Comparing Results of Irrigation Water Demand Forecasting from Three Southern States

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Introduction

Over the years, farmers in the southern/southeastern United States have faced issues such as drought conditions, pest and diseases outbreak, and low crop prices due to competition. These have affected the profit margin for farmers in the region. Available data from U.S. Drought Monitor (2012) on assessment of recent conditions and drought status in the region from the National Oceanic & Atmospheric Administration show that 27.4% of the region's land area is in "extreme" drought conditions. Another 30.6% of the area has come under "severe" drought.

With drought conditions on the rise, policymakers and farmers are interested in combating water shortages. Forecasting irrigation water demand has become an increasingly higher priority for achieving sustainable water conservation and proper allocation. A model is proposed that incorporates water usage, since different crops require different amounts of water for their proper growth, and so the crop mix affects water demand in differing degrees.

Accordingly, the 1995 comprehensive study conducted by the U.S. Department of Agriculture – Natural Resources Conservation Services (USDA-NRCS) on agricultural water demand in the ACT/ACF River Basins shows that 67% of the total water withdrawn was for crop production. Despite the large withdrawal from the basins, it is unknown precisely how much water agriculture uses on a crop-by-county basis. Information on a crop-by-county basis facilitates a better, clearer, and more precise understanding of future irrigation water demand.

Problem Statement and Importance of Work

A major problem encountered by farmers in this region is low crop yield. This is due to varying factors, of which drought condition is one. According to Kevin (2007), due to intense dry weather conditions, farmers do not only experience their crops wither and die, but also *hopes* for sustainable crop yield. A possible solution would be to adopt the model of forecasting irrigation water demand conducted in the three states of Alabama, Georgia, and Mississippi.

These forecasting studies demonstrate the strength of econometric modeling vis-à-vis physical methods and are important to equip policymakers and farmers with better tools that devise programs and government policies to help conserve water under severe droughts in the region.

Additionally, another importance of this work is to produce immediate outcome to address the Alabama, Florida, and Georgia tri-state water allocation issues. In the long run, our study will provide a viable source of information necessary for successfully combating drought, water allocation and conservation issues.

Research Objectives

1. Develop a method of better forecasting agricultural water demand for irrigating some of the major crops (such as corn, cotton, soybeans, rice, and peanuts) in AL, GA, and MS.
2. Compare and contrast results among the three states (AL, GA, and MS).

Data and Methods

This study presents acreage forecasts using a land allocation model to estimate irrigation water demand one year ahead (CRB, 2009; FAPRI, 2012; Greene, 1997; USDA-ERS, 2012; USDA-NASS, 2012; USGS, 2012a-c). These forecasts are then combined with the crop-and region-specific Blaney-Criddle (BC) coefficients (USDA-SCS, 1970) of net irrigation water requirements (in AL and GA) and relevant water use data (in MS) (YMD, 2012). The land allocation model is based on portfolio analysis that combines measures of risks and returns, but also allows for agronomic and other influences.

Two economic methods – a simple statistical method and an alternative method using futures prices and a modified weighted average of past yields (Holt, 1999) – were employed to generate prices and yield expectations. The better of the two methods, based on the "root mean square error" criterion, was used in the land allocation model to generate measures of risks and returns. The model was applied to analyze programs such as one used in Georgia to conserve agricultural water use by taking bids from farmers to reduce irrigated acreage (FRDPA, 2001). Therefore, a method of evaluating the water needs of different crops and the value of water to each crop would provide agricultural producers with valuable information (Banerjee et al., 2007).

Major Results and Implications

Results from this analysis shows that forecasting studies based on this method in Georgia and Alabama (for surface water in the Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) River Basin region) demonstrate the relative strength of econometric modeling vis-à-vis physical methods. Results for Mississippi (for ground water in the Mississippi River Valley Alluvial Aquifer in the region immediate east of the Mississippi River) verify the robustness of those findings. Results from policy-induced simulation scenarios indicate water savings of 19%-27% using the innovative method developed. Though better irrigation water demand forecasting in crop production was the key objective of this pilot project, conservation of a valuable natural resource (water) has turned out to be a key consequence. Furthermore, the method developed herein will allow policymakers to more accurately calibrate acreage reduction programs to meet targeted levels for reductions in irrigation water use.

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