

New Monitoring and Mapping Technology in Watershed Management: A Tiered Approach to Identifying, Tracking and Remediating Pollution Sources in Watersheds

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ABSTRACT

Valuable new tools and technologies are constantly being made available to watershed groups, agencies and individuals if they are willing to implement them. Combining these new techniques into a tiered approach may help better identify, track and remediate pollution sources.

Knowing the specific watershed is the first tier in this approach which is less rigorous and costly. The first tool used involves assessing the land uses throughout the entire watershed. This is done using computer software called Geographic Information Systems (GIS). GIS utilizes County, State and Federal data and superimposes them onto multiple layers which the research scientist can use to get an overall view of the watershed, including soil types, water bodies, topography and land use coverage. This overview is used to decide upon initial sampling points. Initial sampling points are used to create a baseline data set to find any “hot spots” of bacteria and/or other pollutants. These initial sites can be monitored with traditional methods, or new, yet highly effective tools. Tools used successfully in this study included multiparameter probes which can detect chemical pollutants including nitrate, nitrite, ammonia, and chloride. An inexpensive yet effective tool is optical brightener detection. Optical brighteners are fluorescent dyes used in laundry detergents. Simple cotton traps are left in streams over time and then placed

under a blacklight. If the cotton fluoresces, it contains optical brighteners, suggesting a possible sewage leak. This tool is cheap and easy for any volunteer monitoring group to implement.

The second tier in monitoring involves more costly and precise tools. Once a bacterial “hot spot” is identified, more rigorous and complex methods can be employed. One method as MAR (Multiple Antibiotic Resistance) is a qualitative, library-dependent procedure relying on comparisons of antibiotic resistance levels. Another method is real-time, library-independent, quantitative polymerase chain reaction. While not a new laboratory method, it is new in its use as a method in tracking the source of bacterial contamination. qPCR detects molecular primers that are species specific such as a human, horse, bird, etc. F⁺ RNA phage serotyping distinguishes between human and animal bacteria by grouping their RNA signatures into four groups, two being human, two being animal. Other methods of determining if a bacterial source is human are sampling for caffeine or prescription drugs, which only originate from humans.

KEYWORDS

Geographic Information Systems, environmental probes, optical brighteners, qPCR, polymerase chain reaction, MAR, multiple antibiotic resistance screening, RNA phage