Pooled Monitoring Initiative's Restoration Research Award Program

Project Title:
A Power Analysis Web Tool to Enhance Monitoring Studies

Lead Entity:
University of Maryland Center for Environmental Science

Partners:
Arundel County Department of Public Works

The Pooled Monitoring Initiative pools resources to support scientists who answer key restoration questions posed by the regulatory and practitioner communities. The research teams then provide the answers back to those who asked the questions for direct application. The goal of the program is to answer these key restoration questions that serve as a barrier to watershed restoration project implementation.

Questions? See cbtrust.org/grants/restoration-research/

Research question(s)

Given the high variability of nutrient concentrations and flows in coastal watersheds, can we detect a signal indicating change following restoration activities when we compare measurements from small, high density restoration project watersheds with a control site (before vs after restoration activities)? Specifically, we developed an R tool to assess how well common design and sampling approaches used in monitoring programs are able to estimate changes in pollutant loads due to the implementation of stormwater Best Management Practices (BMPs), including stream restoration.

Project findings

(1) we found that optimal monitoring might not be feasible at some spatial scales, watershed characteristics, and pollutants of interest (e.g. when load reductions due to restoration are overwhelmed by the natural variability of discharge), thus appropriate pre-planning of monitoring schemes and the sampling frequency is essential to determine if the resulting data can determine the effectiveness of a given watershed restoration activity. (2) we found that flow-paced storm sampling (when feasible) should be used to monitor urban systems to quantify the restoration signals, and the simulation should be conducted to estimate the change in loads following a restoration effort while accounting for the natural variability in restoration monitoring. We acknowledge that flow-paced storm sampling is not always feasible, especially in headwater streams. (3) Pre-restoration monitoring at a nearby similar site (control), coupled with automated storm sampling and flow normalization are the most likely to detect restoration signals from noisy flow and concentration data.

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Recommendations

(1) For practitioners, the open-sourced tool is an optimization method to address data gaps needed in monitoring restoration efforts at varying scales. This tool can address the need to cost-effectively monitor water quality and understand the impact of BMP more effectively. (2) For regulators, our study indicates that monitoring to estimate load reduction is not the optimal approach for assessing the BMP effectiveness at the sites considered. Flow normalization (when feasible) might be a better solution for BMP monitoring. To better address the TMDL concerns at a broader spatial scale, similar tools should be co-developed to further support data synthesis across local jurisdictions. Early engagement and co-development of monitoring tools can concurrently address science and regulatory needs.

For more information:

To read this study's final report, please visit the Chesapeake Bay Trust's Pooled Monitoring Restoration Research landing page https://cbtrust.org/grants/restoration-research/, https://stormstats.shinyapps.io/Stormstats_Linnean/, or https://stormstats.shinyapps.io/Stormstats_USGS/.

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