USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Sediment Transport Characterization in the Georgia Piedmont

Focus Categories: SED, NPP, WQL

Keywords: Suspended Sediments, Water Quality Monitoring, Water Quality Modeling

Duration: March 1999 to February 2001 (two years)

Federal Funds Requested: $18,000 (first year), $38,000 (total)

Non-Federal Matching Funds: $36,000 (first year), $76,000 (total)

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Congressional District: 11 (Linder)

Critical Regional Water Problem

Sediment in streams and lakes within the Southeast, and Georgia in particular, adversely affect aquatic habitats as well as present a substantial health hazard. Not only do suspended fine sediments reduce the clarity of water, thus reducing biologic productivity, but coarse suspended solids also bury benthic habitats, thus diminishing overall species abundance and diversity. The ecological consequences of sediments in streams from historical cotton-era, as well as modern sources from urban stormwater sources, have been particularly detrimental to Georgia's native aquatic species.

Substantial additional, indirect, adverse consequences result from sediment transport. Nonpoint pollutants (e.g., nutrients, metals, herbicides, insecticides, and fecal coliform) inputs to streams are highly correlated with sediment inputs. In some cases the contaminants are directly sorbed to the finer sediments (e.g., phosphorus, metals, herbicides and pesticides), while other contaminants (e.g., fecal coliform, nitrates) result from overland flow processes that result in concomitant transport. Long term human and environmental health consequences from these nonpoint sources are clearly a matter of local, regional, and national concern.

Results and Benefits

Incomplete data limit our understanding of modern and historical sediment transport rates and inventories in Georgia Piedmont streams. A better understanding of historical (where we have been) and modern (what's going on now) inputs provides the opportunity for identifying alternative management strategies for nonpoint pollution control that reduce

or eliminate future environmental and health risks. We propose to match the financial support provided by the Georgia Water Resources Institute with capital resources provided by the Georgia Research Alliance. Powerful new environmental tools that have recently been developed, with Georgia Research Alliance funding will be applied to this project.

We propose a multi-pronged approach for developing and applying new methods for estimating the magnitude and distribution of suspended and bedload sediments. The components of this approach include: a) New sediment sensor technologies (employing real-time densimetric methods and fluorimetry) that provide continuous information on instream stormwater sediment and water quality; b) State-of-the-art mobile laboratory facilities (the Environmental Process Control Laboratory) that provides additional nutrient and biological water quality information; c) Environmental system identification using time-series analysis; d) Sand dredging operations within the Atlanta metro area that provide information on sediment budgets, and can be used to related changes in sediment inventories on aquatic health; e) Sediment budget studies that examine the relationship between modern and historical inputs; and f) Stream riparian management alternatives and their effectiveness in mitigating stream sediment inputs.

Nature, Scope and Objectives

The Nature of this research project is to study the spatial (e.g., with depth, stream order, et al.) and temporal (current vs historical, baseflow vs. stormflow) distribution suspended and bedload sediments in streams. The relationship of suspended and bedload measurements to other physical, chemical and biological water quality properties will also be addressed.

The Scope of this research is restricted to streams in the Georgia Piedmont. A broad range of stream types will be examined, including coupled measurements with ongoing stream studies by the applicants in Peachtree Creek and South River in Atlanta, Chattahoochee and Chestatee Rivers above Lake Lanier, the Broad River watershed in northeast Georgia, the Oconee River near Athens, the Little River near Eatonton, and Alcovy watershed in Gwinnett and Barrow Counties.

We plan to employ two capital and one computational resources hitherto unavailable for environmental monitoring; the Environmental Process Control Laboratory, the newly developed densimetric sediment sensor, and new environmental identification statistical software. These resources have been developed using funding from the Georgia Research Alliance, a private-public consortium of Georgia industries and government.

The Objectives of this research are six-fold: a) to demonstrate and evaluate a new type of real-time densimetric sensor developed in partnership with the Georgia Research Alliance that promises to provide improved characterization of sediment dynamics during stormwater events; b) to demonstrate and use of the Environmental Process and Control Laboratory for modeling and characterization of sediment transport using the new, state-of-the-art mobile water quality laboratory; c) to employ sophisticate signal processing

techniques using time-series analysis for environmental system identification; d) to coordinate with ongoing urban stream dredging operations in DeKalb county so that detailed stream segment sediment transport statistics can be collected for describing reach-scale sediment dynamics; e) to create sediment budgets that allow identification of current vs. historical stream sediment contributions; and f) stream riparian management manipulations that will lead to the improved evaluation of alternative riparian zone management strategies.