Development of Ecological Reference Models and an Assessment Framework for Streams on the Atlantic Coastal Plain

Lead Organization: Savannah River National Laboratory

PI: Michael Paller

SREL affiliated researchers: Dean Fletcher, Tracey Tuberville, Sean Sterrett, Andrew Grosse

Restoration generally refers to modifying a system to a reference or undisturbed state. In some cases such as urban streams or streams near industrial areas this is impractical. However, in the southeastern United States, large areas of continuous, relatively undisturbed land still exist and provide excellent opportunities to document the characteristics that make up reference streams in this region.

The Department of Defense (DoD) is committed to the recovery of degraded ecosystems with the objective of maintaining sustainable ecosystem dynamics and supporting appropriate diversities of native organisms including threatened, endangered, and at-risk species (TER-S). It is necessary to specify achievable recovery objectives that are ecologically appropriate and compatible with DoD mission requirements for successful ecosystem recovery. It is also essential to have an assessment framework for evaluating ecosystem status and measuring progress towards recovery objectives. The DoD has several large installations in the lower and upper southeastern coastal plains that protect large and relatively intact ecosystems. Of these, the 2007 Southeastern Region TER-S Workshop recommended that "the highest priority focus should be on freshwater systems, especially blackwater streams." Coastal plain streams are an ideal ecosystem type for the development of ecological reference models. They respond to a variety of disturbances on multiple spatial and temporal scales, and the ecological health of streams is an accurate barometer of the ecological health of the entire watershed because of the connectivity among streams, floodplains, and upland ecosystems. This study set out to develop ecological reference models and an assessment framework for streams, including blackwater streams, in the Atlantic Coastal Plain and Sandhills ecoregions.

Ecological reference models (ERMs) are needed in order to set goals and endpoints for recovery and restoration projects and can depict the structure and function of the biota and abiotic environment under minimal human disturbance. ERMs are developed by quantifying conditions at reference sites that are minimally disturbed and/or by predictive modeling and historical reconstruction. In the southeast this has proven difficult due to climate changes, invasive species, legacy impacts, and extensive regional development.

This study is funded by the Strategic Environmental Research and Development Program (SERDP) and represents a multi-year collaboration between the Savannah River National Laboratory (SRNL), the Savannah River Ecology Laboratory (SREL) and Auburn University. The main objectives include 1) the development of Ecological Reference Models that represent achievable end states for the biological recovery of wadeable streams 2) the assessment of relationships between ERMs and land use in watersheds on 4 DoD installations (Savannah River Site, Ft. Stewart, Ft. Bragg and Ft. Benning) 3) and the development of a framework for assessing, displaying and communicating the current status of coastal plain streams and relating that to end-states represented by ERMs. Biological assessments will be conducted on streams with varying disturbance levels in all 4 DoD bases. A combination of Geographic Information Systems data (GIS) and field sampling will be used to obtain a variety of physical, chemical, and

biotic metrics in order to identify the best attainable ERM at the landscape, watershed, riparian habitat and stream levels. Suitable models will quantitatively describe ecologically important metrics representing multiple spatial and temporal scales for best attainable and minimally disturbed conditions. These can serve as the basis for establishing achievable recovery objectives compatible with current and future land uses. This research will provide extensive information on biotic assembalges, instream and riparian habitat, and watershed features of minimally disturbed streams plus a greater understanding of linkages between biotic communities and environmental factors in these habitats.