

Riparian Ecosystem Management at Military Installations: Determination of Impacts and Restoration and Enhancement Strategies

Background:

The Department of Defense recognizes the critical importance of riparian ecosystems as habitat and for maintaining the water quality and ecological integrity of streams and rivers draining military installations. Riparian ecosystems at many military installations are stressed to an unknown degree by singular and interactive effects of training activities involving mechanized vehicles and other disruptive activities such as prescribed fires for forest management efforts to reduce fuel loads. This research is designed to evaluate these impacts on riparian ecosystems and investigate potential remediation strategies by conducting an intensive study at Fort Benning, Georgia, where riparian disturbances are significant and typical of those experienced at other military installations

Objective:

The objectives of this project are to identify the impacts to riparian ecosystem function of upland and riparian disturbances resulting from military training and to evaluate two riparian restoration strategies.

Process/Technology Description:

Key riparian (vegetation, soil) and stream (water chemistry, metabolism, algal/macroinvertebrate communities) ecosystem properties are being compared across disturbance gradients and before and after riparian restoration. In Phase 1, three reference catchments and eight disturbed catchments were studied that cover a range of upland and direct riparian disturbances. Impacts of disturbance to riparian functions were determined by making an extensive set of measurements in riparian and stream ecosystems and applying a combination of analysis of variance and regression analysis. In Phase 2, the eight disturbed catchments received one of the following four treatments: (1) control (no restoration), (2) revegetation of ephemeral channels, (3) woody debris additions to ephemeral and perennial channels, and (4) a combination of revegetation and woody debris additions to ephemeral and perennial channels. To determine the effects of restoration, the same set of measurements used in Phase 1 are continued and randomized intervention analysis (RIA) is applied. RIA involves calculation of the difference between restored and control treatments for each measurement, paired in time, spanning the period before (2 years) and after (3.5 years) restoration.

Results to Date:

Results have shown that activities leading to more than approximately 8% of the watershed becoming highly disturbed produce significant negative impacts on hydrology, water quality, and biological habitat of streams. Ephemeral drainage restoration decreased sediment accumulation by about 80% on disturbed riparian plots located downstream from restoration sites. However, no clear indications exist that indices of nutrient cycling responded to restoration efforts. In-stream restorations increased the hydraulic complexity and rate of nutrient uptake relative to control streams; however, no evidence yet indicates increases in gross primary production. Positive responses of stream biota and habitat variables to wood additions were observed in some streams.



A riparian zone at Fort Benning, Georgia, illustrating heavy erosion and sedimentation.

Expected Benefits:

Results will provide land managers at military installations with the information needed to make decisions, concerning training intensity and the use of prescribed fire, that more effectively protect the function of riparian ecosystems. (Anticipated Project Completion – 2009)

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