



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

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

Investigators:

Principal Investigators:

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Cooperators:

- Steve Amosson - Texas A&M AgriLife Extension
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- Donna Mitchell, Eduardo Segarra, and Phil Johnson - Texas Tech University
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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 Texas water use restrictions and the impact of retiring CRP contracts. Additionally, the emerging issue of concerns over the sustainability of the expanding dairy industry will be addressed. 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 FY15 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. Analyze Texas water use restrictions including a sensitivity analysis utilizing the updated economic policy model. This analysis will include impacts to the regional economy and potential land use changes.
2. Evaluate impacts of changes in land use and water demand due to declining enrollment caps in the Conservation Reserve Program.
3. Assess the sustainability of the expanding dairy industry by evaluating its effect on water use, forage demand, and business composition in the economy of the Southern Ogallala region.
4. Identify and analyze one or two of the most promising projects from the other priority areas of the OAP.

Title: Economic impact of selected water conservation policies in Texas

Objective: Analyze Texas water use restrictions including a sensitivity analysis utilizing the updated economic policy model. This analysis will include impacts to the regional economy and potential land use changes.

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. Thus, in this objective, the current policies and/or Desired Future Conditions will be analyzed to determine the magnitude that restrictions would have to be in order to create a change in current production practices.

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). In 2014, the economic team of the OAP began to make major updates on the inter-temporal dynamic models by incorporating recent data changes and flexibility in linking with other models such as risk, climate variability, and hydrology. Meanwhile, the prototype updated policy model was developed and tested for a baseline scenario for a Groundwater Management District in Southwest Kansas. This updated economic model will be the foundation on which water use restrictions in Texas will be analyzed.

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.
- Golden, B., & Johnson, J. (2013). "Potential Economic Impacts of Water Use Changes in Southwest Kansas." *Journal of Natural Resources Policy Research*, 5(2-3):129-145.

Title: The Potential Economic Impacts of Retiring CRP Contracts on the Southern Ogallala Region

Objective: Evaluate impacts of changes in land use and water demand due to declining enrollment caps in the Conservation Reserve Program.

Rationale/Literature Review/Conceptual framework: The main goal of the Conservation Reserve Program (CRP), which was established by the Food Security Act of 1985, was to retire highly erodible cropland from production. In Texas and Kansas one only has to view a map of CRP acreage to observe that the majority of the enrolled acreage overlies the Ogallala Aquifer. With reductions in funding and relatively high commodities, many of the retiring CRP contracts will return to agricultural production. It has been estimated that 51% of CRP land would return to crop production (USDA, 2004). Ribaud et al. (1990) estimated that 1.8% of the total enrolled acreage was irrigated while Schaible (1989) estimated that 2% was irrigated. With many acres expected to expire/discontinue participation in CRP, the rural economy will be impacted in several distinct ways. First, land currently enrolled in the CRP could switch out of conservation uses. Some of this land would be used to produce crops, livestock, and other agricultural goods. Second, the environmental benefits generated by the CRP may be diminished (Sullivan et al., 2004).

One negative environmental impact might be increased withdrawals from the Ogallala Aquifer. Ribaud et al. (1990) suggested that the bid caps in the states of Kansas and Texas may have encouraged enrollment of irrigated land because average CRP rental rates were nearly equal to or greater than the cash rents for irrigated land. At that time, he estimated that 212,080 irrigated acres had been enrolled in Texas. Enrolling irrigated land in the CRP generated benefits by conserving groundwater supplies, thereby prolonging the life of aquifers. As a result, rural communities have more time to adjust to reduced irrigated output which may ease the transition to dryland production.

Using methods developed by Sullivan et al (2004) and Lubowski et al. (2006) both county level data from the USDA-FSA and parcel-level data from the USDA's National Resources Inventory (NRI) will be used to model the probable impacts. The current distribution of CRP enrollment, probable expirations, rental payments, ground cover, and prevailing commodity prices and costs will be incorporated into the updated inter-temporal economic models to estimate impacts on the rural economies and the Ogallala Aquifer.

How the objective will be met: First, a thorough literature review will be conducted. The brief literature for this proposal suggests that no comparable study on the Ogallala Aquifer region has been conducted. Data will be compiled from public sources and Freedom of Information requests will be filed with the FSA (no other study has attempted to use parcel level, contract specific data). Existing models that this team is very familiar with will be used to model the available data.

Expected Outcomes: We expect to generate unique research on the positive and negative economic impacts associated with retiring CRP contracts in Texas and Kansas. The results are anticipated to be applicable to other areas overlying the Aquifer.

Relevant Publications

Tsoodle, L., B.B. Golden, and A.M. Featherstone. "Factors Influencing Kansas Agricultural Farm Land Values." *Land Economics*. February, 2006. 82(1): 124-139.

Wheeler, E., B.B. Golden, J. Johnson, and J.M. Peterson. "Efficiency of Long-Term vs. Short-Term Water Rights Buyout." *Journal of Agricultural and Applied Economics*. Vol. 40(2): 493-501 (2008).

Literature Cited/References

Lubowski, Ruben N. Shawn Bucholtz , Roger Claassen, Michael Roberts, Joseph Cooper, Anna Gueorguieva and Robert Johansson. *Environmental Effects of Agricultural Land-Use Change: The Role of Economics and Policy*. USDA Economic Research Service. Economic Research Report No. (ERR-25) 82 pp, August 2006.

