Multi-scale assessment of non-point source pollution in agricultural watersheds

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Conservation state agencies need information to guide planning activities and allocation of limited mitigation resources at statewide scale. These agencies often use watershed modeling tools, but at watershed scale, to characterize site-specific processes and then to efficiently evaluate conservation alternatives. Information on few individual watersheds cannot be scaled up to the entire state. Watershed simulations are performed by multiple stakeholders under uncoordinated efforts, often using different modeling tools, varying assumptions, and time periods. Development of a single watershed simulation can be time-consuming as it requires understanding of the model input requirements, knowing of input data sources, and efficient development of model input databases. In this study, we propose an automated procedure to perform large scale non-point source assessment, such as statewide, though the implementation of linked watershed-scale simulations. The objective is to provide the means for estimation of long-term averages of non-point source pollution at state, watershed, and field scales using the same assumptions and procedures. The U.S. Department of Agriculture – Annualized Agriculture Non-Point Source (AnnAGNPS) pollution model was applied to the U.S. State of Iowa using publicly available datasets. The state was divided into 271 hydrological units with average area of 41000 hectares, each representing a watershed simulation. The model was applied in un-gauged mode with the objective of generating long-term relative trends between land use/conservation alternatives rather than absolute estimates. Individual hydrological units were further subdivided into sub-catchments (approximately 1 hectare each) and reaches to describe field conditions. Automated procedures were developed to preprocess data and to develop input database based on temporal and spatial characterization of sub-catchments and reaches for weather, soils, topography, and management. Findings from this study support state agencies in developing guidelines and recommendations for future decision support systems implementation, generation of state-wide GIS data layers of non-point source pollutants at field scale, and generation of watershed simulation templates for use as starting point for future simulations.