

## Project Summary/Abstract

**Location:** North Carolina A&T State University (NCATSU) and Iowa State University (ISU)

**Principal investigators:** Lyubov A. Kurkalova and Catherine L. Kling; **co-principal investigators:** Alicia Carriquiry, Daniel Otto, Silvia Secchi, Philip W. Gassman, and Manoj Jha

**Project title:** Expansion of ethanol production: evaluation of costs and benefits to rural communities in the Upper Mississippi River Basin

**Objectives of the project:** The goal of the study is to provide solid, science-based guidance regarding the design and implementation of corn-based ethanol production to efficiently achieve environmental and economic benefits in the Upper Mississippi River Basin (UMRB). To accomplish this goal, the following five objectives will be pursued.

1. Estimate what the economic benefits of ethanol production have been in terms of jobs created, rural household income boosted, and tax revenue added for the federal and state governments.
2. Quantify what the effect of ethanol plants have been on cropping patterns in response to changes in input demand generated by the plants.
3. Evaluate the water quality consequences of the changes in farming practices attributable to the increasing presence of ethanol plants.
4. Assess the magnitude of energy displacement as the result of the changes in farming practices.
5. Predict cropping pattern changes, environmental outcomes, and rural economic development benefits for several probable scenarios of expanded ethanol production in the area.

**Description of the project: I. Methods:** This project is novel in that it is the first study to simultaneously assess the impacts of corn-based ethanol production on crop prices, cropping patterns, water quality, and regional economic indicators for a major U.S. agricultural producing region and within an explicit spatial framework. To achieve the project objectives, the following tasks will be accomplished.

1. Develop and apply an economic model that explains how corn prices are affected by the distance between markets and ethanol plants and by plants' characteristics.
2. Develop and use an economic model of crop choices in the UMRB to estimate the change in land use resulting from ethanol production.
3. Develop and use a spatially explicit model of regional economic impacts.
4. Develop and use an energy displacement accounting scheme.
5. Use the Soil and Water Assessment Tool (SWAT) model to estimate the water quality effects attributable to the altered cropping patterns arising from the presence of ethanol plants.
6. Using the tools developed in tasks 1-5, estimate the potential economic and environmental impacts (benefits and/or costs) of potential future growth in ethanol production in the region.

**II. Potential impact:** The UMRB region is crucial in studying the impacts of ethanol production on rural economies because of high concentrations of both ethanol and corn production. Intensive nitrogen and phosphorus applications are used to support the high levels of corn production in the region, resulting in degradation of the Mississippi River and its tributaries, and contributing to the seasonal hypoxic zone in the Gulf of Mexico. These factors imply that agricultural activities and their induced effects constitute a substantial portion of the economies of the watershed and related environmental externalities, and that the UMRB is likely to be greatly affected by shifts in the nation's energy policy towards biofuels. The knowledge gained from the project will facilitate the understanding of the interlinked economic and environmental outcomes of increased ethanol production for sustaining and improving the environmental quality and enhancing the quality of life for rural communities in the region.

**III. Major participants:** This is a collaborative research project between Department of Economics and Transportation/Logistics, NCATSU, and the Center for Agricultural and Rural Development, Department of Economics, and Department of Statistics, ISU.