Assessing Water Use and Water Quality Change with Respect to Large-Scale Expansion of Ethanol Feedstock Production in United States

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Overview
The strong national interest in biofuel production from agricultural crops including corn, crop residue and perennial grasses complicates the design and implementation of water conservation policy. The potential impacts of the 2007 biofuel mandate (produce 36 billion gallons of ethanol by 2022 with 21 billion gallons of ethanol from feedstock other than corn) on water demand and quality will be experienced locally or regionally and difficult to anticipate.

Objectives
- Quantify the gross water use required and water quality changes at county (n = 3011) and Agricultural Statistic District (n = 305) levels to meet the anticipated demand for ethanol feedstock under different cropping scenarios.
- Identify policies that will enhance water quality and water conservation under mandated ethanol production goals and estimate the impacts of potential national water policy tools.

Methodology
- EPIC: a field level soil and water influence model used to generate environmental parameters.
- Integration of POLYSYS and EPIC will be useful in analyzing agricultural production impacts on water resources in United States assuming that crop and residue production goals will be achieved through the National Energy Mandate in 2022.

Research Questions
- How will water requirements for crop production change in order to the ethanol feedstock demand?
- With different cropping and management practices, how would that affect the chemical runoffs hence the water quality in different regions across the nation?

Preliminary Results
- The majority of cellulosic feedstock production occurs in the central, south central, and heartland regions of the United States. Switchgrass is produced primarily in the southeast, while corn stover is produced in the corn growing areas of the Midwest.

Discussion and Ongoing Research
- The growth of bioenergy sector and cellulose-to-ethanol development will affect water demand and chemical use mainly in southeast region.
- Regional differences in land use and environmental conditions denote the need to incorporate specific regional conditions in the design of policy instruments encouraging biofuel feedstock production.
- It is important to understand the complex changes anticipated by the growth of the bioenergy sector in terms of local capacity and regional constraints as they pertain to water quality, water and soil conservation, and community well-being.
- Ongoing research focuses on providing timely information about the economic environmental, agricultural water demand, and agricultural economic and environmental trade-offs under multiple policy scenarios: including: (1) technical changes in bioenergy production, (2) different production targets, (3) conservation tillage practices, and (4) agricultural policies as related to expanding ethanol feedstock supply.