

The 2008 Midwest flooding impact on soil erosion and water quality: Implications for soil erosion control practices

Birl Lowery, Craig Cox, Dean Lemke, Pete Nowak, Ken Olson, and Jeff Strock

The winter of 2007–2008 produced record snowfall in parts of the US midsection, and the spring of 2008 caused record flooding in this part of the country. These floods were once-in-a-lifetime events for all of Iowa, southern Wisconsin, southeastern Minnesota, and northwestern Illinois. However, given the expected extreme weather events predicted to take place because of global climate change, this kind of weather might become what we can expect as normal. If this is the case, we need to change our management approach for our most precious natural resources—soil and water. While the floods caused enormous financial loss of infrastructures in some urban and rural areas, our soil resources were devastated because of record erosion levels on upland soils. Estimated soil erosion levels from sheet, rill, and gully erosion were far in excess of any imaginable “tolerable soil loss” level (not that any soil loss is tolerable). Soil erosion caused by these floods will have a double impact on natural resources in that the environmental impact resulting from the erosion, in most cases, resulted in impaired water quality because of sediment deposition in waterways, streams, rivers, lakes, and reservoirs; or, the soil will eventually just be deposited in the Gulf of Mexico and contribute to the ongoing hypoxia. Entrained with the sediment were agricultural chemicals and fertilizers imparting a source of pollution to these waters.

Soil erosion caused by these floods brings into question current soil conserva-

tion practices and their implementation by landowners or the lack of soil conservation practices. Soil conservation for the most part is an empirical process whereby one learns from past events and then develops practices to prevent resource degradation during future events. The great flood of 1993 provided an excellent opportunity for Midwest conservationists (us) to improve upon conservation practices in preparation for future events, such as the 2008 Midwest flooding, especially in the Mississippi and Missouri River basins. In Missouri, for example, the impact on alluvial soils was partially addressed by raising and strengthening some of the levees, and in other areas the land use was converted from agricultural use to wildlife conservation use following the 1993 flood. However, on the upland Midwest soils the flooding lesson was not learned because if conservationists (us) and landowners had learned from the 1993 flood, we likely would not have seen as much soil erosion-related destruction from this flood on both the upland and bottomland soils. So, now the question remains as to what we learned from the 2008 floods and will we implement practices for future floods given the projection for more frequent extreme weather events?

The 2008 floods in the upper Mississippi River basin caused considerable devastation with extensive property loss. The estimates of financial loss because of structural damages can be readily assessed because each property likely had a known market value. However, we do not have this kind of cost analysis or market value data for the environmental (soil and water degradation) damage; even if the data existed, the eroded soil cannot be replaced. Thus, we need a plan to save our soil.

We decided not to recommend changing the soil loss tolerance levels for Midwest soils used on the uplands and bottomlands since they are set based on how fast topsoil and subsoil are formed in specific parent materials. The problem is not that they are too high, but that these soils are subject to more intense rainfall events before and

during planting, which can cause greater soil erosion, water runoff, and sedimentation than our equations would predict. Perhaps one starting point is to assume a more intense rainfall factor (potential global change impact) than currently used to calculate the soil loss. Then, we should focus on ways to reduce soil loss associated with tillage and water runoff when Midwest soils on uplands are used for row crops. Many soil and water conservation and management and cropping practices, such as terraces, grassed waterways, strip cropping with fewer row crops in the rotation, and conservation tillage including no-tillage, reduce soil erosion when utilized. There is a need to expand the use of filter strips, utilize cover crops more on sloping and highly erodible soils, increase the use of conservation tillage including no-tillage, add small grains and forages into crop rotations, construct more temporary water storage dams, check dams or retention ponds on the uplands, and take highly eroded lands out of row crop production and replace with forages or timber or other plant material that could be used as lignocellulosic feedstock for biofuel. If more of the runoff waters and sediment can be retained on the uplands for a longer period of time, there will be reduced crop production loss, less degradation of the bottomland soils, and less sediment in the surface waters.

Urban development in natural floodplains and attempts to reduce flooding damage in these urban areas had increased the severity of the damage caused by significant flooding events. Construction of levees, which are subject to catastrophic failure, also restrict the width and increase the depth of the stream flow and reduce the size of the floodplain, which is not without impacts further downstream. It would appear that any attempts to reduce the impacts of future flooding in the Midwest, as a result of climate changes, would require soil and water conservation and management practices and land use changes on both the upland and bottomlands of the Midwest.

Birl Lowery is professor in the Department of Soil Science and **Pete Nowak** is professor in the Gaylord Nelson Institute for Environmental Studies, University of Wisconsin-Madison, Madison, Wisconsin. **Craig Cox** is Midwest Vice President of Environmental Working Group, Ames, Iowa. **Dean Lemke** is chief of Water Resources Bureau, Iowa Department of Agriculture and Land Stewardship, Des Moines, Iowa. **Kenneth R. Olson** is professor of soil science in the College of Agricultural, Consumer, and Environmental Sciences, University of Illinois, Urbana, Illinois. **Jeff Strock** is associate professor and soil scientist in the Department of Soil, Water, and Climate and Southwest Research and Outreach Center, University of Minnesota, St. Paul, Minnesota.