ABSTRACT

Maringanti, Chetan. M.S.E, Purdue University, May, 2008. Development of a Multi-Objective Optimization Tool for the Selection and Placement of BMPs in a watershed for NPS Pollution Control. Major Professor: Indrajeet Chaubey.

Best management practices (BMPs) are effective in reducing the transport of agricultural nonpoint source pollutants to receiving water bodies. However, selection of BMPs for placement in a watershed requires optimization of the available resources to obtain maximum possible pollution reduction. In this study, an optimization model is developed to select and place BMPs in a watershed to provide solutions that are both economically and ecologically effective. Total pollutant load from the watershed, and net cost increase from the baseline were the two objective functions that were minimized during the optimization process. The optimization model, consisting of a multi-objective genetic algorithm (NSGA-II) in combination with watershed simulation tool (SWAT), was tested for pollution reduction on two watersheds with varying land use, topographic, climatic, management conditions, and pollutants of concern. The first model was developed for L'Anguille River Watershed located in Eastern Arkansas for nutrient and sediment control. The optimized solutions provided a tradeoff between the two objective functions for sediment, phosphorus, and nitrogen reduction. The results indicated that buffer strips were very effective in controlling the NPS pollutants from leaving the crop lands. A reduction of 33%, 32%, and 13% was observed in sediment, phosphorus, and nitrogen loads, respectively. The second model was developed for atrazine reduction in Wildcat Creek Watershed located in Northcentral Indiana. The tradeoffs generated from the optimization provided solutions that would produce a reduction of approximately 19% in atrazine loading in the watershed. Similar to the L'Anguille River Watershed, buffer strips were effective in controlling the transport of atrazine.