

LINKING WATERSHED MANAGEMENT WITH STREAM ECOSYSTEM PROCESSES

Reducing the loading of “stressors” (i.e., pollutants) from watershed lands to streams and lakes is the concern of a broad range of environmental stakeholders—including local and state governments, utilities, farm collectives, construction firms, and even homeowners. Their adoption of EPA Best Management Practices (BMPs) for controlling both urban and rural sources of waterborne pollutants is helping reduce contaminants at the watershed level. However, attempts to measure the effectiveness of specific watershed BMPs on stream ecology have usually been unsuccessful because they have lacked a systematic framework for linking pollution reductions to in-stream biological conditions. EPA’s National Risk Management Research Laboratory (NRMRL) water researchers are attempting to close this data gap with the operation of an Experimental Stream Facility (ESF) and watershed level monitoring program to test how well different management practices meet their desired biotic endpoints.

Experimental Stream Facility

The ESF, based in Clermont County, OH, is designed to provide a balance between the controlled conditions of a laboratory and the variability of the natural environment required to sustain natural communities. Fully automated, continuous flows of river water from the Lower East Fork River are delivered to eight, 12-m stream channels called mesocosms (or “half-way worlds”). The indoor mesocosms are used to study the relationships between multistressor loads on biotic structure and functional responses. The studies are incorporated into a watershed-level research plan designed to characterize, track, and model water quality from BMP implementation projects ranging in scale from headwater streams to larger multiuse channels and reservoirs.

The ESF is distinctive in design and experimental setup. Emerging contaminants of concern, such as endocrine-disrupting compounds,



Experimental channels at the ESF in Clermont County, OH.

can be added precisely and simultaneously with the influent river water at the head of each experimental channel. In addition, suspended solid and nutrient concentrations in the supplied river water can be manipulated, as well as stream characteristics such as light intensity and substrate type. The ESF is unique in its level of dosing precision and fail-safe design in a setting that can be scaled up to field conditions. This allows researchers to explore the effects of contaminants on traditional assessment endpoints, as well as to develop new, more effective measures (e.g., early warning biological-based monitors and reproductive endpoints). Furthermore, linkages between pollutant loads and biotic endpoints can be identified—a critical step in the development of effective models in support of EPA water quality regulations and subsequent implementation and monitoring plans.

The ESF is the result of collaborative efforts from a number of sources and provides building facilities not normally accessible to publicly funded research institutions. EPA leases the ESF from Clermont County, and NRMRL scientists share space with the Clermont County Sewer District Water Quality Testing Laboratory. Cross-laboratory collaboration takes advantage of expertise within several

Office of Research and Development divisions, while biweekly meetings attended by lead scientists, project officers, technicians, and supporting contractors, guide the research activities.

In the first year of its operation, experiments conducted at the facility have resulted in a number of published abstracts and one proceedings paper delivered at national and international meetings. The chief beneficiaries, of course, are the environmental decision-makers who will use the ESF data in watershed models to quantitatively link known stressors in stream flow with the structure and function of stream ecosystems.

This month’s column was contributed by Dr. Christopher Nietch, a systems ecologist with EPA’s NRMRL. For further information, visit EPA’s water quality research Web site at www.epa.gov/nrmrl/wswrd/wqm.htm. **em**

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