Social-Economic Assessment of Declining Ogallala Aquifer Availability: Integrated Solutions to the Sustainability of Groundwater and Regional Economy in Texas High Plains

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3. Proposed Research

The Ogallala Aquifer is the primary water source for the Texas High Plains (THP) region. Over time irrigated agricultural production, growing municipalities and livestock production have led to substantial decline of water tables. The current expended biofuels policy contributes to demand altering the crop mix toward more of the heavy water user (e.g. corn). Additionally, climate change has implications for water use by agricultural, municipal and industrial interests. In the face of this situation effective groundwater conservation and management is socially desirable. However, there is little scientifically sound information on short- and long-run impacts on regional natural resource, environment and economy plus appraisals of various policies and emerging agricultural industry. Better understanding of spatial variability of groundwater availability and socio-economic consequences of different strategies has significant implications for the sustainability of agricultural industries and rural communities in the THP region (Amosson et al., 2009).

The primary objectives of this research are to: 1. develop an accurate estimate of current and future groundwater resource capabilities with regard to agricultural land use under future climate change and evolving water conservation policies and practices such as adoption of various drought-tolerant genetically modified (GM) crops 2. develop a comprehensive socio-economic assessment of various water conservation activities and policies at the farm, water district and regional scales.

Existing models underestimate conservation needs by assuming homogeneous hydrological and agricultural distribution over a whole county (Amosson et al., 2009). Accurate modeling of spatial distribution of irrigated areas and their temporal variations are a prerequisite for this study. As a consequence, we will develop and apply a dynamic economic model integrating agricultural, climatic and hydrologic sectors to simulate the optimal water extraction and land use time path. The model will contain conventional and GM row crops and perennial grasses with projected climate change scenarios and will depict a 50-year planning horizon. The model will start from initial conditions on aquifer status at the sub-county level which will be developed based on Geographic Information System (GIS) information on spatial crop cover/yield, aquifer characteristics and climatic conditions. The results of changing production with alternative water conservation policies and practices particularly adoption of GM crops will then be aggregated into categories and input into the input-output model IMPLAN (IMpact analysis for PLANning) to evaluate the direct, indirect and induced impacts on regional economy and employment.

Texas is actively addressing current and anticipated future water issues through a planning process that starts at the grassroots level. Even though policy makers, producers and groundwater managers consistently argue that they are preserving the scarce groundwater resource, its socially beneficial future level of exploitation uses remain unidentified (Willis and Johnson, 2011). Facilitating adoption of water conserving practices by providing assessment of socio-economic impacts of various water management strategies is therefore identified as a high priority activity for sustainable development in the Ogallala Aquifer Region (USDA, 2011). This research will seek to identify methods for optimizing spatial and temporal water allocation and to determine optimal groundwater management practices which maximize social benefits taking into account land use and climate change. By doing cost-benefit evaluations of

emerging policy proposals and technology changes in agricultural industry, this research is useful for policy makers to pursue both physically and economically feasible strategies to meet declining water table with new demands in the future.

References

Amosson, S., L. Almas, B. Golden, B. Guerrero, J. Johnson, R. Taylor, and E. Wheeler-Cook. (2009). "Economic Impacts of Selected Water Conservation Policies in the Ogallala Aquifer." Ogallala Aquifer Project. pp. 50.

USDA, 2011. "Priority Activities for the Ogallala Aquifer Program 2011 to 2016" Ogallala Aquifer Program, USDA-ARS Research Initiative.

Willis D. B. and J.W. Water Policy in Texas: Responding to the Rise of Scarcity. Griffin, R., ed. RFF Press Water Policy Series, 2011

5. Academic

B.S. Department of Mathematics
Hefei University of Technology, China
GPA:

M.S. Department of Applied Mathematics,
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Mathematical Economics		Climate Change	
Microeconomic Theory		Statistic in Research	
Applied Econometrics Methods in Agriculture		Operation Research Method in Agriculture	
Production Economics & Dynamic Optimization		Resource and Environmental Economic	
Geographic Information Systems		Water and Land Economics	

Awards:

- Environmental Health and Safety Research Award, Texas A&M University, 2011.
- Distinguished Scholarly Achievements Awards, Gamma Sigma Delta International Society, Texas A&M University, 2011.

6. Proposed use of funds

With the funds from this scholarship, I would buy books and software which is helpful for doing this project. It would also be used for covering the travel expense of presenting this project on national/international conferences.

7. Intended career path

After receiving my Ph.D. degree, I will either pursue a career with a consulting firm working in natural resource and environmental management or work in an international scientific/policy institute. My ultimate goal is to devote my knowledge and skills in water and land economics to finding the solutions of optimal resource management practices and sustainable development in undeveloped countries or areas. I think these areas are quite in need of resolving conflict between increasing demands and limited resources.