Pre-Proposal Application Form
2016–2017 TWRI Graduate Student Research Programs

1. Assessing crop yields under climate change and decadal climate variability in the High Plains: impacts and adaptation strategies

2. Student Contact:
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4. Abstract

   Agriculture in the High Plains of Texas is highly reliant on water resources from the Ogallala Aquifer. Due to high demand, water levels in the aquifer are declining. Climate change is expected to lead to further declines in available water. Decadal climate variation is an understudied driver in climate and thus, water resources. Using econometric techniques and regional agricultural models, this research proposes to consider the impacts of decadal climate variation and climate change on water availability in the Ogallala Aquifer and the subsequent impacts on crop yields. Based on results, the project will consider a discussion of applicable adaptation strategies. Results and adaptation strategy discussion will then be used to show the economic impact of these climate drivers on agricultural crops. This research could then be used by policymakers and users to address and anticipate future changes to water availability based on climate change.

5. Description of the student’s proposed research

   The Ogallala Aquifer is the primary source of water supporting agricultural in the High Plains region of Texas which yields high economic gains from production of crops such as cotton, wheat, sorghum, and corn (“County Estimates Thematic Map”). Due to increased pumping for agriculture, water levels in the aquifer have declined and are expected to continue to decrease under increased demand and climate change (Vaughan, E. G., et al, 2012). Climate change is expected to cause changes to temperature and precipitation patterns and increase the frequency of drought conditions (Walthall, C. L., et al, 2012). For crop production in the region, these factors lead to substantial estimated losses in economic activity and agricultural production (Johnson, J. W., et al., 2010; Wagner, 2012).

   An unstudied system driver is decadal climate variation (DCV) and its interaction with climate change will alter water availability and ultimately crop productivity. DCV, such as the well-known El Nino-Southern Oscillation, describes multi-year or multi-decade climate interactions which
cause known changes to temperature and precipitation. Documented research on the interaction of DCV and agricultural systems is relatively recent with few sources citing the economic and agricultural impact of DCV—and even fewer showing the combined impact of DCV and climate change (Ding and McCarl, 2014; Mehta, V.M. et al., 2012).

This project seeks to expand current research on water resources in the High Plains to model the impact of climate change and DCV on crop yields. Current literature on water availability in Texas under climate change does not provide specific estimates for crop loss due to changes in water availability under climate variations in the High Plains. Others have worked to estimate the impact of climate change and DVC on crop yields but in other geographic regions. The outcome of the research will be estimated economic impacts as a result of changing water availability. The final product will also include a discussion of possible adaptation strategies under modeled water availability. The project will undertake the following activities under the preliminary timeline:

1) Literature review of climate variability (spring 2016)—a detailed literature review to include but not be limited to: DCV, climate models, hydrology of region, previous water availability studies.

2) Data gathering and specification summer 2016)—the research will rely on climate data from the region, crop yields and other agricultural data.

3) Model specification and results (late summer/fall 2016)—using existing models that simulate the impact of climate on crops for the region the research will be able to show the estimated impact of climate on water availability and thus crop production. The introduction of updated datasets and the inclusion of DVC data will provide more accurate and specific predictions.

4) Report writing (winter/end of grant)—dissemination of results and research into applicable adaptation strategies will be considered and reported.

When complete, this research will provide detailed predictions of the impact of climate drivers on crop yields. Coupled with a discussion adaptation strategies and economic impacts, the research might then be useful to policymakers, users, and other parties invested in managing water resources in the region and adapting to climate change predictions.

Sources


6.
B.A. Wellesley College (2012) in Economics and Environmental Studies (double major)
PhD Texas A&M University (expected 2018) in Agricultural Economics

Please see attached unofficial transcripts which include detailed lists of graduate coursework not limited to classes in: renewable resource economics, non-renewable resource economics, econometrics, advanced econometrics, and operational research methods in agriculture.

7.
After graduation, I intend to pursue a career providing research, analysis, and technical expertise on agricultural production in either the public or private sector. I am drawn to research projects which have a direct connection to agricultural systems and livelihoods. Agriculture’s dependence on water resources and expected changes to water availability under climate change suggests limitless future projects examining the anticipated impacts to food production.