Project Plan from FY2016
(Fiscal Years 2017-2018)

Title: Economic and Policy Implications of Underground Water Use in the Southern Ogallala Region

Investigators:
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Summary/abstract
The analysis of alternative water conservation policies and scenarios is essential in providing information to policymakers within the region. The demand for economic analysis of groundwater conservation policy has expanded greatly in the past several years as a result of OAP funded projects and stakeholder outreach efforts. The economic team will use the updated inter-temporal dynamic models to analyze the necessary water use restriction to achieve the desired future conditions (such as 50/50) in Texas. Additionally, an innovative alternative objective function – maximizing regional value-added – will be employed to analyze groundwater management policy in Southwest Kansas. We will also identify and analyze two of the most promising projects from the other priority areas of the OAP. Importantly, all of these objectives are the result of stakeholder requests and fit in well with the strengths and capabilities of the team.

Objectives:
The research objectives for FY16 include policy and impact analysis of emerging issues associated with water management to sustain rural economies to address the issues identified by the leadership team of the OAP. The specific objectives are:

1. Quantify the inter-temporal impacts on producer net revenues, regional employment, and economic output under a water withdrawal restriction necessary to achieve the optimal path to the desired future conditions of 50/50 for the central sub-region of the Southern Ogallala Aquifer.
2. Evaluate groundwater management policy in Southwest Kansas by incorporating measures of regional economic welfare into the objective function of the optimization process by maximizing total regional value-added.
3. Identify and analyze two of the most promising projects from the other priority areas of the OAP.

Title: Economic impacts of the required restriction to achieve desired future conditions.

Objective: Quantify the inter-temporal impact on producer net revenues, regional employment, and economic output under a water withdrawal restriction necessary to achieve the desired future conditions (such as 50/50) for the central and southern sub-regions of the Southern Ogallala Aquifer.

Rationale/Literature Review/Conceptual framework: Current water policy in Texas is still in infancy and is often not viewed as being a binding constraint on agricultural producers. However, enough time has passed since the initial implementation of the 50/50 desired future condition (DFC) that comparisons may now be made between the optimal time path to the DFC (such as 50/50) and actual observed aquifer drawdown. Given the likelihood of divergence between the actual and projected optimal paths, there is benefit in identifying the current necessary restriction to force producer behavior on to a new optimal time path to the DFC. Such a restriction will most likely have negative impacts (e.g. short-term reductions in producer profits), but result in long-term sustainability of agricultural production. The long-term sustainability of agricultural production in the Southern Ogallala Aquifer is vital to the viability of rural economies and populations in the region.

How the objective will be met: The inter-temporal dynamic models have been used extensively in policy development and analysis throughout the Southern Ogallala Region (Amosson et al., 2014, Golden and Johnson, 2013). Current saturated thickness data at the county level will be obtained from the groundwater conservation districts. The model will then be utilized to identify the necessary water use restriction on currently irrigated acres that would be necessary to achieve the DFC. Producer net revenues, regional economic value-added, and saturated thickness will be evaluated over the 50 year horizon and compared to the unrestricted model.

Expected Outcomes: The results of this project will be made available to the public and professionals through peer-reviewed papers and professional meetings within the scientific community. To ensure that results are disseminated to stakeholder groups, the outcomes generated will also be presented in multiple meetings specifically designed to target legislative, regulatory, and producer groups. This research will primarily be used to educate and enlighten stakeholders as to the ramifications associated with alternative water conservation policies, including direct, indirect, unexpected, and external impacts of those policies.

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

Amosson, S., B. Guerrero, D. Mitchell, J. Johnson, and P. Johnson. “Evaluation of Changing Land Use and Potential Water Conservation Strategies: North Plains Groundwater Conservation District.” Texas A&M AgriLife Extension Service, West Texas A&M University, and Texas Tech University, January 2014. 25 pp.

Title: An innovative optimization model to manage groundwater depletion.

Objective: Evaluate groundwater management policy in Southwest Kansas by incorporating measures of regional economic welfare into the objective function of the optimization process by maximizing total regional value-added.

Rationale/Literature Review/Conceptual framework: Measures of producer profit have historically defined the objective function in inter-temporal allocation models. This implies that groundwater conservation policy should be managed for the sole benefit of agricultural producers. However, KSA 82a-702 states that "All water within the state of Kansas is hereby dedicated to the use of the people of the state, subject to the control and regulation of the state in the manner herein prescribed"[1]. This implies that groundwater conservation policy should be managed for the benefit of rural communities. Recent research by our team suggests that conservation policies which maximize long-run producer profits may not maximize the long-run welfare of rural communities (Golden and Johnson 2013). In this research we will incorporate IMPLAN multipliers into the inter-temporal model which will allow the development of a module which will incorporate measures of regional economic welfare into the objective function of the optimization process. All IMPLAN data for the region will be updated by county to include new Census data, and County Business Patterns Data. This will allow for a more current status of the interrelationships of agriculture with the regional economy.

