



Building a
Culture of Conservation
Farmer to Farmer: Iowan to Iowan



The Cost of Soil Erosion



Preserving precious soil: It begins with you

Soil erosion can be caused by a single rainfall event or at a slow, steady, misleadingly labeled “tolerable” rate. Slow topsoil erosion across a field can lull a farmland owner into thinking that the value of the lost soil is minimal. The farmer must keep in mind that average rates of soil formation are likely under one ton per acre per year. Eroded topsoil does indeed have value!

Erosion represents costs to farmers including a loss of nutrients and soil carbon. Erosion also produces costs to society. These costs include filled roadway ditches, sedimentation of streams, rivers and lakes that often require costly dredging restorations, more turbidity in water bodies which interrupts the natural cycles of aquatic life and reduces the aesthetic value for recreation.

The United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), through the Natural Resources Inventory (NRI), estimates that farmland soil erosion in Iowa decreased from 7.4 tons per acre in 1982 to 5.1 tons per acre in 2007. In the same time period nationwide, farmland soil erosion fell from 4.0 tons to 2.7 tons per acre.

Adoption of reduced tillage, leaving more crop residue on the soil surface, enrollment in USDA-NRCS programs including the Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP) and conservation compliance requirements, all have helped reduce soil erosion. However, high corn prices have encouraged expansion of row crop production to lands which often are at greater risk for soil erosion.

Farmland owners are urged to recognize the threat of soil erosion and employ a suite of best-management practices to protect this precious resource.





EQIP best management practices

The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides financial and technical assistance to agricultural producers through contracts up to a maximum term of 10 years. These contracts provide financial assistance to help plan and implement conservation practices that address natural resource concerns and for opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland. In addition, EQIP helps producers meet federal, state, tribal and local environmental regulations.

Statewide EQIP practices include, but are not limited to, nutrient management, terraces, cover crops, grassed waterways, manure management facilities, and pasture management.

Iowa State University Extension and Outreach (ISUEO) Agricultural Economist Michael Duffy analyzes the costs of topsoil erosion in three categories:

Farmer costs: the cost of applied fertilizer nutrients carried away by soil erosion, loss of soil organic matter (soil carbon), the costs to apply soil amendments and higher rates of fertilizer to offset erosion losses. USDA-NRCS reports that each ton of eroded soil contains 2.32 pounds of nitrogen and 1 pound of phosphorus.

The 2012 ISUEO publication “Estimated Costs of Crop Production in Iowa” states nitrogen and phosphate fertilizer costs at \$0.63 and \$0.64 per pound, respectively. By these figures, the cost of lost fertilizer alone is \$2.10 per ton of eroded soil (2.32 pounds nitrogen x \$0.63 per pound plus 1.0 pound phosphate x \$0.64 per pound). USDA-NRCS suggests implementing EQIP practices will reduce soil erosion, on average, 8.6 tons per acre. Farmers utilizing EQIP can save \$18.06 per acre (8.6 tons soil saved per acre x \$2.10 fertilizer value per ton of eroded soil).

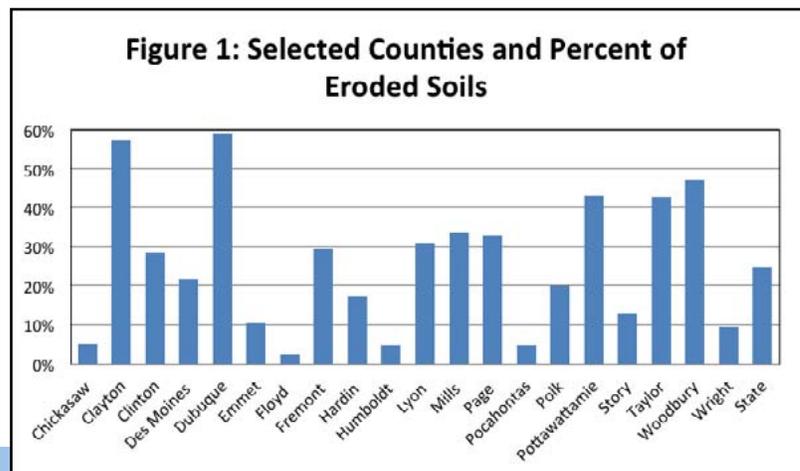
Societal costs: paid by all taxpayers, includes the cost to remove displaced topsoil from roadside ditches and other off-site locations, costs to remove sediment deposited in water control structures, costs to filter sediment-polluted lakes, rivers and other water bodies.

