LEOPOLD CENTER
FOR SUSTAINABLE AGRICULTURE

Effects of biomass harvest on soil erosion

Abstract: The Water Erosion Prediction Project (WEPP) model was used to estimate the effects that harvesting corn residue would have on soil erosion. The erosion at different crop residue removal rates was compared on different soils and on different slopes.

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High rates of stover removal are possible on gentle slopes with no-till management or extended crop rotations that include perennial crops. On steep slopes, more intensive tillage systems (moldboard plow or even minimum tillage) are not sustainable in corn-bean rotations regardless of biomass removal rates.

ECOLOGY

What was done and why?

Harvesting crop residues (corn stalks and stover) as a co-product with grain provides additional income for the producer, while providing raw material for bio-based manufacturing. However, harvesting several tons per acre of crop residue from millions of acres carries certain environmental risks. Left in place, crop residue is effective in reducing erosion, and contributes to organic matter recycling and carbon sequestration in the soil. Removing excessive amounts of residue will increase both erosion and carbon loss.

The researchers used a simulation modeling approach to investigate the effects of biomass harvest on erosion under typical Iowa conditions. The Water Erosion Prediction Project (WEPP) model, developed by John Laflen, is used to predict soil erosion in the United States. Several cropping system scenarios and soil types were investigated, as were biomass harvest rates ranging from 10 to 90 percent. One of the essential steps to developing appropriate cropping strategies and appropriate residue removal rates is to clearly define the amount and types of residue needed to maintain the soil resource base.

Only two management plans were evaluated with all four soil types. No-till and fall-moldboard tillage plans were selected because it was hypothesized that these management plans would be the extreme values for minimum and maximum soil erosion.

What did we learn?

This study provided critical early evidence that the sustainable removal of crop residues for biomass energy depends on both site and management factors, and that these factors dominate the analysis far more than the fractional residue removal rate. This has led to development of stover harvest equipment that allows variable rates of residue removal depending on local conditions. The study also demonstrated that extended crop rotations were comparable to no-till management in minimizing erosion for a wide range of soil and slope conditions.