American Water Resources Association
2009 SUMMER SPECIALTY CONFERENCE
Adaptive Management of Water Resources II
June 29 – July 1, 2009
Snowbird, UT

Wednesday, July 1
1:30 PM – 3:00 PM
SESSION 40: Stream Research Supporting Adaptive Management

1. Applying Monitoring Results to Develop Recommendations for Constructing Forest Road Stream Crossings to Control Soil Losses - Pamela Edwards, USDA Forest Service, Northern Research Stn., Parsons, WV (co-authors: Jingxin Wang, Joshua T. Stedman)

Stream water samples were collected once daily and throughout storms from a small forested watershed in north central West Virginia for approximately 8 years. The turbidity of each sample was measured to determine how water quality changed in response to road construction with three stream culvert crossings. The influence of the crossings and the immediate approaches to the crossings could be isolated in this study because sediment inputs from the hillsides of the watershed were restricted by silt fence that was installed along the entire stream perimeter, except in those crossing and near crossing locations. Prior to the construction of the stream crossings, turbidity levels generally were <20 NTU, and peak turbidities generally were <100 NTU. Daily and peak turbidity values increased significantly during the ~1.25-yr construction period compared to the 2.5-yr pre-disturbance period. Mean daily turbidities increased from a mean of about 2 NTU to almost 13 NTU during crossing construction, while mean peak turbidities increased from a mean of about 27 NTU to 276 NTU. For both types of samples, mean turbidities remained elevated during the rest of the study, but fell by about 50 percent compared to the crossing-construction period. The largest turbidity increase and largest turbidity value (2,352 NTU) occurred during a storm event in the construction period. The ability to isolate the influence of the crossings here shows that more attention should be given to controlling soil losses during the actual construction period. Based on the results of this study, recommendations to reduce soil losses from future similar crossing construction efforts in steep terrain include: requiring full bench construction, especially where road approaches are at small angles to the stream; requiring the immediate installation of permanent culverts rather than allowing the intial installation of temporary culverts; requiring that in-stream equipment operation pads, if needed, be constructed of large, clean, nonfriable gravel; and altering contract language so that soil covering is required within a specified limited number of days after disturbance is started, rather than within a set amount of time after the disturbance in the area is completed.

2. Quantitative Stream Profile Analysis for Red River and Arkansas River - Arpita Nandi, East Tennessee State University, Johnson City, TN

The longitudinal stream profile of a graded stream (stream in dynamic equilibrium) approaches a curve with decreasing gradient towards downstream. Stream longitudinal profiles are the result of underlying rock, climate and history of the region. Where certain conditions are met, streams may adopt a smooth, concave upward profile, which may be considered at grade or in dynamic equilibrium. It has been reported that most equilibrium profiles follow the path of least resistance and optimal length to reach an equilibrium in which the stream carries away the entire sediment load that it produces. The concave upward longitudinal stream profile accounts for the equilibrium state with minor deviations that can be correlated with differences in rock resistance, debris size, or other specific geologic or geomorphic circumstances. Quantification of stream profiles for geomorphic studies has been conducted by other workers using exponential, logarithmic and hyperbolic functions. This paper investigates the cycloid function as a theoretical model for stream longitudinal profiles, which is the solution path of least time between two vertically separated points in the absence of friction. The involute of a half arch of the cycloid has a basis for serving as an end-member, high-efficiency profile for streams. The Red River and Arkansan River are major tributaries of the Mississippi River and give rise to concave upward longitudinal profile of a graded stream, and were selected for the study. In a region, slope of graded streams are roughly inversely proportional to the discharge. Slope-discharge analyses were performed to evaluate the state of equilibrium for the two streams. Profiles were extracted from digital elevation model data and were estimated with the involute of a half arch of the cycloid using regression analyses. Over the full length of a stream, the major condition that may not be met is the constancy of total energy (through both additions of mass from tributaries and frictional loss). Nevertheless, in both Red River and Arkansas River the cycloid provided a suitable match.