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Using Genetic Algorithms and an Integrated Water Quality-Economic Model to Identify Efficient Placement of Conservation Practices in the Walnut Creek

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Abstract Text:

This research is part of the Conservation Effects Assessment Project whose overall goal is to integrate economic and water quality modeling capability to study the effects of conservation practices at the watershed scale. In this paper, we study the efficient placement of a set of conservation practices in the Walnut Creek watershed in central Iowa that considers both the costs of the practices and the water quality benefits in terms of nitrogen and phosphorous.

We use the water quality model, SWAT, in conjunction with detailed information on conservation practices, to calibrate the water quality model to flow, sediment, and nutrients for the Walnut Creek Watershed. The genetic algorithm SPEA is used to find the set of watershed configurations that provide the lowest nutrient levels for a wide range of costs.

The Walnut Creek watershed consists of 12,860 acres located in the Southern Iowa Drift Plain landscape region of Iowa, an area characterized by steeply rolling hills and well-developed drainage.From 1992 to 2005, nearly 3,000 acres, or 23% of the watershed were converted from row crop to native prairie in the Walnut Creek watershed by the US Fish and Widlife Service at the Neal Smith National Wildlife Refuge. Conservation practices in Walnut include conservation tillage, nutrient management and structural practices. A data set describing the extent and location of numerous conservation practices for the watershed has been collected at the CLU scale and economic data on the costs of these practices have been collected and are used in conjunction with the SWAT model via the SPEA algorithm.

Impact Statement:

This research identifies the efficient placement of conservation practices within a watershed which will allow watershed planners and conservation managers to consider tradeoffs between different watershed configurations.