Data Collection and Monitoring of Stream-Channel Processes in Support of Numerical Models and Developing Water-Quality Targets for Sediment

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Biographical Sketches of Authors

Andrew Simon is a Research Geologist at the USDA-ARS-National Sedimentation Laboratory in Oxford Mississippi. He has over 24 years of research experience (16 with the USGS) in sediment transport and unstable landscapes, particularly incised channels and streambank processes. He is the author of numerous technical publications and has edited several books and journals. Dr. Simon is an adjunct Professor at the University of Mississippi, a Special Professor in the School of Geography, University of Nottingham, and is on the Editorial Board of the journal *Geomorphology*.

Robert Wells is a Post-Doctoral Research Associate at the University of Mississippi. He received his PhD from Cornell University in the Department of Agricultural and Biological Engineering. His work at the University of Mississippi has concentrated on using a numerical model of stream-channel evolution to determine sediment loadings and channel changes in disturbed watersheds. Dr. Wells is the author of several journal articles and technical reports, and helps in providing training in use of the CONCEPTS channel-evolution model and associated field techniques.

Eddy Langendoen is a Research Hydraulic Engineer at the USDA-ARS-National Sedimentation Laboratory (NSL) in Oxford Mississippi. He is the developer and author of CONCEPTS, a 1-D channel-evolution model, which is unique in that it dynamically incorporates streambank failures along with flow and sediment routing. Dr. Langendoen received his PhD from Delft University, Netherlands and came to NSL after serving as a Research Professor at the Computational Center for Hydroscience Engineering at the University of Mississippi.

Abstract

Sediment, either suspended in the water column or accumulated on the streambed is recognized as a leading cause of water-quality impairment of assessed rivers and lakes in the United States. In studies of streams and watersheds impaired due to sediment, a deterministic, numerical channel-evolution model (CONCEPTS) is used to estimate "existing" rates of sediment transport while background or "reference" rates are determined through a combination of rapid geomorphic assessments and regional, historical flow and sediment-transport data.

CONCEPTS is a one-dimensional unsteady-flow model that routes flow and sediment while adjusting the channel vertically, and laterally by incorporating bank-failure mechanisms. Best results are obtained when supporting data on channel morphology and the hydraulic and geotechnical resistance of the bed and bank materials is provided. *In situ* measurements of bank-material shear strength and bank-toe erodibility are conducted at each cross section location. Particle-size samples of non-cohesive sediment are obtained for sediment-sorting routines and to provide data on critical hydraulic shear stress. Model results provide information on sediment loads, morphologic changes and sediment sources, thereby aiding in the design and implementation of remediation strategies.

Results from the CONCEPTS model represent conditions as they exist for the boundary and input conditions provided to the model but do not provide information as whether the sediment-transport rates are in excess of background or "reference". "Reference" transport rates are obtained by calculating sediment yields for sites in the same ecoregion with historical flow and sediment-transport data and then differentiating these sites into stable and unstable reaches of different dominant bed-material compositions. This is done using a channel-stability index and identifying stage of channel evolution. The combination of geomorphic and numerical modeling techniques supported by sufficient field data has been found to be a powerful tool in developing water-quality targets for sediment.