

Implementing Precision Conservation in the Susquehanna River Watershed

Monitoring and Measuring performance

Project summary

To pilot a new innovative approach to conservation, Chesapeake Conservancy, Susquehanna University, Bloomsburg University, the Chesapeake Bay Foundation, and the Pennsylvania Department of Conservation and Natural Resources propose to collaborate and harness newly available high-resolution GIS datasets and tools to conduct precision conservation and better focus restoration efforts and BMP implementation on the ground. This project has the potential to demonstrate improved efficiency, effectiveness, and returns on investment through better site selection prioritization and support technology transfer to broaden adoption across multiple regions.

This project proposes to coordinate the organizational strengths of multiple partners to demonstrate the capabilities of the new tools and high-resolution data, target implementation of agricultural BMPs where models suggest they can make the greatest pollution reduction impact, and validate this premise with pre- and post- construction chemical and biological monitoring in two-three pilot sites.

The long-term outcome will be a technically-sound framework to target BMP siting on agricultural lands that leads to more cost-effective and efficient restoration work in the Susquehanna River watershed.

Monitoring protocols

This project will use applied research protocols developed by Dr. Jonathan Niles, Director of the Richard King Mellon Freshwater Research Initiative at Susquehanna University, and Dr. Steven Rier, Associate Professor of Biology at Bloomsburg University. Protocols were developed based upon a combination of standard metrics and protocols and the Before-After-Control-Impact (BACI) experiment design.

Fish

Fisheries data will be collected through electrofishing at each site pre and post implementation. A 100-meter reach, representing multiple habitats will be electrofished according to standard protocols. We will utilize a single pass of electrofishing, collecting all species during the effort, which will be identified to species and counted. All game fish will be measured to the nearest mm and weighed to the nearest 0.1g. We will quantify changes in the fish community through various standard fisheries metrics. In addition, we will utilize the Pennsylvania DEP Index of Biotic Integrity for the Susquehanna River Watershed to assess site and watershed condition. This index has been widely used in United States and many countries, and

has proven to be a reliable means of assessing the effect of human disturbance on streams and watersheds.

Benthic Macroinvertebrates

Benthic macroinvertebrate samples will be collected at each site pre and post implementation. All collection, processing, and identification of aquatic macroinvertebrates will be done according to Pennsylvania DEP, ensuring sampling areas representative of the variety of riffle habitats within the sample reach. We will quantify changes in the benthic macroinvertebrate community through various benthic macroinvertebrate metrics. In addition, we will utilize the Pennsylvania DEP Protections Index of Biotic Integrity for Wadable Freestone Streams to assess site and watershed condition. This index is used by the DEP to establish aquatic life status for streams in Pennsylvania.

Habitat

Habitat measurements at each site will be completed pre and post implementation using the Pennsylvania DEP Habitat Assessment Field Protocol in order to account for the limitations that are due to existing stream conditions. This is particularly important in cause/effect and cumulative impact studies where the benthic community at any given site can be limited by background watershed and habitat conditions or impacts from current land uses. We will quantify changes in the habitat at each site by multi-metric analysis of the changes in numeric scores of various habitat parameters established by the PDEP Habitat Assessment Field Protocol.

In-situ Water Quality

We will also measure nutrient and sediment loads, and the capacity of algae and other microorganisms colonizing solid surfaces in the streams to sequester nutrients from the water column, an important ecosystem service in healthy streams. Measurements will occur pre and post implementation. Nutrients and suspended sediments and basic physical and chemical measurements will be collected monthly beginning in the spring of 2017 and continuing through the fall of 2019. On each date, we will measure temperature, turbidity, dissolved oxygen, specific conductance, pH, total suspended solids, total phosphorus, total Kjeldahl nitrogen, soluble reactive phosphorus, nitrate+nitrite, ammonium, dissolved organic carbon, chloride, and algae and fine sediment percent cover. In addition, Dr. Rier will conduct several analyses indicative of nutrient uptake by the in-situ algal community

In addition to monthly samples, we will also measure nutrient and sediment loads during high flow events in each stream during the spring and summers of 2017, 2018 and 2019 using auto samplers attached to rain gauges and water level recorders. These samples will be analyzed for total suspended solids, total phosphorus, total Kjeldahl nitrogen, soluble reactive phosphorus, nitrate+nitrite and ammonium. Additional analyses may be conducted, as additional funding allows.