

Public Abstract

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Title:APEX AND FUZZY MODEL ASSESSMENT OF ENVIRONMENTAL BENEFITS OF AGROFORESTRY BUFFERS FOR CLAYPAN SOILS

Contamination of surface waters with pollutants from agricultural land is a major threat to the environment. A field-size watershed study in Northeast Missouri showed that vegetated filter strips containing grass and grass+trees (agroforestry) buffers placed on contours reduced sediment and nutrient loadings by 11-35%. Watershed scale studies are overly expensive while computer simulated hydrologic models offer efficient and economical tools to examine environmental benefits of conservation practices. The current study used the Agricultural Policy Environmental eXtender (APEX) model and a fuzzy logic model to predict environmental benefits of buffers and grass waterways of three adjacent watersheds at the Greenley Memorial Research Center. During the second phase of the study, an automated computer technique was developed to optimize parameter sets for the APEX model for runoff, sediment, total phosphorous (TP) and total nitrogen (TN) losses. The APEX model was calibrated and validated satisfactorily for runoff from both pre- and post-buffer watersheds. The sediment, TP, and TN were calibrated only for larger events during the pre-buffer period (>50 mm). Only TP was calibrated by post-buffer models. The models simulated 13-25% TP reduction by grass waterways, and 4-5% runoff and 13-45% TP reductions by buffers. The fuzzy model predicted runoff for the study watersheds and for watersheds 30 and 50 times larger in northern Missouri. A stepwise multi-objective, multi-variable parameter optimization technique improved calibration of sediments, TP, and TN after optimization for runoff parameters. The results of the study show that models can be used to examine environmental benefits provided long-term data are available.