to farmers and are often neglected, account for about three-fourths of that total cost.

Economic benefits of conservation practices

For this study, the annual net benefit (dollars per acre) for each tillage system was calculated by subtracting the production cost from the crop revenue in each region. Yields of corn and soybeans from 2002 to 2008 were obtained from the experimental plots at the Iowa State University (ISU) Research and Demonstration Farms in each study area.

The costs of crop production were estimated using the Ag Decision Maker developed by ISU Extension. The total expense was calculated by combining the market costs of machinery, labor, seeds, chemicals and land rent for corn-following-soybeans and soybeans-following-corn, respectively.

The project also considered average costs to build conservation structures plus annual maintenance costs (three to five percent of initial costs) spread over an average life span of 10 years for grassed waterways and filter strips and 25 years for terraces.

Overall, the economic benefits of conservation tillage and conservation structures were more evident when the value of eroded soil was considered. In many areas, the use of conservation practices gained a net benefit, particularly in regions that are more susceptible to water erosion. For example, the adoption of no-till or strip till in northwest Iowa had a net benefit of about \$21 and \$40 per acre, respectively, compared to chisel plow.

WEPP, the soil erosion model

This project uses the Water Erosion Prediction Project (WEPP) model, a computer simulation that can predict soil erosion by water from hillslopes and small watersheds at the field scale. The model was used to estimate the annual sediment yield over a 50-year period using climate, topography, crop management, soil type, and watershed characteristics. Climate information was generated for each site using meteorological data at the nearest weather station to the site.



Buffer strips in Fayette County field.



Grassed waterway

Conclusions

- The WEPP-estimated annual soil losses to erosion in a corn-soybean rotation varied from 0.23 tons to as much as 28 tons per acre, which makes soil protection critical in areas prone to erosion.
- Grassed waterways were very effective in reducing soil erosion by minimizing channel erosion and retaining sediments from upland fields, particularly when excessive erosion occurred.
- Converting a portion of row-cropped field to perennial vegetative strips greatly reduced the sediment delivery to waterways.
- The economic benefit of conservation structures varied by region, which showed a net benefit in most of the areas when the value of eroded soil was considered. Conservation structures were more efficient in the areas where massive erosion occurred.
- Besides improving environmental quality, conservation practices also can have an economic benefit. This study showed that adopting no-till and strip-till saved some operational costs with few yield losses.

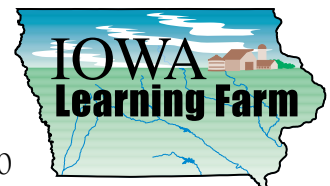
Specific soil region inserts

For more information about your soil region, see the specific supplement sheet: Northwest Loess Hills, Deep Loess Hills, Des Moines Lobe, Western Deep Loess and Drift, Eastern Deep Loess and Drift, Eastern Till Prairies, Northern Mississippi Valley Loess Hills and Southern Heavy Till Plain. To obtain copies of the supplement sheets, contact the Iowa Learning Farm at the address below.

For more information

Contact the Iowa Learning Farm for more information about water quality modeling.

Iowa Learning Farm
2104 Agronomy Hall
Iowa State University
Ames, Iowa 50011-1010



www.extension.iastate.edu/ilf

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References

Hansen, L. and M. Ribaud. 2008. Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment, TB-1922. USDA, Economic Research Service.