How the objective will be met: The economic inter-temporal allocation model will be modified to incorporate new IMPLAN multipliers. The objective function for the proposed model will be based on optimizing regional economic value-added. The model will focus on three high-priority areas in Southwest Kansas within the groundwater management boundaries of District Three. Results will be compared to Golden and Johnson (2013) which was a previously funded OAP project based on optimizing measures of net producer profit.
Expected Outcomes: The model will generate measures of producer profit, regional economic value-added, and groundwater decline rates. Comparisons will be made between those policies that maximize producer profit and those that maximize regional economic value-added. Effectively, policies will be compared based on what is best for sustaining the overall regional economy, and thus rural communities, versus what is best for individual agricultural producers.

Relevant Publications

Amosson, Steve, et al. "Economic impacts of selected water conservation policies in the Ogallala Aquifer." *Ogallala Aquifer Project* (2009): 50.

Guerrero, Bridget, Steve Amosson, and Lal Almas. "Integrating stakeholder input into water policy development and analysis." *Journal of Agricultural and Applied Economics* 40.02 (2008).

Johnson, Jeffrey W., et al. "Groundwater Policy Research: Collaboration with Groundwater Conservation Districts in Texas." *Journal of Agricultural and Applied Economics* 43.3 (2011): 345-356.

Tewari, R., L. Almas, J. Johnson, B. Golden, S. Amosson, and B. Guerrero. 2014. "Multi-year water allocation: an economic approach towards future planning and management of declining groundwater resources in the Texas Panhandle." *Texas Water Journal*. 5(1):1-11.

Literature Cited/References

Golden, Bill, and Jeff Johnson. "Potential economic impacts of water-use changes in Southwest Kansas." Journal of Natural Resources Policy Research 5.2-3 (2013): 129-145.

[1] Source: http://www.kslegislature.org/li/b2015_16/statute/082a_000_0000_chapter/082a_007_0000_article/082a_007_0002_section/082a_007_0002_k/

Title: Economic analysis of experimental results

Objective: Provide economic analysis of experimental results of two projects from the other priority areas of the OAP.

a. One of the following from Jim Bordovsky's projects:
    a. Effects of variable in-season irrigation capacity on cotton.
    b. Evaluation of crop row direction and offset distances from SDI laterals.
    c. Water use by cotton in non-traditional crop rotations.
b. One of the following:
    a. Limited water production: corn versus sorghum (IPM 12.08)
    b. Cover crops for Texas High Plains (PS 12.07)
    c. Replacing fallow for increasing profitability (12.08)

Rationale/Literature Review/Conceptual framework: Decreased groundwater availability necessitates alternatives to fully irrigated crop production in order to ensure the continuation of rural economies and populations in the Ogallala Aquifer region. To this end, the research funded by the OAP must be in front of the transition in order to provide producers with best management practices for limited irrigation and dryland production systems.

How the objective will be met: The research team will work with the PIs from the aforementioned project(s) to understand the motivation behind the work and to attain the experimental results. Economic analysis of the experimental results will include 1) an evaluation of the benefits and costs of the practices used in the experiments, 2) a comparison of net revenues as compared to known alternative production systems, and 3) conducting of sensitivity analyses to evaluate the efficacy of the system under alternative conditions (e.g. output prices, input prices, and meteorological factors).

Expected Outcomes

The analysis of the experimental results from previous studies will provide the needed economic component necessary to guide future research in sustaining rural economies through best management practices for transition to dryland production systems.

Literature Cited/References

Bordovsky, JP, JT Mustian, GL Ritchie, and KL Lewis. 2015. "Cotton irrigation timing with variable seasonal irrigation capacities in the Texas South Plains." Applied Engineering in Agriculture 31(6): 883-897.

Bordovsky, JP, D Winters, and JT Mustian. 2015. "Cotton response in non-traditional crop rotations at low irrigation levels." Proceedings of the 10-12 November 2015 ASABE/IA Irrigation Symposium: Emerging Technologies for Sustainable Irrigation, Long Beach, CA. ASABE Publication Number 701P0415, Paper Number 152132333.

Bordovsky, JP and JT Mustian. 2012. "Cotton response to crop row offset and orientation to subsurface drip irrigation laterals." Applied Engineering in Agriculture 28(3): 367-376.

Schedule:

	1st Qtr CY17	2nd Qtr CY17	3rd Qtr CY17	4th Qtr CY17	1st Qtr CY18	2nd Qtr CY18	3rd Qtr CY18	4th Qtr CY18
1. Title - Economic impacts of the required restriction to achieve desired future conditions.								
Data collection								
Policy analysis								
Validate results, publish & distribute								
2. Title - An innovative optimization model to manage groundwater depletion.								
Data collection								
Policy analysis								
Validate results, publish & distribute								
3. Title – Economic analysis of experimental results								
Data collection								
Economic analysis of experimental results								
Validate results, publish & distribute								