CSREES National Water Quality Program

Title: Predicting Nitrogen Losses from Poorly Drained Watersheds

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Organization: North Carolina State University

State: NC **Region:** Southern **Year of Funding:**

Theme: Watershed Management

Situation: Excessive nutrient loading from agricultural lands contributes to water quality problems in streams and estuaries. Management practices have been developed to reduce nutrient loads at the field edge. However, water quality impacts usually occur miles downstream from the field at the watershed or river basin scale. Methods are needed to assess the impact of practices applied at the field scale on nutrient loads at the watershed scale.

Objectives: Objectives were to develop hydrologic and water quality models to predict effects of land uses and management practices on nitrogen loads from poorly drained watersheds; to instrument a large (25000 ac) watershed and continuously measure nutrient losses in drainage water at the field and watershed scales; to use these data to test the models; and to apply the models to coastal watersheds to show how field scale management practices might be distributed to optimize treatment effects.

Methods: A 25000 ac. watershed was instrumented to continuously measure drainage outflows and sample for water quality at over 50 locations. A suite of watershed simulation models was developed by combining the field scale model DRAINMOD with various methods of predicting the hydraulics and water quality changes in the canals and small streams draining the area. Products include an improved understanding of factors affecting N loss from poorly drained watersheds, a suite of models, a 6-year GIS based data set, and maps showing delivery ratios as a function of location for 3 watersheds.

Partnerships: The work was conducted in close cooperation with Weyerhaeuser Co. scientists. Other partners were local farmers, NC Coop. Extension Service, USDA-NRCS, Forest Service, and the Water Quality Division of NC DNER.

Research: N.C. State University faculty has used the site to teach methods for measuring soil properties and water quality, and to demonstrate the effectiveness of controlled drainage. The site is often visited by agricultural and forestry tours, and by scientists from other countries and states. Models and other products of the research will be used directly by state agencies to determine the fields where BMPs will be most effective in reducing nitrogen load at the watershed outlet.

Resources: Weyerhaeuser Co supplied instrumentation for a 10000 ac. Forested tract, and contributed in kind support for data collection and analysis. USDA-NRCS and the US Forest Service provided in-kind support. Projects funded by the EPA 319 program were also conducted on the site.

Results: Outputs: A total of 8 graduate students have conducted their theses/dissertation research on various aspects of the project. The site is used for training and demonstration to students, farmers, and foresters. Outcomes include an improved understanding of in-stream losses of N as drainage water moves through the watershed, and a suite of simulation models for predicting watershed scale impacts of field scale BMPs on poorly drained watersheds. Results can be used directly to target BMPs for maximum reduction of N load from the watershed.