USGS Chesapeake Bay Activities

River Observatory and Monitoring Applications (ROMA)

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Statement of Problem: The USGS recognizes the critical role of large rivers in the environmental and economic health of the nation. Large rivers provide observatories for monitoring the regional to local impacts of Global Change. This project uses geomorphic, geochemical, and isotopic techniques to compare present and past rates of landscape change and sediment transport. We will apply improved methods of sediment budgeting based on investigations by Brown et al. (1988), Gellis et al. (2002), Trimble (1999), and Valette-Silver et al. (1986). Sediment budgets in a distributed set of river tributaries provide information for managers concerned with erosion management and ecosystem health. The Susquehanna River is a key source of sediment for the Chesapeake Bay. Analyses will be directed at improving the sediment budgets for tributaries and the mainstem Susquehanna in order to quantify past and present sediment delivery to Chesapeake Bay. ROMA will provide information on river histories, sediment budgets, and geomorphic processes critical to the management of riverine

habitats and resources. The task areas will be chosen to compare and contrast rivers in different physiographic regions. This information generated in these basins can be linked to other spatial geographic and ecologic investigations to improve DOI's management strategies.

Objectives: The overarching objective is to bring together USGS, university, and other agency researchers to conduct studies of the impacts of sediment fluxes on habitats in various parts of the Susquehanna River Basin. The significance of sediment to habitat restoration and water quality has recently been highlighted in creation of the Chesapeake Bay program. The Susquehanna River is historically the largest single sediment source for Chesapeake Bay. The objective in this project is to identify the main sources of sediment to the Susquehanna by quantifying the sediment yields from tributary basins and the contributions of disturbed soil surfaces to the sediment budgets, and determining the scale-related changes in sediment yield. The proposed strategy in this proposal is to apply recently developed cosmogenic isotopic techniques (see references below) along with traditional sediment budget techniques to inventory variations of sediment yield and load that are related to climate, geologic substrate, soils, land cover, land use, and habitat. This effort will require the integration of expertise from all the disciplines of the eastern region USGS, and experts from outside the USGS.

Approach: This project is divided into three tasks: (1) Comparison of accelerated and background rates of erosion in the Susquehanna Basin; (2) Stratigraphy of Little Conestoga Creek alluvium; and (3) GIS analysis of consequences of land-use change. The main strategy of the project is to quantify background sediment yields using *in situ* ^{10}Be, quantify landscape disturbance using meteoric ^{10}Be erosion indices, and modeling relations of sediment yields to land use change using the WEPP model and GIS analysis of the consequences of land use change.

Selected Reports and Other Products:

Harden, J.W. Freis, T.L., and Pavich, M.J., 2002, Cycling of beryllium and carbon through hillslope soils in Iowa, Biogeochemistry, 60, 317-336.

Bierman, P.R., Caffee, M.W., Davis, P.T., Marsella, K., Pavich, M., Colgan, P., and Mickelson, D., 2002, Rates and timing of Earth Surface Processes from *in situ* produced cosmogenic Be-10, in: Grew, E.S., ed., *Beryllium*: *Mineralogy, Petrology and Geochemistry*, Reviews of Mineralogy and Geochemistry, v. 50, p. 147-196.

Matmon, A., Bierman, P.R., Larsen, J., Southworth, S., Pavich, M.J., and Caffee, M., 2003, Temporally and spatially uniform rates of erosion in the southern Appalachian Great Smoky Mountains, Geology, 31, 155-158.

Pavich, M.J. and Chadwick, O.A., 2003, Soils and the Quaternary Climate System, In Gillespie, A.R., The Quaternary of North America, Special Volume for the 2003 INQUA.

Pavich, M.J., Bierman, P.R., Gellis, A.C., and Reuter, J.M., 2003, Rates and scales of sediment production in the Rio Puerco basin, New Mexico, XVI INQUA Congress, Programs with Abstracts, p. 119.

(planned report) Pavich, M.J. and Gellis, A.C., in prep, Sediment budget of the Susquehanna River

Relevance and Benefits: One of the key elements of the Chesapeake Bay Program is to improve the understanding of the sources and impacts of sediment on habitats. The models developed in these studies are being used to evaluate the spatial relations of sediment yield to geology, geography and land use history. These models will aid land management by predicting the strategies and scales that will have the largest impact on reducing sediment yields.