USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Effectiveness of Streamside Management Zones in Protecting Aquatic Habitat in Timber Management Areas

Focus Categories: NPP, WQL, MET

Keywords: Water quality, Nonpoint Source pollution, Silvicultural Best Management Practices, Streamside Management Zones, Bioindicators, Biomonitoring, Aquatic macroinvertebrates, Riparian vegetation, Streams, Water quality monitoring

Duration (month/year to month/year): March 1, 1999 to February 28, 2001

Federal Funds Requested: $13,088

Non-Federal (matching) Funds Pledged: $26,176

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Congressional District of University Where the Research is to be Conducted: 3rd Mississippi Congressional District

Statement of Critical Regional Water Problems

The Federal Water Pollution Control Act of 1972, the Clean Water Act of 1977, and the Water Quality Act of 1987 (Section 319) collectively provide federal legislation designed to control nonpoint source (NPS) water pollution. In response, states in the southern U.S. have designed Best Management Practices (BMPs) to minimize the impacts of forestry practices on water quality. Forestry practices such as harvesting may result in soil erosion, nutrient loss, and resultant NPS pollution in the form of sediment and nutrient delivery to streams that not only produce potential degradation of water quality, but also can potentially alter aquatic habitat and endanger aquatic biota.

Streamside management zones (SMZs), designed to provide intact or selectively harvested forest buffers between silvicultural activities and adjacent streams, are being used as a component of BMPs to maintain streamwater quality, aquatic habitat, and aquatic biota by minimizing streamwater temperature changes and the transport of sediments, nutrients, and pesticides into surface waters. However, scientifically-based assessment of effectiveness of these measures, particularly in relation to protection of aquatic habitat and maintenance of aquatic communities, has been lacking because monitoring programs have not been widely implemented. If landowners are expected to enthusiastically incorporate SMZs into their forest management protocols, then it is necessary to quantify the benefits of this practice in forested watersheds of Mississippi.

Statement of the Results, Benefits, and Information Expected From This Project

The central hypothesis to be tested by this project is that SMZs effectively protect streamwater quality, aquatic habitat, and aquatic biota from forest-harvesting operations in the Upper Coastal Plain region of Mississippi. Specific hypotheses to be evaluated include: (1) increased width of SMZs will improve SMZ effectiveness ; (2) SMZ effectiveness is a function of upslope harvesting practices, slope steepness, soil erodibility, size of harvesting operation, and residual overstory within the SMZ; and (3) relationships between SMZ characteristics and streamwater quality, aquatic habitat, and aquatic biota will diminish over time since harvesting. Data collected from at least 30 logging operations with a range of existing SMZs on perennial streams during the two years of the proposed study will be used to test these hypotheses.

The findings of this project will be used to support the implementation of NPS abatement programs such as silvicultural BMPs in Mississippi. Specifically, this project will provide a quantitative measure of the effectiveness of SMZs for mitigation of erosion, sedimentation and subsequent impacts on aquatic habitat and communities in association with forest-harvesting activities. The research watersheds proposed for evaluation will be utilized as demonstration areas for silvicultural BMP workshops and related technology-transfer activities conducted by personnel from Mississippi State University, government agencies, and private timber companies. Research results will be presented at regional and national scientific meetings, submitted for publication in peer-reviewed journals, and made available to the public. This study will also provide training in forest management and policy, forest hydrology, silviculture, and stream ecology for graduate and undergraduate students who are initiating careers in natural resource management.

Nature, Scope, and Objectives of the Research

Silvicultural best management practices (BMPs) have been widely accepted as effective management tools to minimize nonpoint source (NPS) pollution associated with forest management activities. However, scientifically-based assessment of effectiveness of these measures, particularly in relation to protection of aquatic habitat and maintenance of aquatic communities, has been lacking because monitoring programs have not been widely implemented. Streamside management zones (SMZs) are commonly implemented to protect aquatic functions and values. But decisions regarding SMZ width and intensity of harvesting within SMZs can still benefit from evaluations of the responses of aquatic habitats and the communities they support to SMZ alternatives. Acquiring quantitative information of effectiveness across an array of SMZ widths and levels of management activities within SMZs will enhance our ability to improve these management practices and thus help achieve or maintain sustainable forest management systems.

Evaluation of SMZs has traditionally relied on assessing physicochemical responses of the stream (Comerford, et al., 1992). However, this approach is limited because sampling is usually done at one point spatially and temporally and many of the metrics can vary over time scales of hours. As such, spatial and temporal variations in physicochemical properties can mask responses to forest management activities occurring upslope from

the stream. Combining physicochemical, habitat assessment, and biomonitoring offers a more powerful tool to accurately evaluate SMZ effectiveness.

The overall objective of the proposed study is to evaluate the effectiveness of different 1) SMZ widths, 2) residual amounts of residual overstory within SMZs, and 3) amounts of time since implementation of SMZs currently used on intensively managed loblolly pine (Pinus taeda) plantations in Mississippi. This study will also determine relationships between SMZ characteristics and responses of physicochemical, habitat, and biotic stream properties. Outcomes of the proposed research will enable forest managers to modify ineffective BMPs and to promote BMPs which are meeting management goals.