Tyler Netsch
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Iowa Soil Erosion: A Problem and Solution Assessment

Objective

The objective of this paper is to bring awareness to the reader the extent of soil erosion in Iowa, and possible solutions to reduce the rate of soil loss.

Introduction

Soils play a tremendous role in water quality and plant growth. These roles consist of; water availability, nutrients, gas exchange, anchorage/support, seed protection, waste disposal, biological symbiosis, and toxins mitigation. Soil is also Iowa's number one water quality issue (Cruse). Increased levels of nitrogen and phosphorous, along with higher sediment loads are the leading contributors to poor water quality in Iowa. As a result of the fertilizer-enriched sediments, eutrophication—the growth of algae and other aquatic plants—occurs, decreasing dissolved oxygen levels (Al-Kaisi). Soil loss is a serious problem due to these important roles in water quality and plant growth. It is even more important to the farmer when a decrease in land value occurs because of soil erosion. So how bad is soil erosion in Iowa, and what can farmers and conservationists due to reduce the rate of soil erosion?

Discussion

According to Michael Duffy, conductor of Iowa State University's land value survey, Iowa's soil loss has decreased from 7.4 tons per acre of soil erosion on cropland in 1982, to an estimated average of 5.2 tons per acre on cropland in 2007 (Duffy). Figure 1 below shows the estimated decrease in land values due to erosion using dollar value per corn suitability rating in some of Iowa's counties where erosion is prevalent.

Table 2: Estimated Decrease in Land Values Due to Erosion using Dollar Value per Corn Suitability Rating Point

County	Average Land Value	Average Dollar Value Lost	Percent of Land Value Lost	Range in Percent Loss High	Low
Chickasaw	$6,622	$303	4.6%	7.1%	2.9%
Clayton	$6,151	$377	6.1%	9.8%	3.9%
Clinton	$6,334	$226	3.6%	4.7%	3.1%
Des Moines	$6,492	$450	6.9%	7.6%	3.0%
Dubuque	$7,039	$388	5.5%	11.5%	3.8%
Emmet	$8,244	$354	4.3%	6.3%	3.1%
Floyd	$7,397	$326	4.4%	7.4%	2.9%
Fremont	$6,497	$396	6.1%	8.2%	3.3%
Hardin	$8,205	$208	2.5%		2.5%
Humboldt	$8,777	$240	2.7%		2.7%
Lyon	$8,689	$337	3.9%	6.8%	3.4%
Mills	$7,254	$484	6.7%	16.4%	3.3%
Page	$5,406	$300	5.6%	7.8%	3.1%
Pocahontas	$8,748	$233	2.7%		2.7%
Polk	$7,552	$207	2.7%		2.7%
Pottawattamie	$7,843	$483	6.2%	8.5%	3.4%
Story	$8,782	$314	3.6%	6.5%	2.6%
Taylor	$4,104	$311	7.6%	11.7%	3.3%
Woodbury	$6,670	$611	9.2%	16.7%	4.2%
Wright	$9,017	$240	2.7%		2.7%
AVERAGE		$339	4.9%		

Fig 1-http://www.extension.iastate.edu/agdm/crops/html/a1-75.html

But where do all of these soil loss numbers come from?

The universal soil loss equation estimates how much erosion is occurring by taking into account factors such as; rainfall and runoff, soil erodibility, slope length and steepness, cover management, and supporting practice. Although Duffy's numbers seem promising, to many the soil erosion problem is far from being under control.

The tolerable rate for soil loss for most types of soil is 5.0 tons/acre/year. This is the rate at which soil loss equals soil formation. Duffy's numbers show the estimated average soil loss was still above the tolerable rate level in 2007. Some recent findings from new research at Iowa State University may prove Iowa's estimated average soil loss to be underestimated.

Adam Heathcote, an Iowa State University researcher recently published a study in January of 2013. His study measured the accumulation of sediment in the bottom of 32 of Iowa's natural lakes. His findings weren't quite what he expected. Heathcote and his

researchers found that the rate of sediment buildup in the bottom of the lakes is actually increasing despite better management practices by farmers.

> "In 1900, it took more than 23 years for an inch of sediment to settle at the bottom of a lake, said John Downing, an ISU professor of ecology, evolution and organismal biology and agricultural and biosystems engineering. Now it takes only 4 years for an inch of sediment to build up, Downing said" (Des Moines Register).

Figure two below represents a graph from Heathcote's research where the red line shows average watershed erosion versus time for the 32 lakes in his study.

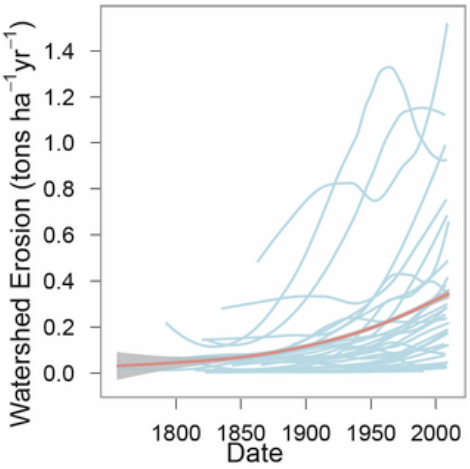

Fig 2-http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0053554

As you can see from the graph the average amount of watershed erosion in Iowa has been steadily increasing for quite some time.

Figure three below shows changing agricultural practices and regional lake sedimentation rates since European settlement, shown as decadal averages across all 32 lakes (Heathcote). In the bottom graph the blue line represents time for 1mm of sediment to buildup in the bottom of a lake. The black line represents estimated sediment buildup in the bottom of Iowa's lakes over time. The amount of sediment eroded has increased

and the amount of time to build up sediment in the bottom of a lakebed has decreased dramatically.

