A watershed-scale refined flowing water exposure modeling approach for endangered species assessments

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Current approaches to flowing water exposure modeling at the screening phase of endangered species assessments make simplified assumptions about water body characteristics and the surrounding landscape. Using the US EPA Pesticide Root Zone Model (PRZM) and Variable Volume Water Model (VVWM), screening simulations are limited to representation of agricultural runoff from a uniformly cropped watershed draining into a single stream. In reality, pesticide entering streams associated with medium (order 100 km^2) and large (order 1000 km^2) watersheds would be routed through a network of variable size streams draining a heterogeneous landscape of both agricultural and non-agricultural land uses. A refined approach was developed to account for variability in environmental conditions by coupling PRZM simulations of landscape processes to the Soil and Water Assessment Tool (SWAT) for stream routing. A case study simulating all of the NHDPlus version 2 flowlines with flow direction in the northern South Atlantic hydrologic region (HUC2 03N) is presented. Daily time series of runoff, sediment, and pesticide loadings were predicted by PRZM for all NHDPlus catchments based on observed acreage of 18 different land use groups, soils, and weather. These loadings were provided as inputs to SWAT to simulate water, sediment and pesticide routing and transformation. By using PRZM to generate loading time series, existing EPA scenarios and parameter assumptions could be leveraged while making the simulations spatially explicit. The refined approach led to more realistic predictions of pesticide concentrations in a wide range of flowing water bodies.