The Economics of Conservation

Dr. Bill Golden (Kansas State University)
Dr. Bridgett Guerrero (West Texas A&M)

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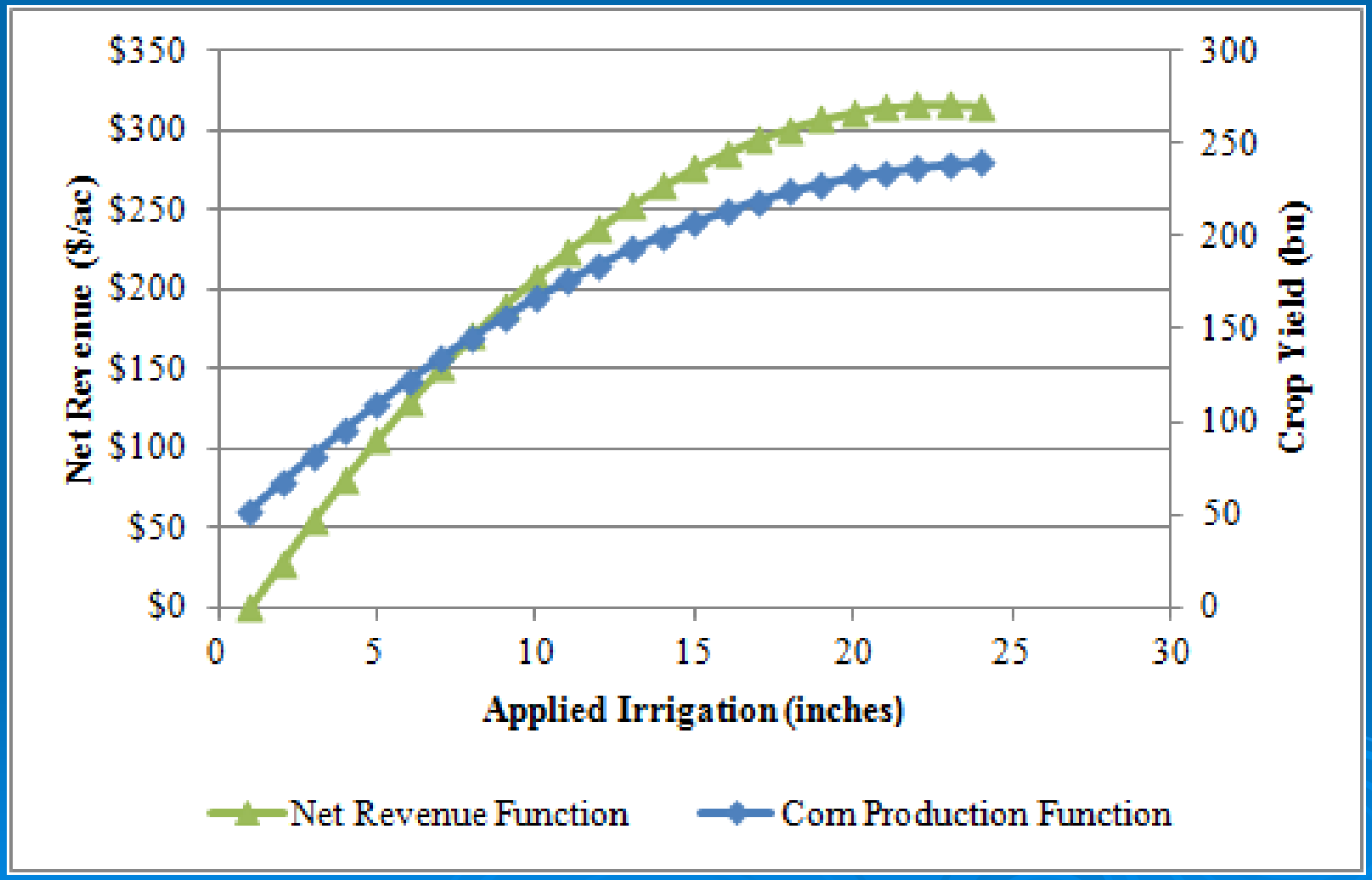
Big Question

- What happens to producer income as we reduce groundwater usage?
- Past evidence is not consistent !!!

