Government Performance Results Act (GPRA) Goal 4.5.2
Annual Performance Measure 248

Significant Research Findings:

Population Models for Stream Fish Response to Habitat and Hydrologic Alteration: the CVI Watershed Tool

Scientific Problem and Policy Issues	Under the Clean Water Act, the EPA is involved with protecting, restoring, and maintaining the biological integrity of the nation's streams. Often, local and regional watershed groups are also committed to such activities. One such group in the Mid-Atlantic Highlands (MAH) region of the eastern United States is the Canaan Valley Institute (CVI), whose goal is to develop and implement solutions to restore damaged areas and protect aquatic systems in the MAH. To achieve this goal, they require sound science that combines theory, detailed knowledge, monitoring and modeling. EPA NERL ERD is helping CVI in this endeavor by providing science and tools to address environmental problems associated with aquatic systems in the MAH. This direct assistance of the client allows them to better manage land and development in their region, through the planning and prioritizing conservation and restoration activities in the watershed.
Research Approach	To assist CVI with its goal to develop and implement solutions to restore damaged areas and protect aquatic systems in the MAH, the EPA NERL ERD has developed an interactive watershed toolkit. In this toolkit, habitat quality and aquatic ecosystem response models have been linked to a regional hydrologic model that simulates habitat characteristics (e.g., water depth, current velocity and water temperature) that determine the survival, reproduction, and recruitment of fish and aquatic invertebrates. This toolkit contains four tools: 1) a Hydrologic Tool for predicting hydrologic inputs to streams; 2) a Clustering Tool for the prediction of fundamental fish assemblages in the Mid-Atlantic Highlands, 3) a Habitat Suitability tool, to relate habitat measures to the suitability of streams for specific fish species, and 4) the BASS (Bioaccumulation and Aquatic Systems Simulator) model tool, a generalized aquatic ecosystem simulator to examine fish community dynamics over time. The toolkit also provides a tutorial for the user to examine scenarios for fish stocking and harvest, and stream restoration. Peer review of this tool consists of an initial academic review of the approach, and a review by CVI for the relevance of the toolkit to their goal.
Results and Impact	The CVI Watershed Tool developed by EPA NERL ERD is a stream-based decision support tool that is object-oriented in design and easily maintained. To facilitate the use and application of the models within the CVI Watershed Tool, graphical user interfaces (GUI), supporting databases, and libraries of management scenarios were developed. Stakeholders interact with the GUI to frame the environmental problem by: selecting valued endpoints of concern and analytical

methods, accessing data and models to establish the causal relationships between management actions and changes in endpoint status/trend, and performing multiple model executions and visualizations of projected outcomes to span the range of various management scenarios that might be taken so that associated costs and benefits can be evaluated. For example, with this Tool, stakeholders can examine the effects of a Best Management Practice (BMP) on the aquatic community: the stakeholder can select from three present BMP scenarios, examine how the BMP changes instream habitat characteristics and in turn how these habitat characteristics affect individual fish species, and finally, can elect to run a simulation of the stream ecosystem in order to see how the dynamics of fish species and other components of the ecosystem change through time as a result of the BMP application.

Research Collaboration and Research Products	The ERD research team worked together with the CVI clients to develop this project. Other collaborators include EPA Region 3, the U.S. Fish and Wildlife Service, and Partners in Wildlife.
	Examples of recent publications from this study include:
	Cyterski, M., R. Parmar, C. Barber, B. Rashleigh, J. Johnston, and K. Wolfe. "Prediction of Fundamental Assemblages in Mid-Atlantic Fish Communities " Presented at the EPA Science Forum, Washington, DC. June, 2004.
Future Research	A Phase-II level version of the CVI Watershed Tool is currently under development. The Phase-II version will allow users to enter any stream of interest within the region, and apply the Hydrology, Clustering, Habitat Suitability, and Community Dynamics Models to that stream. A "wizard" function is being developed to guide users more easily through the use and application of the models. Additional relevant research is underway to further develop the CVI Watershed Tool, including: an improvement of the BMP applications and efficiencies, which will build on work being conducted at EPA NRMRL; the analysis of additional data available from the region to test the predictive abilities of existing models in the tool; and more complex formulations for BASS stocking and harvesting functions, in order to represent more realistically the various efforts that are undertaken by states in the MAH region.
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