

Report for 2004KY43B: Fine sediment source areas and in-channel sediment storage in the Upper Green River Basin, KY

- Conference Proceedings:
 - Kenworthy, Stephen, 2005, Landscape Attributes Affecting Sediment Production and Sediment Delivery in the Upper Green River Basin, in Proceedings Kentucky Water Resources Annual Symposium, March 3, 2005, Kentucky Water Resources Research Institute, Lexington, Kentucky, p. 23.

Report Follows

Problem and Research Objectives

Fine sediment pollution is an important water quality concern in the Commonwealth of Kentucky. Fine sediment accumulation can lead to degradation of aquatic ecosystems as a result of habitat alteration or because of contaminants and nutrients bound to sediments. As part of the US Department of Agriculture Conservation Reserve Enhancement Program (CREP), state and federal funds have been committed to reduce by 10% the amount of sediment, pesticides, and nutrients entering the Upper Green River between Green River Lake and Mammoth Cave National Park. These funds are targeted to support the implementation of soil conservation practices in the Upper Green River Basin, and emphasize the environmental and ecological importance of fluxes of sediment and sediment-bound contaminants into riparian zones and channels. In order to monitor and evaluate the effectiveness of these conservation efforts, management agencies require information on the spatial pattern of potential agricultural and non-agricultural sediment sources and on the quantity and distribution of fine sediment stored in the stream channel network.

The scientific objectives of the research are to identify potential sources of fine sediment in the Upper Green River Basin CREP area and to explain the distribution of fine sediment storage in terms of the spatial pattern of source areas and the geomorphic controls on in-channel and riparian sediment deposition. The work will provide a detailed assessment of the potential supply of fine sediment from agricultural and non-agricultural portions of the CREP area, based on the integration of digital landscape data with field surveys of sediment storage and potential sediment delivery pathways. Field surveys of the pattern of fine sediment storage within the Green River and major tributary valleys will facilitate identifying portions of the landscape that are important sediment sources and will also provide information on long-term patterns of fine sediment routing through the watershed. This information will be valuable to the CREP partner agencies and to individual program participants in assessing the effectiveness of conservation practices in specific locations, and will serve as critical habitat data for resource management agencies charged with protecting aquatic biota in the Green River and Mammoth Cave system.

Methodology

The project includes documenting the spatial distribution of fine (< 2mm) sediment stored in the channel and riparian zone of the Green River and its major surface tributaries. Field surveys of a stratified sample of channel reaches determine locations and volumes of in-channel fine sediment storage. Reaches will be delimited and selected on the basis of geomorphic factors such as valley slope and width that can influence patterns of sediment storage. Large samples of bed material will be sieved in the field to determine fine sediment content. Subsamples of the fine fractions will be retained for laboratory grain-size analysis.

A GIS-based spatial analysis of topography, geology, soils, land use, and soil conservation practices will be used to assess the sediment production potential of

different subwatersheds and landscape units within the study area. This analysis of source areas will be overlaid on the patterns of sedimentation observed in the field to assess the relationship between sediment storage patterns and the distribution of likely sediment sources. Although it is usually difficult to link sedimentation at a given location conclusively to a particular source area, the downstream pattern of sediment transport in fluvial systems constrains potential source areas. The pattern of sediment sources and sediment deposition will be analyzed and explained in terms of landscape attributes affecting the delivery of eroded soil to channels (e.g. presence and type of conservation practices) and fluvial transport mechanisms that control patterns of sediment deposition (such as flow regime and channel morphology). Observed correlations between the volume of sediment stored in study reaches and descriptors of the number and (along-channel) distance of potential upstream sediment sources will provide one test of the spatial coherence of the patterns of sediment supply and storage within the drainage network. Additional field observations of sediment delivery pathways in land areas identified as potential sediment sources will be used to refine the assessment of sediment supply and soil conservation practices.

Principal Findings and Significance

Because field data collection efforts were limited by high flow conditions during late summer and fall of 2004, findings reported here are preliminary. Despite the likelihood of significant reduction in fine sediment supply to the tailwater reach of the main channel of Green River between Green River Lake and the confluence of Russell Creek, bed material samples in this portion of the river contain relatively large proportions (> 10%) of sand, suggesting that the small tributaries entering along this reach supply considerable amounts of fine sediment. Bed material samples from larger tributary streams also contained large sand fractions, suggesting that the Green River is a fairly fines-rich system in its current state. Additional sediment sampling during summer 2005, especially in the lower reaches of the CREP area, will complete the assessment of in-channels fine sediment abundance in the study area. Synthesis of the landscape-attribute analysis with the field surveys of fine sediment storage is ongoing and will be described in detail in the project completion report, along with recommendations for resource management agencies charged with protecting aquatic biota in the Green River and Mammoth Cave system.