USDA-NRCS estimates that for each ton of prevented soil erosion, water cleanup costs are reduced by \$4.93 per acre. Farmers utilizing EQIP can save society \$42.40 per acre in water quality improvement costs (8.6 tons soil saved per acre x \$4.93 per acre). The sum of implementing EQIP practices per acre is \$7.03 per ton of prevented soil erosion (\$2.10 fertilizer value + \$4.93 in water quality benefits).

Landowner costs: lost farmland asset value resulting from reduced productivity. In 2007, farmers rented over 50 percent of Iowa farmland and 38 percent of U.S. farmland. Topsoil erosion reduces crop yield and income potential. Soil erosion carries away applied nutrients and may necessitate application of more fertilizer, aglime or other soil amendments to offset the impact of loss. This represents a true loss of asset value to landowners—whether or not they are the farmer-operator.

Evaluation

When analyzing the impact of soil erosion on farmland value, Duffy focused specifically on soils in differing erosion phases from 20 randomly selected Iowa counties (Figure 1) and included only soils in a



county with the same Soil Map Unit (SMU) but differing erosion phase designations (e.g. 183E v. 183E2 or 183E3). Three methods were used to evaluate the cost of soil erosion: a) change in land value due to reduced Corn Suitability Rating; b) change in land value due to loss of yield potential; and c) change in land rent value due to the change in soil erosion phase.

Characteristics from the Iowa Soil Properties and Interpretations Database (ISPAID) were taken into account: the Corn Suitability Rating (CSR), a soil's relative productivity index ranging from 5 (least productive soil) to 100 (most productive soil), and the estimated corn and soybean yield potentials.

Corn Suitability Rating (CSR): The data set features the calculated change in CSR, corn and soybean yield potential resulting from degrading a soil from one erosion phase to another (i.e. 183E to 183E2). Based upon July 2012 Iowa farmland values, Duffy concludes that estimated loss in farmland value caused by soil erosion—based on the CSR change and the dollar value per CSR unit—ranges from 3 to 17 percent, depending on the particular SMU. Average loss in land value per unit change in CSR value for all counties is 4.9 percent, or \$339 per acre.

Lost Crop Yield Potential: Erosion's impact is the difference in corn or soybean yield resulting from degrading a soil from one erosion phase to another, with continuous corn, corn after soybeans, and soybeans. Duffy used a single corn yield potential figure and also analyzed continuous corn net returns separately from corn following soybean, based on 2012-estimated production costs.² The impact of soil erosion on land value is less for a continuous corn system because average per-acre return is greater from the corn after soybean rotation. Planting corn after soybean generally produces higher net returns and resulting higher land values. Therefore, the impact of soil erosion on land value is accentuated for corn following soybean relative to continuous corn.

Reduced Cash Rental Rates³: The "2012 Survey of Cash Rental Rates for Iowa" data showed that of the 20 counties studied, soil erosion reduced cash rental rates from \$9.43 to \$16.17 per acre.



Identifying Iowa Soils

All Iowa soils are identified with a Soil Map Unit (SMU) within the Iowa Soil Properties and Interpretations Database (ISPAID) maintained by the ISU Department of Agronomy http://extension.agron.iastate.edu/soils/SSDS_maps.html. A soil's SMU includes a number representing the soil type, a letter designating the soil's slope measurement, and if applicable, a number designating the soil's erosion phase. Each SMU has a unique set of identifying characteristics described within ISPAID. For example, a soil designated "183E2" is in the Dubuque soil series with an E slope and "moderately eroded" soil erosion phase, represented by the number "2."

