



**Project Plan from
FY2015
(Fiscal Years 2016-2017)**

Title: Economic and Policy Implications of Groundwater Conservation in Southwest Kansas

Investigators:

Principal Investigators:

- Bill Golden – Kansas State University
- Bridget Guerrero – West Texas A&M University
- Jonathan Aguilar – Kansas State University

Cooperators:

- Josh Roe – Assistant Secretary of Agriculture for the Kansas Department of Agriculture

Project narrative

Objective:

The research objective for this project is to transfer previous technology developed by the OAP to the local groundwater management process. This will be accomplished by applying the recently developed dynamic optimization and socio-economic models to the Southwest Kansas area (Groundwater Management District #3). The updated models (developed through 2014 OAP funding) has refined hydrologic, engineering, and agronomic components. This project has been requested by the Kansas Department of Agriculture (KDA) which will also provide financial support for the project.

Rationale/Literature Review/Conceptual framework

In southwest Kansas, irrigated agriculture relies primarily on groundwater to make up for the lack of rainfall. Groundwater provides the basis of the region's economy, where irrigated crops are produced in order to provide inputs for feedlots, dairies, and an expanding biofuel industry. Specifically, in Groundwater Management District #3 (GMD#3) groundwater supplies over two million acre feet annually from approximately 7800 active wells (GMD#3, 2007). In many portions of the Ogallala aquifer, up to 50% of the pre-development storage has already been depleted and, in some areas, the remaining usable life estimated as less than 25 years (KGS, 2000). Concerns over aquifer decline rates have motivated local stakeholders to focus on Local Enhanced Management Areas (LEMA) as a means to reduce consumption rates (GMD#3, 2007). In this research project we plan to evaluate the economic and hydrologic impacts of potential water use change, resulting from the implantation of alternate levels of groundwater reduction. We will develop and examine several policy options that meet aquifer sustainability goals and elaborate on the resulting economic, agricultural, hydrologic implications as well as its significance for rural areas.

How Objectives will be met

This project will assemble a research team from multiple institutions and will utilize the expertise of OAP participating scientists. An interdisciplinary team approach is essential to assess the impact that groundwater conservation policies will have on groundwater depletion rates and regional economic activities. Teams can leverage the skill, experience, knowledge, and perspective of diverse individuals/groups necessary to accomplish the research and outreach goals of such a multidimensional and interdisciplinary project. Our team will consist of farmers/ranchers and other local stakeholders, hydrologists from the Kansas Geological Survey (KGS), engineers, economists, policy makers, and state and regional water managers from the KDA. The KDA will define a minimum of 3 groundwater conservation policies to be modeled. By

engaging these market participants we will insure that not only are the water conservation policies technically and economically feasible but that they are also politically and socially acceptable.

Multi-year county-level dynamic optimization and socio-economic models are being updated/developed by the Economic Assessments group. These models generate a 60-year prediction of annual groundwater use, aquifer decline, net farm income, and regional economic impacts. In order to insure accurate predictions these models require that the imbedded aquifer model, production functions, and crop budgets are tailored to the priority areas to be defined by KDA.

The Irrigation and Precipitation Management (IPM), Irrigation Systems and Technology (IST) and Production Systems (PS) groups have developed several single-year producer-level tools for profit maximization, irrigation scheduling, and optimal cropping systems. Lessons learned from these projects will be used to define the crop budgets and crop-specific production functions. The aquifer model will be calibrated to mimic the MODFLOW model currently in use by the KGS. Additionally, in collaboration with the KGS, OAP researchers will define the relationship between saturated thickness, well capacity, and annual pumping capacity for the priority areas.

This proposal will complement other projects on water scarcity in the Kansas High Plains. While data collection and estimation efforts in this proposal have already begun in related OAP projects, the current proposal is an extension of that work.

Expected Outcomes

Results will be disseminated through reports, fact sheets, news releases, video, and Extension bulletins. The research and outreach associated with this project will greatly improve our understanding of the relationship between groundwater use, the environment, and the regional economy and will have significant short-, intermediate- and long-term impacts on the groundwater policy development in southwest Kansas. It is expected that the groundwater policies developed in this study will be incorporated into the State's groundwater management plan and implemented in southwest Kansas. Results from this project will also be applicable to other areas in the High Plains region.

Relevant Publications

- Amosson, S., L. Almas, B. Golden, B. Guerrero, J. Johnson, R. Taylor, and E. Wheeler-Cook. "Economic impacts of selected water conservation policies in the Ogallala Aquifer." *Ogallala Aquifer Project* (2009): 50.
- Golden, B., and J. Johnson. "Potential economic impacts of water-use changes in Southwest Kansas." *Journal of Natural Resources Policy Research* 5.2-3 (2013): 129-145.
- Guerrero, B., S. Amosson, and L. Almas. "Integrating stakeholder input into water policy development and analysis." *Journal of Agricultural and Applied Economics* 40.02 (2008).
- Johnson, J., P. Johnson, B. Guerrero, J. Weinheimer, S. Amosson, L. Almas, B. Golden, and E. Wheeler-Cook. "Groundwater Policy Research: Collaboration with Groundwater Conservation Districts in Texas." *Journal of Agricultural and Applied Economics* 43.3 (2011): 345-356.

Literature Cited/References

- Kansas Geological Survey (KGS). An Atlas of Kansas High Plains Aquifer. 12/04/2000. Kansas Geological Survey. 8/30/09 <<http://www.kgs.ku.edu/HighPlains/atlas/>>.
- Groundwater Management District #3 (GMD#3). Southwest Water. Volume 2, Issue 1, January 2007. 9/1/2009 <<http://www.gmd3.org/NEWSLETTERS/>>.

Schedule:

Task	Primary Responsibility	1 st Qtr FY16	2 nd Qtr FY16	3 rd Qtr FY16	4 th Qtr FY16	1 st Qtr FY17	2 nd Qtr FY17	3 rd Qtr FY17	4 th Qtr FY17
Define Policies & Sub-Areas	KDA & Golden								
Define Production Functions	Jonathan Aguilar								
Define Hydrology Model Parameters	KGS & Golden								
Define Crop Budgets	Golden								
Construct & Test Intertemporal Economic Models	Golden, Guerrero, & KDA								
Final Report to KDA	All								
Conduct Outreach Activities	All								
Final Report to OAP	All								