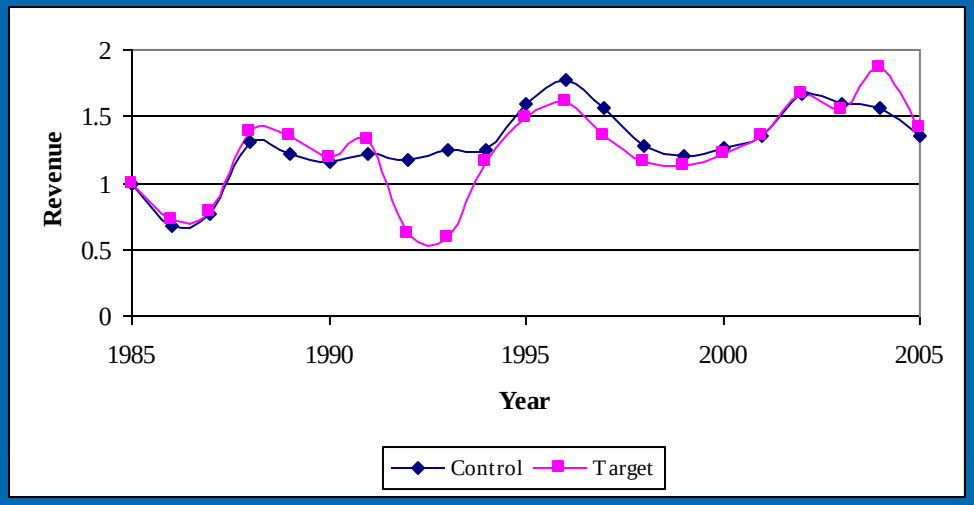
What We Think We Know



Example from Southwest Kansas. Both curves exhibit diminishing marginal returns to applied groundwater. Curves vary by crop, location, precipitation, and time

