Monitoring of Steambank Erosion Processes: Hydraulic, Hydrologic and Geotechnical Controls

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Biographical Sketches of Authors
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Abstract
Sediment emanating from eroding streambanks represents the dominant source of sediment in many disturbed fluvial systems. Gravitational forces acting on *in situ* bank material act in concert with hydraulic forces at the bank toe and seepage forces within the bank to determine rates of bank erosion and, therefore, bank morphology. Because these processes comprise a mix of hydrologic, hydraulic and geotechnical processes, accurate prediction of sediment loads and erosion rates must be based on accurate characterization of the controlling variables for each process.

A study conducted in the Goodwin Creek, Mississippi highlights the different monitoring requirements. To characterize shear strength and shearing resistance to bank failure, geotechnical properties of the bank are required. A borehole shear-test device (BST) is used to obtain independent measures of cohesion and friction angle *in situ*. Samples of known volume are obtained to determine bulk unit weight and pore-water pressure at the point of testing using a digital, miniature tensiometer. Surveys of the bank profile are used to provide data on bank mass and angle. Tests of the tensile strength of riparian tree roots for a range of diameters and species are conducted so that the effects of root reinforcement are included.

A submerged jet-test device is used to determine the critical hydraulic shear stress and erodibility coefficient of *in-situ* materials. For non-cohesive materials, measures of the particle size distribution based on bulk samples are used. Pressure transducers at the upstream and downstream ends of the reach monitor stage, flow depths and provide data to calculate average boundary shear stress and the confining pressure supporting the bank during high stages. Nests of tensiometers are used to monitor streambank pore-water pressures under three vegetative treatments to establish variations in hydrologic conditions due to the effects of the different vegetation types.

These data are then used together to support numerical bank-stability analyses and models that include sub-routines for bank–toe erosion.