- Ribaudo, Marc O., et al. Natural Resources and Users Benefit from the Conservation Reserve Program. No. PB-90-167453/XAB; USDA/AER--627. Economic Research Service, Washington, DC (USA). Resources and Technology Div., 1990.
- Schaible, G. D. (1989), Irrigated acreage in the Conservation Reserve Program, Agric. Econ. Rep. 610, Econ. Res. Serv., Washington, D. C.
- Sullivan, P., D. Hellerstein, L. Hansen, R. Johansson, S. Koenig, R. Lubowski, W. McBride, D. McGranahan, M. Roberts, S. Vogel, and S. Bucholtz. "The Conservation Reserve Program: Economic Implications for Rural America." Agricultural Economic Report, 834, Economic Research Service, Washington, D.C. 2004. <http://www.ers.usda.gov/publications/aer834/>.
- U.S. Department of Agriculture. 2004. "ERS Report to Congress: Conservation Reserve Program Economic and Social Impacts on Rural Counties." Economic Research Service, Washington, D.C. Accessed May 20, 2015.
- JunJie Wu and Bruce Weber, Implications of a Reduced Conservation Reserve Program, The Council on Food, Agriculture & Resource Economics, July 2012.

Title: Implications of Continued Expansion of the Dairy Industry in the Southern Ogallala Region

Objective: Assess the sustainability of the expanding dairy industry by evaluating its effect on water use, forage demand, and business composition in the economy of the Southern Ogallala region.

Rationale/Literature Review/Conceptual framework: Growth in the dairy industry has been exponential in the Southern Ogallala Region where inventories grew from 41,500 head in 1990 to 466,000 head in 2009 (Guerrero et al., 2012). In the Texas High Plains, the escalation in inventory has been even more dramatic as numbers have increased from 16,800 head to 234,000 in a ten year period (2000 – 2010). These increases can be attributed to the building and expansion of two of the largest cheese plants in the country (Southwest Cheese in Clovis and Hilmar Cheese in Dalhart). Another expansion of at least one of these plants is underway, suggesting dairy inventories will continue to rise in the area for the foreseeable future. Dairies rely on forages, silage in particular, which must be grown relatively close to the dairy due to moisture content (Amosson et al., 2010). In contrast, most other types of confined livestock operations require more feed grains that can be imported. This suggests that the relative water use by dairies per animal unit is significantly higher. In addition, the conversion of irrigated land that was initially used to grow grain to silage/forage production to support dairies has and/or will lead to a change in business composition within the area which may affect the economy.

How the objective will be met: The Texas High Plains will be used as the study area. Data from NASS and FSA will be utilized to track changes in dairy inventories and crop composition which will be used to determine associated water use from the pre-expansion period to current years. Data from County Business Patterns corresponding to the same time period will be utilized to analyze changes in business composition for the area. Multiple regression analysis or similar appropriate techniques will be used to determine the predictive relationship between inventory numbers and water use, crop mix, and business composition. Projected growth rates identified in the regional water plan (Freese and Nichols Inc., 2015) will then be utilized to project changes in water use; crop & business composition 10, 20, and 30 years in the future. In addition, a sensitivity analysis will be performed with varying expansion rates.

Expected Outcomes: An estimation of the impact that growing dairy inventories will have on crop composition, water use, and business composition including type, employment, and income will be reported.

Relevant Publications/Literature Cited/References

- Guerrero, B., S. Amosson, and E. Jordan. 2012. "The Impact of the Dairy Industry in the Southern Ogallala Region." B-6252, Texas A&M AgriLife Extension Service, College Station, Texas.
- Amosson, S., B. Guerrero, J. Smith, J. Johnson, P. Johnson, J. Weinheimer, L. Almas, and J. Roberts. 2010. "Water Use by Confined Livestock Operations and Ethanol Plants in the Texas High Plains." Texas AgriLife Extension Service, Texas Tech University, and West Texas A&M University. 31 pp.
- U.S. Department of Commerce, Bureau of Census. "Texas County Business Patterns", U.S. Department of Commerce, Bureau of Census.
- Freese and Nichols Inc., LBG – Guyton Associates, Inc. and Texas A&M AgriLife – Amarillo. "Draft - Initially Prepared Regional Water Plan for the Panhandle Water Planning Area." April, 2015. <http://www.panhandlewater.org/>

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. Tillage and cattle grazing effects on soil properties and grain yields in a dryland wheat-sorghum-fallow rotation (Baumhardt et al. 2011).
- b. One of the following:
 - a. Limited water production: corn versus sorghum (IPM 12.08)
 - b. Alternative crop rotations with limited irrigation (PS 12.02)
 - c. Cover crops for Texas High Plains (PS 12.07)
 - d. 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 analysis 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

Baumhardt, R. L., R. C. Schwartz, J. C. MacDonald, and J. A. Tolk. 2011. "Tillage and cattle grazing effects on soil properties and grain yields in a dryland wheat-sorghum-fallow rotation." *Agronomy Journal* 103(3):914-922.

Schedule:

	1 st Qtr CY16	2 nd Qtr CY16	3 rd Qtr CY16	4 th Qtr CY16	1 st Qtr CY17	2 nd Qtr CY17	3 rd Qtr CY17	4 th Qtr CY17
1. Title - Economic impact of selected water conservation policies in Texas								
Data collection								
Policy analysis								
Validate results, publish & distribute								
2. Title - The Potential Economic Impacts of Retiring CRP Contracts on the Southern Ogallala Region								
Data collection								
Data analysis								
Validate results, publish & distribute								
3. Title - Implications of Continued Expansion of the Dairy Industry in the Southern Ogallala Region								
Data collection								
Analysis								
Validate results, publish & distribute								
4. Title – Economic analysis of experimental results								
Data collection								
Economic analysis of experimental results								
Validate results, publish & distribute								