Geophysical Research Abstracts
Vol. 19, EGU2017-18263, 2017
EGU General Assembly 2017

Bioenergy and Climate Change Induced Impacts on Ecosystem Services

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Watershed scale ecosystem services can be substantially impacted by land use and climate change. In this study, we quantify ecosystem services of bioenergy-based land use change and compare them to climate change impacts. We evaluated 17 bioenergy crop production scenarios with Miscanthus, switchgrass, and corn stover as candidate bioenergy crops and SWAT (Soil and Water Assessment Tool) model. Biomass/grain yield, hydrology and water quality simulated by the SWAT model were used to quantify fresh water provision (FWPI), food (FPI) and fuel provision, erosion regulation (ERI), and flood regulation (FRI). Nine climate projections were used to quantify the potential climate change variability. Overall, ecosystem services were lower in row-crop dominated Wildcat creek watershed. Generally, ecosystem services improved with bioenergy production. Overall, Miscanthus in marginal lands of Wildcat creek (9% of total area) increased FWPI by 27% and ERI by 14% and decreased FPI by 12% from the baseline. For St. Joseph watershed, Miscanthus in marginal lands (18% of total area) improved FWPI by 87% and ERI by 23% while decreasing FPI by 46%. For the scenarios evaluated in this study, we found that land use change impacts on ecosystem services were generally greater than climate change impacts.