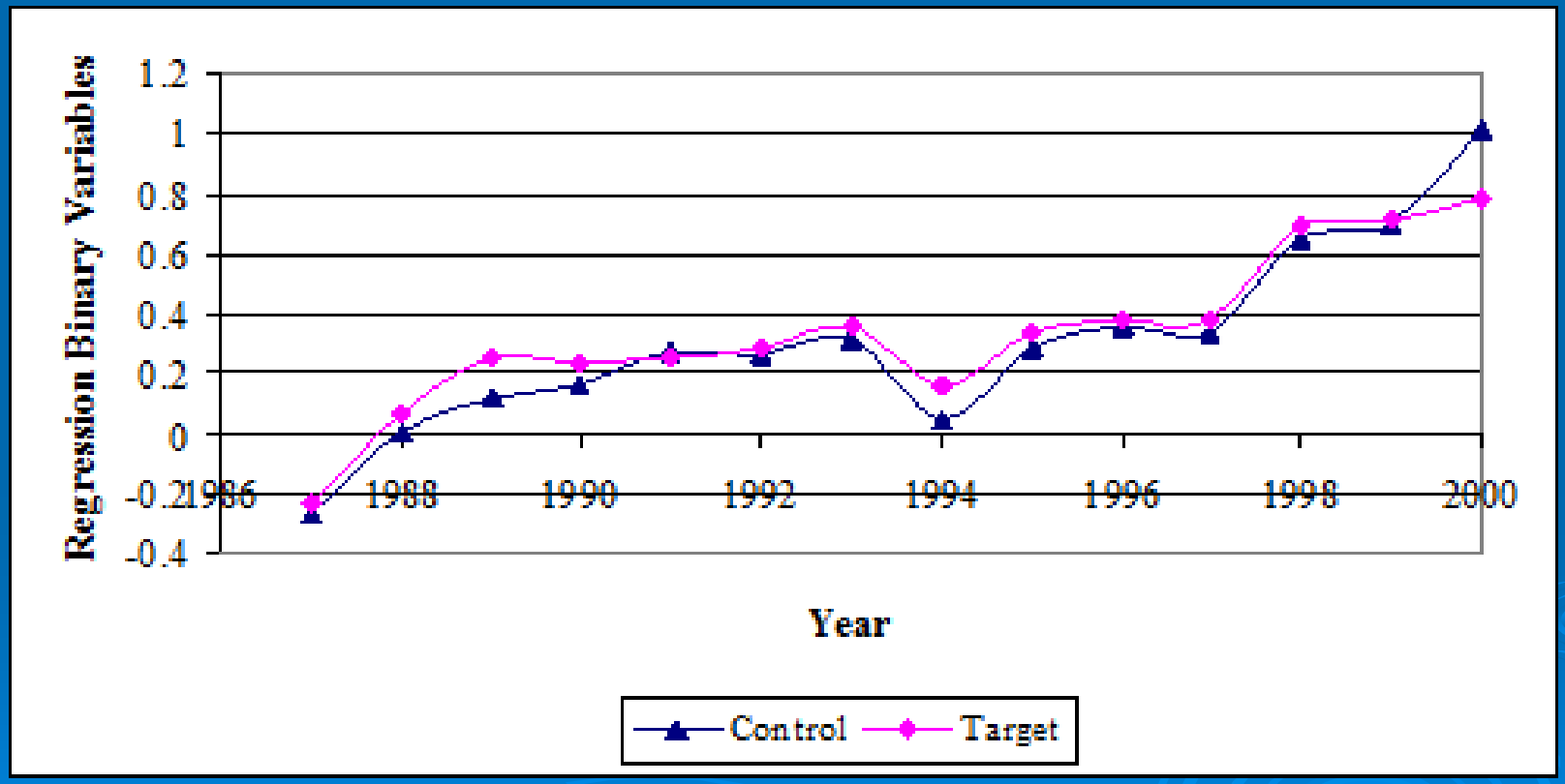
What We Have Observed: Wet Walnut Creek IGUCA: Irrigated Crop Revenue

Figure 6. Time Series Comparison of the Indexed Values of Irrigated Crop Revenue

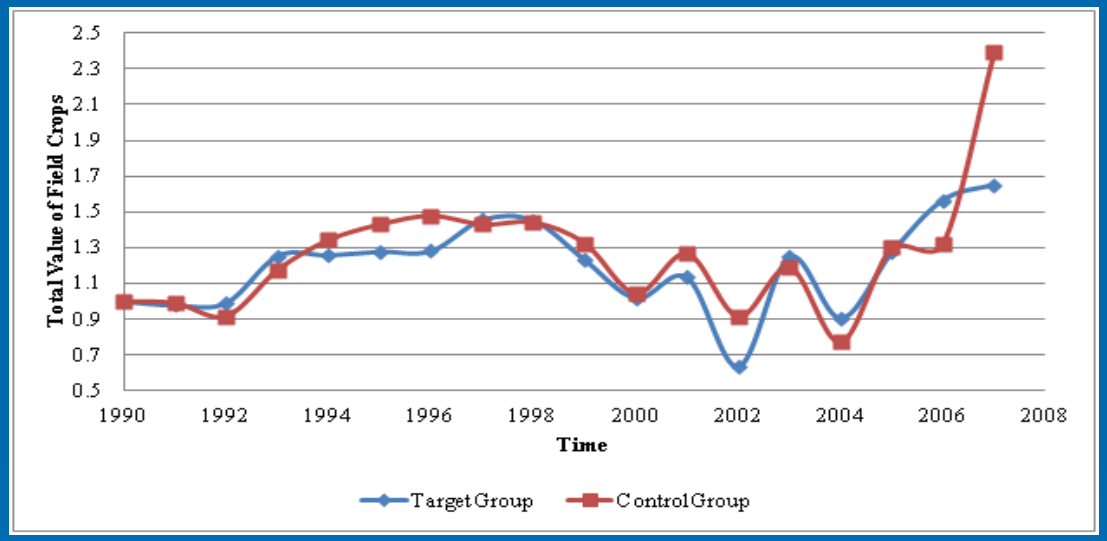


- Statistically significant short-run and a statistically insignificant long-run reduction in annual irrigated crop revenue.

