Water Quality Screening Tools: A Practical Approach

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Abstract

Water quality modeling has typically been beyond the domain of most local government agencies, and their use in practical decision making at the local level has often not been realized. In locations where more robust calibrated models are not readily available for use in local land use management programs, simple screening level tools offer great promise in assisting local efforts at prioritizing pollutant sources and improving water quality.

This investigation reports on several approaches to bring a range of water quality assessment tools into the domain of programs and decisionmaking at the local level. An emphasis on simple risk-based approaches to several tested protocols has resulted in practical value for local watershed management and non-point source control activities in upstate New York. The role of riparian buffer zones, land-use-based contributions to sediment and nutrient loading, and saturation excess contributions to runoff are evaluated in the context of prioritizing the relative effects on stream water quality.

Attempts to use the Riparian Buffer Delineation Equation (RBDE) have been frustrated by an emphasis on calculating specific variable-width buffer distances along individual stream segments. The RBDE is designed to evaluate the effectiveness of a particular riparian zone at reducing pollutant and sediment loading in comparison with a reference condition across an entire watershed. The methods developed here present results from implementing the RBDE in the form of both a sensitivity index and a current risk ratio. All variables are determined objectively from existing GIS datasets. This strategy has important implications for objectively evaluating the value of existing riparian buffers in particular stream reaches and for guiding management strategies toward improving riparian buffer conditions as one technique to improve environmental water quality.

Export coefficient models have been widely accepted as screening level tools for assessing contributions to sediment and nutrient loading within specific watershed units. The method presented here offers local government officials and staff a simple to use approach for assessing current and proposed land use scenarios in the context of management strategies for reducing non-point source contributions. Inputs are based entirely on existing landcover and terrain raster GIS datasets. The results have been used to assist program managers in prioritizing areas of greatest risk and evaluating scenarios for improvement.

Saturation excess has also been established as a primary mechanism for the mobilization of nutrients and sediment in runoff in the northeast region of the United States. A simple GIS-based tool grounded in variable source area (VSA) hydrology offers an alternative view into areas of greatest risk from traditional infiltration excess models based on the National Resources Conservation Service (NRCS) Curve Number method. Inputs are based entirely on soil and terrain raster GIS datasets that are ubiquitously available and offer the potential to help guide local land use managers in determining where source areas exist in the context of ongoing efforts to reduce pollutant loads.

When used together to augment ongoing program efforts, these screening level tools offer immediate and cost effective ways for programs to evaluate strategies and prioritize efforts within their watersheds.

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