USDA-CSREES 2006 National Water Quality Conference

Can Subsurface Flow Erode Streambanks?

One of the most severe pollutants of surface waters is excessive sediment from agriculture. Excessive sediment increases the potential for downstream flooding, diminishes water quality and destroys aquatic habitat. Significant research advances have been made in the past several decades in understanding erosion, sedimentation and associated pollutant transport. However, the future management of water resources requires continued advancements in understanding sediment loading to streams. The two primary sources of sediment entering streams from agricultural watersheds are erosion from adjacent landscapes and erosion of streambank sediment. In fact, bank material may contribute as much as 80% to the total sediment load from incised stream channels in some areas. There exists an incomplete understanding of one of the basic mechanisms governing sediment loading to streams: erosion by concentrated lateral, subsurface flow. Subsurface flow is known to contribute significantly to stream flow but its contribution to streambank failure is not well known. Research is needed on the contribution of concentrated, lateral subsurface flow to streambank failure and the hydraulic properties controlling seepage erosion. Laboratory experiments were conducted with two-dimensional soil lysimeters to observe subsurface flow induced erosion of bank faces under controlled conditions. Experiments were performed with single-layer sediment and also layered profiles to mimic natural streambanks along one stream reach where seepage erosion has been observed. The lysimeter experiments were compared to in-situ measurements of seepage discharge and erosion at field sites in Mississippi. The soil and hydraulic conditions controlling seepage erosion were investigated. Changes in soil water pressure were modeled using a two-dimensional variably-saturated flow code to deduce information regarding soil water pressures at the time of tension crack formation and bank failure.
A seepage erosion sediment transport model was proposed. Future research will incorporate this transport model with a bank stability/ground water flow model for predicting streambank failure by seepage.

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