Report as of FY2007 for 2005CO115B: "Colorado's Evolving Irrigated Agriculture: Economic Accounting Impact Analysis"

Publications

- Water Resources Research Institute Reports:
  - Thorvaldson, Jennifer and Pritchett, James, 2006, Economic Impact Analysis of Reduced Irrigated Acreage in Four River Basins in Colorado, Completion Report 207, Colorado Water Resources Research Institute, Colorado State University, Fort Collins, Colorado, 48 pp.
- Other Publications:
  - Thorvaldson, Jennifer and Pritchett, James, 2006, Economic Impact Analysis of Reduced Irrigated Acreage in Four River Basins in Colorado, Colorado Water Newsletter of the Water Center of Colorado State University, April/May 2007, Colorado Water Resources Research Institute, Colorado State University, Fort Collins, Colorado, 20-22 pp.

Report Follows

Economic Impacts of Reduced Irrigated Agriculture in Eastern Colorado: A Summary of Three Studies

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Irrigated agriculture is a primary water user in the West, but rapid population growth is driving a reallocation of water use. As Colorado's population grows, water will shift from agriculture to municipal and industrial (M&I) uses. Indeed, it is expected that 428,000 acres of irrigated farmland will dry up to meet future needs (Colorado Water Conservation Board, 2004), and these estimates may be quite conservative (Smith, 2005). In addition, evolving legal institutions and groundwater depletions have significantly decreased available irrigation water and have reduced irrigated cropland.

Initial Research: *Colorado's Evolving Irrigated Agriculture: Economic Accounting and Impact Analysis*

The primary goal of this research project was to estimate the short-term regional economic impacts associated with a reduction in irrigated agriculture as a result of increasing population and urbanization in Colorado. The study involved four river basins in eastern Colorado (the Arkansas, Republican, Rio Grande, and South Platte basins). Each basin was analyzed separately because of the unique economic base and idiosyncratic water demand/supply conditions in each basin. Specific outcomes included:

- Establishment of economic demographics for each basin, including a description of irrigated agriculture's contribution to the local economy.
- Development of an Input-Output (I-O) model for each basin, representing the financial interactions between all of the sectors in that basin's economy.
- "Shocking" each I-O model to approximate the short-term economic effects of a reduction in irrigated agriculture. Acreage reductions were based on projected population growth and were provided by the SWSI report publicly released in December 2004. All formerly-irrigated acres were assumed to be fallowed, with the original crop-mix being maintained (i.e., acres were assumed to be taken out of irrigation proportionately). A summary of the output impacts can be seen in Table 1.
- Multiple outreach presentations to stakeholders, a presentation in the CSU Department of Agricultural and Resource Economics seminar series, and a presentation to the annual Western Agricultural Economics Association meetings in Anchorage, Alaska.
- Four fact sheets published on the Colorado State University website and a Completion Report (# 207) published on the CWRRI website and in print.
- A Master's thesis.

Table 1: Output Impacts by Basin

Basin	Estimated Acres Lost	Total Economic Impact	Impact as % of Total Output	Impact as % of Agriculture	Impact as % of Irrigated Crop Sales	Economic Activity per Acre
East South Platte	159,500	-$110,065,962	1.02%	3.20%	13.87%	$428
East Arkansas	47,500	-$20,333,467	0.12%	5.64%	52.28%	$690
Republican	20,000	-$13,550,801	0.43%	0.82%	2.08%	$678
Rio Grande	80,000	-$98,783,450	3.95%	8.16%	8.72%	$1,235

Current Research: *Some Economic Effects of Changing Augmentation Rules in Colorado's Lower South Platte Basin: Producer Survey and Regional Economic Impact Analysis*

The previous research project focused on building the capacity to examine the economic contribution of irrigated agriculture, and then quantifying the economic impacts of reduced irrigated acres due to the growth and urbanization of Colorado's population, based on the forecasts from SWSI. It focused on four basins in eastern Colorado, where the majority of the state's agricultural production takes place and where the majority of water transfers are expected to originate. Economic demographics have been established in each basin for building the appropriate model, resulting in a baseline value for the impacts in each basin.

