231. Forecasting changes in water quality and aquatic biodiversity in response to future bioenergy landscapes in the Arkansas-White-Red River basin

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Abstract: Landscapes with intensive agriculture often contribute to poor water quality and lower aquatic biodiversity. Future projections made by an economic model (POLYSYS) suggest that the dedicated energy crop, perennial switchgrass (Panicum virgatum) will replace pasture and conventional crops in agricultural landscapes of the Arkansas-White-Red River Basin (AWRRB). Little is known about the potential impact of projected landscape shifts on water quality and biodiversity. In this study, we used the Soil and Water Assessment Tool (SWAT) to forecast how alternative bioenergy futures will influence water quality and species richness of native fish and freshwater mussels. We used Poisson regression to model species richness based on occurrence data reported by NatureServe for 8-digit USGS hydrologic units (HUC8), and SWAT-projected water quality. Richness was expressed as a function of river discharge, elevation, HUC8 position within the AWRRB, area in agriculture, number of dams, and SWATpredicted
annual loadings of nutrients and sediment. Alternative models with subsets of predictor variables were compared using information-theoretic criteria. We identified environmental gradients in flow and river discharge as the strongest predictors of species richness in aquatic biota. Water quality predictions suggested that the cultivation of switchgrass may reduce nutrient and sediment loads in drainages dominated by agriculture, and thereby lessen adverse effects on aquatic biodiversity.

Keywords: biodiversity, bioenergy, switchgrass, water quality