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Evaluation of Abiotic and Biotic Responses to BMP Implementation in Small Agricultural Streams of the Spring Creek Watershed in Central Pennsylvania

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Abstract:

As part of the CEAP competitive grants program, we evaluated BMP performance in the agriculturally-influenced Spring Creek watershed. Using supplemental and existing data collected both prior to and for several years after BMP restoration, we investigated the utility of substrate, fish, and macroinvertebrate measures of water quality in describing the effects of BMPs on stream ecosystems. Samples were collected in May from Cedar Run, Slab Cabin Run (treatment streams), and Spring Creek (reference stream). Substrate was collected in habitat suitable for brown trout redds using a stovepipe sampler, with percent fines serving as the primary index of substrate permeability. Brown trout densities were estimated via electrofishing gear and the successive removal method. Triplicate macroinvertebrate samples were collected from riffle habitats with a Surber sampler. Median percentage fines declined significantly ($P < 0.001$) in treatment streams from pre-restoration through post-restoration years, although the response in Slab Cabin Run was delayed by drought conditions. Density of age-1 and older brown trout increased from pre-restoration to post-restoration, but the magnitude of the response was small for Slab Cabin Run, where brown trout densities were lower than Cedar Run and Spring Creek. Median macroinvertebrate densities were significantly higher in post-restoration years than prior to restoration in treatment streams ($P < 0.05$), although the magnitude of change was much less in Slab Cabin Run due to drought conditions. Prior to restoration, macroinvertebrate densities were 2.92 and 3.07 times higher in Spring Creek than in Cedar Run and Slab Cabin Run, respectively. These ratios declined significantly during the post-restoration period to a ratio of 0.836 for Cedar Run and 1.10 for Slab Cabin Run ($P < 0.05$). Results suggest that substrate composition, fish and macroinvertebrate communities all respond to stream restoration and provide useful measures of BMP performance, but the magnitude of these responses may be affected by other stressors (i.e., drought).

Impact Statement:

This project, titled 'Analysis of BMP implementation, performance, and maintenance in Spring Creek, an agriculturally-influenced watershed in Pennsylvania,' represents a unified effort between researchers from the Pennsylvania State University (Penn State Cooperative Wetlands Center, Pennsylvania Cooperative Fish and Wildlife Research Unit), Smithsonian Environmental Research Center, and Canaan Valley Institute. Various outputs from this project will include (1) a landscape characterization to determine the best spatial scale for assessing BMPs; (2) hydrologic and landscape modeling of BMP performance objective; (3) ground-based monitoring and ecological analyses to determine the appropriate measures of water quality for evaluating BMP effectiveness; and (4) socio-economic analyses and outreach to evaluate effective farmer adoption of BMPs and citizen perception of water quality, as well as develop methods for effectively communicating and increasing understanding of water quality changes from BMP implementation. This abstract and presentation is in specific reference to output #3 and represents the initial data results from ground-based monitoring and ecological analysis.

Category: Agricultural BMPs

Type of Presentation: Oral Presentation