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Field Observations and Measurement of Streambank Seepage Erosion

In many watersheds, the majority of sediment entering streams may originate from the streambank. A mechanism of streambank erosion that has received little attention to date is ground water seepage. Seepage erosion of unconsolidated sediment above water restricting horizons leads to streambank failure by undercutting banks. The objective of this research was to expand the limited documentation of field measurements of streambank erosion by quantifying subsurface flows and seepage erosion of bank sediment. The streambank site was located in Northern Mississippi in the Goodwin Creek (GC) experimental watershed and measurements from Goodwin Creek were compared to seepage erosion measurements at Little Topashaw Creek in Northern Mississippi. Undisturbed soil cores taken in triplicate along with disturbed soil samples in soil layers on the streambank face suggested less than an order of magnitude difference in hydraulic conductivity with depth. GC seeps were not similar to other seeps reported in the literature in that eroded sediment did not originate from the seepage layer but rather from layers underneath the primary seepage layer. Subsurface flows and sediment loads quantified using lateral flow collection pans placed against exposed faces of the stream bank at pre-identified seepage locations were dependent on the type of seep at GC: intermittent “low-flow” seeps primarily active following large rainstorm events and as a result of reverse bank storage, perennial “high-flow” seeps which developed the most significant headcuts, and “buried” seeps which eroded unconsolidated bank material from previous bank failures. The timing of “low-flow” seeps correlated to river stage and precipitation. “High-flow” seeps at GC began after rainfall events resulted in the adjacent streambank reaching near-saturation conditions. Seep discharge from these “high-flow” seeps was measured as high as 1.0 L/min and sediment concentrations commonly approached 100 g/L. “Buried” seeps were intermittent but exhibited the most significant erosion rates and sediment concentrations, reaching as high as 738 g/min and 989 g/L, respectively. In cases where perched water table conditions exist and perennial “high-flow” seeps occur, the subsequent erosion and bank collapse of streambank sediment may be significant, especially in cases with “buried” seeps.

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