What Happened to Land Prices?



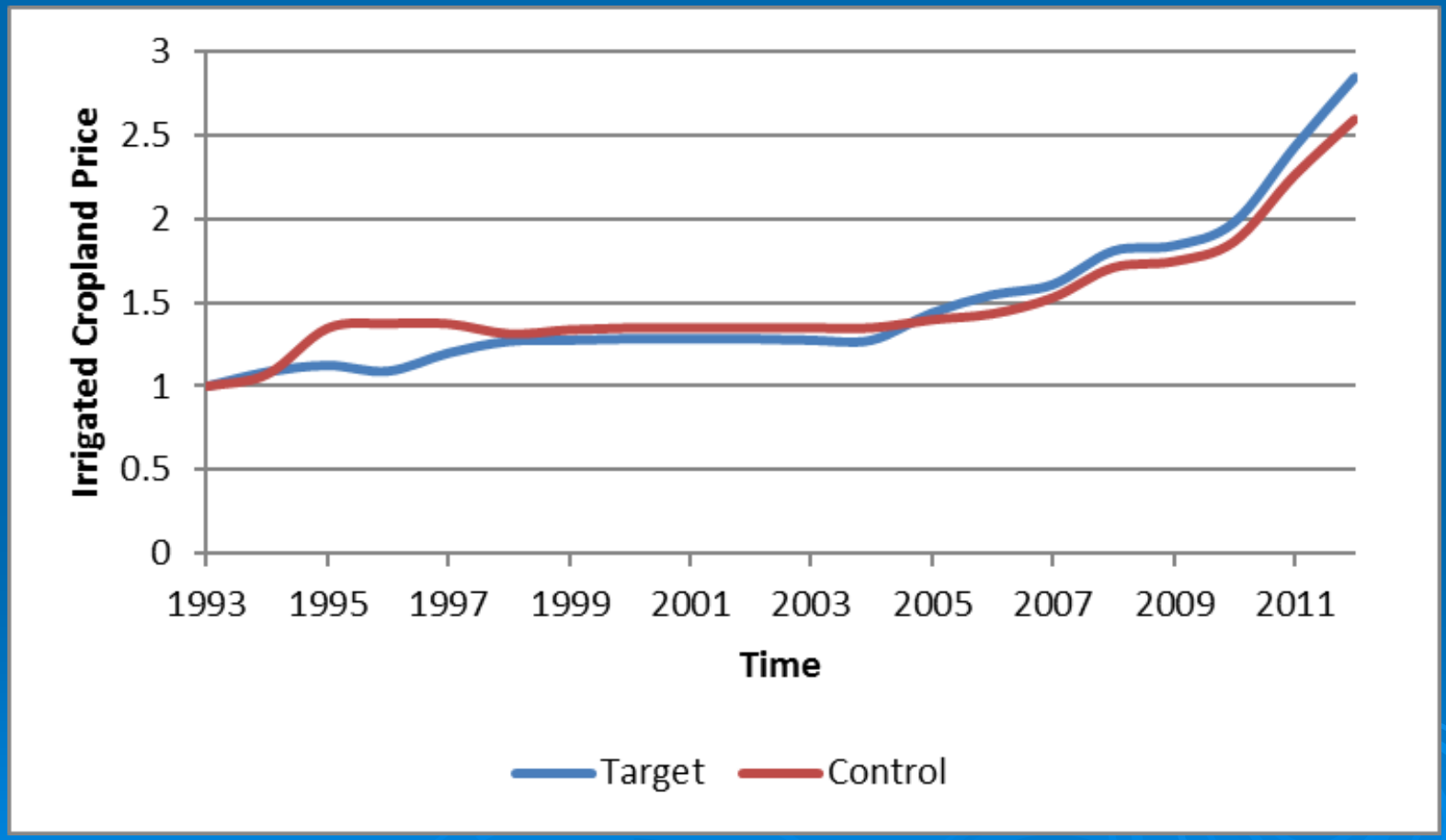
What We Have Observed: West Central Kansas



- No statistically significant reduction in the annual total value of all crops.