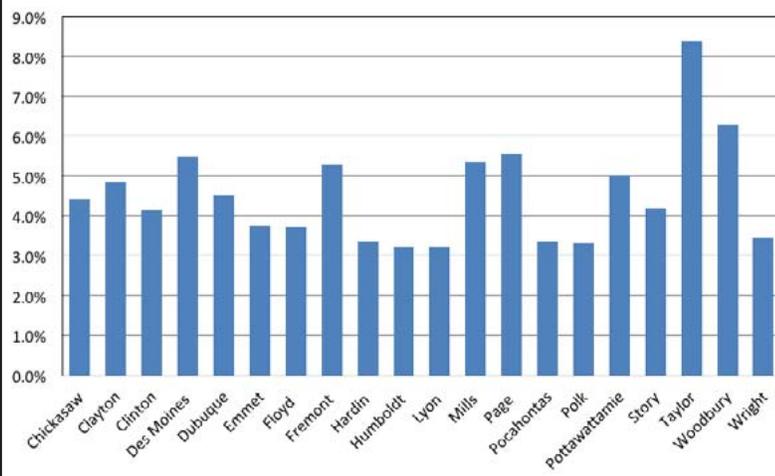
SMU slope measurements include:

- Blank** 0 to 2 percent slope
- B** 2 to 5 percent slope
- C** 5 to 9 percent slope
- D** 9 to 14 percent slope
- E** 14 to 18 percent slope

SMU erosion phase designations include:

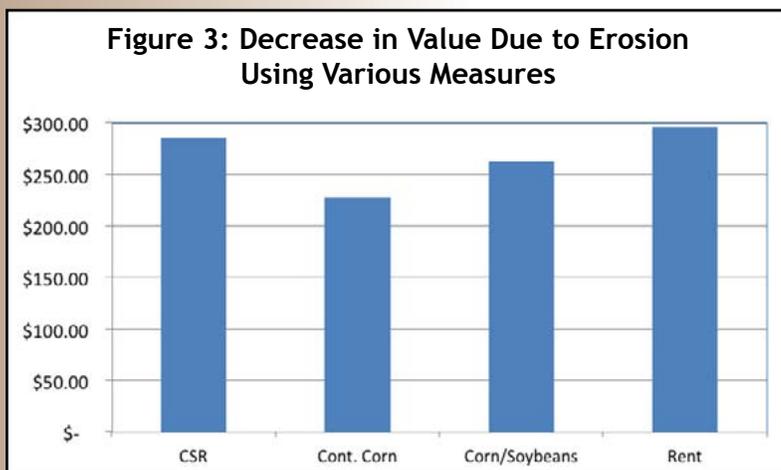
- Blank** no erosion to slightly eroded; greater than 7 inches of A horizon (topsoil) thickness
- 2** moderately eroded; 3 to 7 inches of A horizon thickness
- 3** severely eroded; less than 3 inches of A horizon thickness

Figure 2: Estimated Percent Decrease in Land Value Due to Erosion



Conclusions

Across Iowa, there is considerable difference among soil types with respect to loss of farmland value caused by topsoil erosion. The estimated loss in value ranges from 3.4 to 7.1 percent for eroded soils, relative to the same soils without erosion.



The three methods used to estimate the impact of soil erosion on land values produced similar results. Figure 3 summarizes the average estimated impact of erosion on per acre land value based on CSR change, the yield loss with a continuous corn or a corn/soybean rotation and the average loss using the three different rent methods. The estimations are relatively similar.

The biggest difference is between the continuous corn estimate and the average of the rental methods of \$68 per acre or 30 percent. The lower impact for continuous corn is expected because the greater

input costs associated with that rotation reduces net returns. The corn/soybean rotation produced a \$33, or 13 percent, difference between it and the loss due to erosion using the rental method.

The estimated loss of farmland value resulting from soil erosion is relatively consistent whether measured by decreased CSR value, loss of corn or soybean yield, or loss of land rent value.

Soil erosion can cause a decrease in land values. Erosion costs the landowner because of lost farmland productivity and potentially decreased land sales price. Protecting farmland from erosion protects the value of the land asset investment.

More ILF Resources to Mitigate Erosion

Read these other publications for further information on reducing erosion on your land:

- Transition to No-till
- Economics of Residue
- Strip-tillage Crop Management

They can be found on the ILF website; print copies are available by request.

Resources:

¹ ISU Extension Ag Decision Maker Publication A1-75, "Value of Soil Erosion to the Land Owner" (August 2012); Mike Duffy.

² (2012 Estimated Costs of Crop Production in Iowa, ISU Extension and Outreach Publication FM-1712).

³This analysis is based upon information detailed in Dr. William Edwards' ISU Extension and Outreach Publication FM-1851, "2012 Survey of Cash Rental Rates for Iowa."

For more information

Contact your area Iowa State University Extension and Outreach Field Agronomist or Iowa Learning Farms for more information.

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