The current project focuses on agricultural producers in the Lower South Platte (LSP) basin[1] that had GASP wells. To fine-tune the model and estimates from the initial study, the current project began by administering a survey of these producers to better gauge producers' responses to the increasingly limited water supply in Colorado. Thus, rather than assuming that all formerly-irrigated land is fallowed and that cropping patterns remain unchanged, the survey provides more-precise estimates of changing acreages and cropping patterns. As irrigated acres are reduced, different cropping patterns may result, suggesting alternative impacts to the regional economy. For instance, the impact will likely be greater if the lost irrigated acres are all converted to grassland (i.e., taken out of production) than if they are converted to dryland crops (those reliant on rainfall). Furthermore, if the acres are all converted to dryland crops, the magnitude of the impact will depend on which dryland crops are chosen (e.g., winter wheat vs. sunflowers), as each of these crops will bring in varying amounts of revenue and will require different inputs from local agribusiness. Specific objectives include:

- Development of an Input-Output (I-O) model for the LSP basin, representing the financial interactions between all of the sectors in the regional economy.
- "Shocking" the I-O model to approximate the regional economic effects of changes in irrigated agriculture based on two scenarios:
    1. The high-end scenario assumes acreages change exactly as estimated by the survey.

[1] For the purposes of this study, the Lower South Platte Basin is defined as Logan, Morgan, and Sedgwick counties.

2. The low-end scenario makes the assumption that the high-valued crops taken out of production by GASP farmers are replaced elsewhere in the LSP basin by farmers that have irrigation sources other than GASP wells. These non-GASP producers are assumed to replace some of their lower-valued crops with the higher-valued crops, such that the *net* loss of acreage in the LSP is the same as estimated by the survey but the lost acres are composed of lower-valued crops.

- Multiple outreach presentations to stakeholders and a presentation in the CSU Department of Agricultural and Resource Economics seminar series.
- A fact sheet published on the Colorado State University website and a Completion Report published on the CWRRI website and in print.

Preliminary results (as of yet unpublished) are shown in Table 2.

Table 2: Output Impacts by Scenario

Scenario	Acreage Change	Total Impact	Impact as % of Total Output	Impact as % of Agriculture	Impact as % of Irrigated Crop Sales	Economic Activity Generated by Lost Acres
High-End	-29,190	-$28,209,654	0.8%	3.4%	18.7%	$966.42 / ac.
Low-End	-29,190	-$10,752,816	0.3%	1.3%	7.1%	$368.37 / ac.

Forthcoming Research: *Preparing for Drought: A Survey of Producer Adoption of Limited Irrigation Practices and Dynamic Optimization of Limited Irrigation Cropping Patterns*

In the West, the economic sustainability of agricultural producers is tightly woven with water availability. Irrigation is an important risk-reducing input that shelters farm income from drought and boosts crop yields. In addition, irrigation permits farmers to produce crops that otherwise could not be grown competitively in our semi-arid environment. As irrigation was developed, farms generated important economic activity for rural communities and regional economies.

Irrigated agriculture is a primary water user in the West, but rapid population growth is driving a reallocation of water use. As Colorado's population grows, water will shift from agriculture to municipal and industrial (M&I) uses. Indeed, it is expected that 428,000 acres of irrigated farmland will dry up to meet future needs (Colorado Water Conservation Board, 2004), and these estimates may be quite conservative (Smith). In addition, evolving legal institutions and groundwater depletions have significantly decreased available irrigation water and have reduced irrigated cropland.

Specific objectives of this research project include:

- Analyzing the feasibility and profitability of potential irrigation systems. In particular, comparing cropping systems according to the ability to meet a financial need is central to farmers' ability to make strategic cropping decisions.

- Estimating current and future adoption rates of such systems and the resulting changes in cropping patterns and irrigated acreages.
- Using the adoption rate estimates, provide initial examination of the impact of changing cropping patterns on regional economies.

The procedure begins by calculating whole farm net returns based on different cropping patterns and irrigation systems. These financial data will be presented to agricultural producers in eastern Colorado, after which a survey of these same producers will be administered to gauge the adoption rates of limited irrigation practices and any corresponding changes in cropping patterns. The IMPLAN software will then use the most recently available data to create an Input-Output (I-O) model for each of the major water conservation districts in eastern Colorado. The baseline I-O model will be used to gauge irrigated agriculture's relative importance to rural communities in the study area and the spillover effects that irrigated agriculture's sales create for local economies. The changes in cropping patterns and irrigated acreage estimated by the survey will then be used to "shock" the I-O model in order to estimate the economic impacts of these changes on regional economies. Significant economic effects will result as cropping patterns evolve from full irrigation to innovative cropping systems and dryland agriculture.