Source: www.ipsr.ku.edu

What Happened to Land Prices?



Since the Evidence is Not Consistent

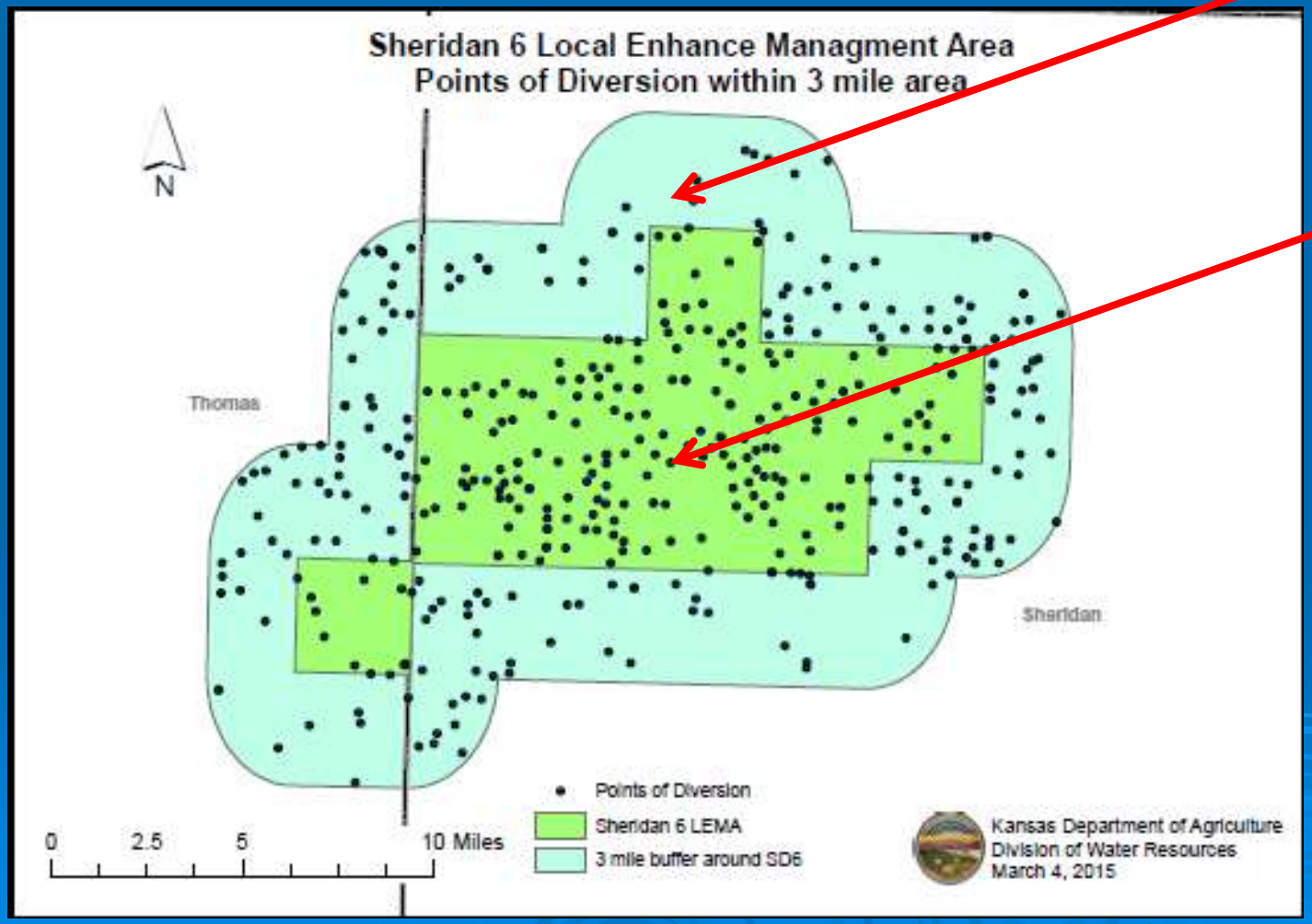
- We need to monitor irrigated acreage and water use in Sheridan #6 LEMA in real time. Will producers:
  - Shift acres to dryland production
  - Maintain crop mix and reduce water use per acre
  - Shift to crops that require less water
- What are the economic consequences of these changes

