2008 USDA-CSREES National Water Conference
Sparks, NV

Land use change and nutrient losses due to expanded biofuels production

Silvia Secchi, Lyubov Kurkalova, Philip W. Gassman, and Chad Hart

Abstract Text:

This study focuses on the land use impact of the biofuels expansion on both the intensive and extensive margin, and its nutrient loss consequences. We link economic, geographical and environmental models by using spatially explicit common units of analysis and use remote sensing crop cover maps and digitized soils data as inputs. Land use changes are predicted via economic analysis of crop rotation choice and tillage under alternative crop prices, and the Environmental Policy Integrated Climate (EPIC) model is used to predict corresponding sediment, nitrogen, and phosphorus losses. The study focuses on Iowa, which is the leading biofuels hotspot in the U.S. due to intensive corn production and the high concentration of ethanol plants that comprise 28% of total U.S. production. We consider the impact of the biofuels industry both on current cropland and on land in the Conservation Reserve Program (CRP), a land set-aside program. We find that substantial shifts in rotations favoring continuous corn rotations are likely if high corn prices are sustained. This is consistent with larger scale analyses which show a shift of the current soybean production out of the Corn Belt. We find that sediment losses increase substantially on the intensive margin, while nitrogen losses increase less. Returning CRP land into production has a vastly disproportionate environmental impact, as non-cropped land shows much higher negative marginal environmental effects when brought back to row crop production. This illustrates the importance of differentiating between the intensive and extensive margin when assessing the water quality consequences of the expansion of biofuel production.

Impact Statement:

The project spatially identifies landscape level changes brought about by the biofuel expansion in the major U.S. crop production region, quantifies some of the related water quality-related impacts at a fine geographical scale, and assesses some of the economic impacts for farmers. The results can also be used as inputs for both groundwater and surface water modeling to analyze likely water quality and quantity impacts. This is going to be of particular importance in biofuels hotspots where the production of biofuel crops requires irrigation, such as the Great Plains area in the US.