

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

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**ABSTRACT**

Agricultural non-point source pollution is a serious threat to the environment. A paired watershed study with no-till management in a corn (*Zea mays* L.)-soybean [*Glycine max* (L.) Merr.] rotation in Northeast Missouri, showed 11-35% reduction in sediment and nutrient loads by agroforestry (grass+trees) and grass upland contour buffers. The study objectives were to: (1) evaluate environmental benefits of grass waterways and buffers by simulating the parameterized, calibrated, and validated Agricultural Policy Environmental eXtender (APEX) model, (2) evaluate a fuzzy logic model for runoff prediction from rainfall, and (3) develop a multi-objective, multi-variable parameter optimization technique for the APEX model. Both pre- and post-buffer models were parameterized, calibrated and validated for event runoff and total phosphorous (TP) losses with  $r^2$  and Nash-Sutcliffe Coefficients (NSC) values between 0.4 and 0.8. Sediment and total nitrogen were only calibrated for pre-buffer models for rainfall > 50 mm events. The models predicted 13-25% of TP reductions by grass waterways, and 4-5% runoff and 13-45% TP reductions by buffers. The fuzzy model predicted runoff with  $r^2$  and NSC values over 0.6 for calibration and validation, and for watersheds 30 and 50 times larger. The stepwise multi-objective, multi-variable parameter optimization technique revealed that the optimization of the APEX model for all runoff related parameters were crucial and a prerequisite for subsequent calibration of sediment, TP, and TN losses.