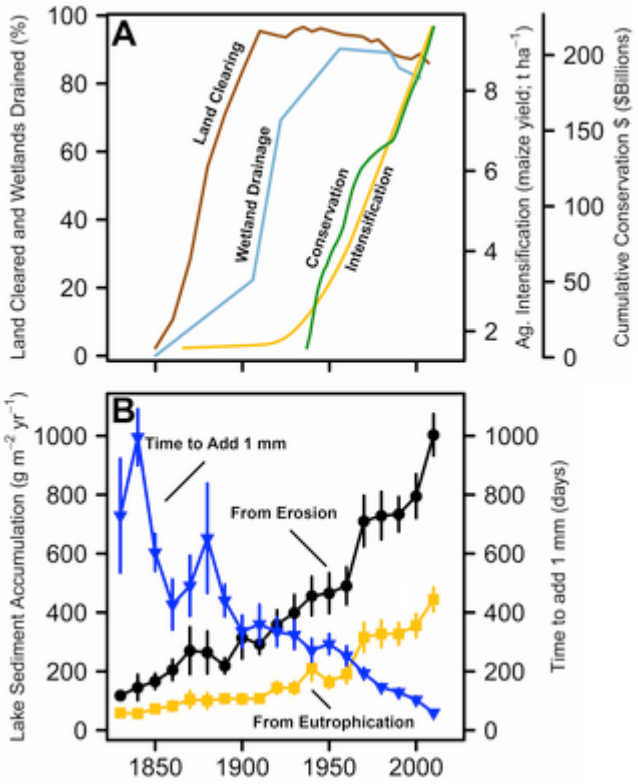

Fig 3- http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0053554http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0053554

So how can soil loss in Iowa be increasing despite all the efforts put in by many of Iowa's farmers and conservationists? One answer may be pressure on farmers to produce more as a result of demand for farm products increasing in recent years; farms collaborated and expanded onto previously unfarmed slopes and riparian buffers zones. The Increasing use of chemical fertilizers and intensive row cropping can be connected to sediment movement into Iowa's lakes and rivers (Heathcote).

The most important part of water erosion is raindrops hitting the soil, because it leads to degradation and erosion. Climate change may make erosion rates even worse in

the years to come. Over the past couple decades, the upper Midwest has seen a 30% increase in the frequency of intense rainstorms (Cruse). So what can farmers due to reduce the rates of soil erosion in Iowa?

Conclusion

Increasing pressure on farmers to produce more, and more intense rainstorms has negatively influenced rates of soil erosion in Iowa. Some things farmers can do to reduce these rates are changing tillage practices. Implementing no till practices can reduce breakage of nutrient cycling and loss of organic matter. Cover crops and residue management also significantly reduces soil loss. This additional cover allows raindrops to hit the biomass of the intended crop, instead of hitting the soil and detaching sediment particles. The figure below shows soil loss in tons per acre versus residue percentage. As you can see from the graph the more residue cover left in a field provides a better chance to the farmer of not having soil erosion problems.

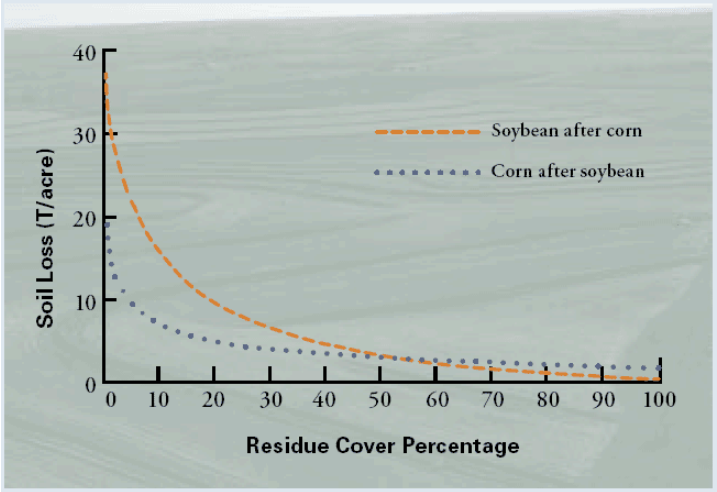

Figure 1. Soil loss due to water erosion in relation to percent residue cover for Iowa, based on the Universal Soil Loss Equation.

Fig 4-www.extension.iastate.edu/Publications/PM1901E.pdf

Grassed waterways are another practice used to control soil erosion. These

waterways slow down the movement of water preventing gully formation. They also act as a sediment trap keeping the particles out of our waterways.

Terraces are another management tool used by many Iowa farmers for soil erosion. Terraces break up slope length and reduce steepness. This reduces the surface flow and transport of any soil particles.

Contour farming is a popular practice used by many farmers here in the state. Contour farming consists of planting the crop along the contour. This helps to channel runoff across, rather than down the slope (Al-Kaisi).

A combination of these better management practices can significantly reduce soil erosion rates. Although it is still not exact on how much erosion is occurring in the state of Iowa, the effects and extent of this problem can be seen not only in Iowa's lakes and rivers, but many other bodies of water like the Gulf of Mexico. Soil erosion represents costs to the farmer, conservationist, outdoorsman, and taxpayers. According to Heathcote, soil mitigation programs were created in response by our government due to the excessive soil loss from farmer's fields. Despite these programs sediment erosion downstream has not decreased. With increasing demand for food, feed, fuel, and fiber soil erosion rates may continue to accelerate. The best thing farmer's can do is to implement better management practices for soil erosion, restore riparian buffers, and convert to low intensity agriculture.

Works Cited

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