Research Question

- How did the production decisions the producers inside the LEMA made, compare to the production decisions the producers outside the LEMA made

- This is a 5 year study. We have 3 years of data.

Sheridan #6 LEMA

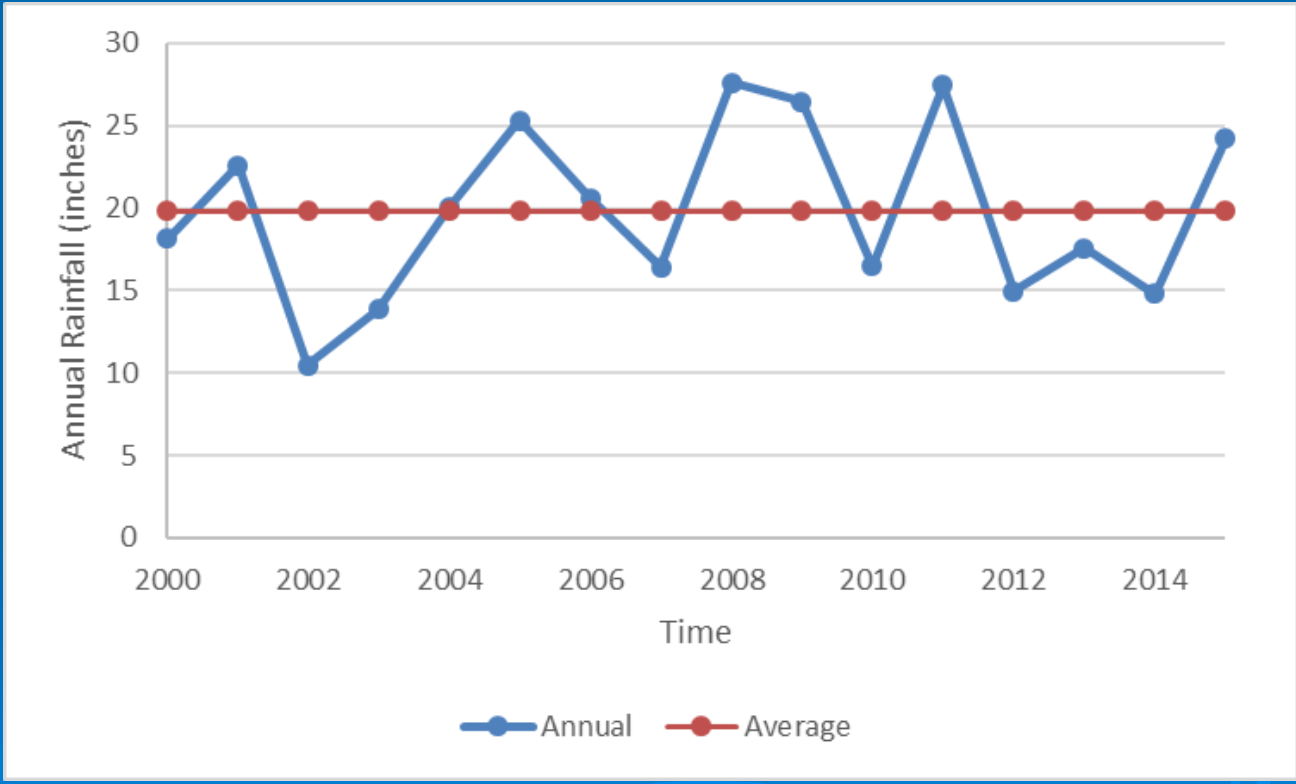


Control Area

Target Area

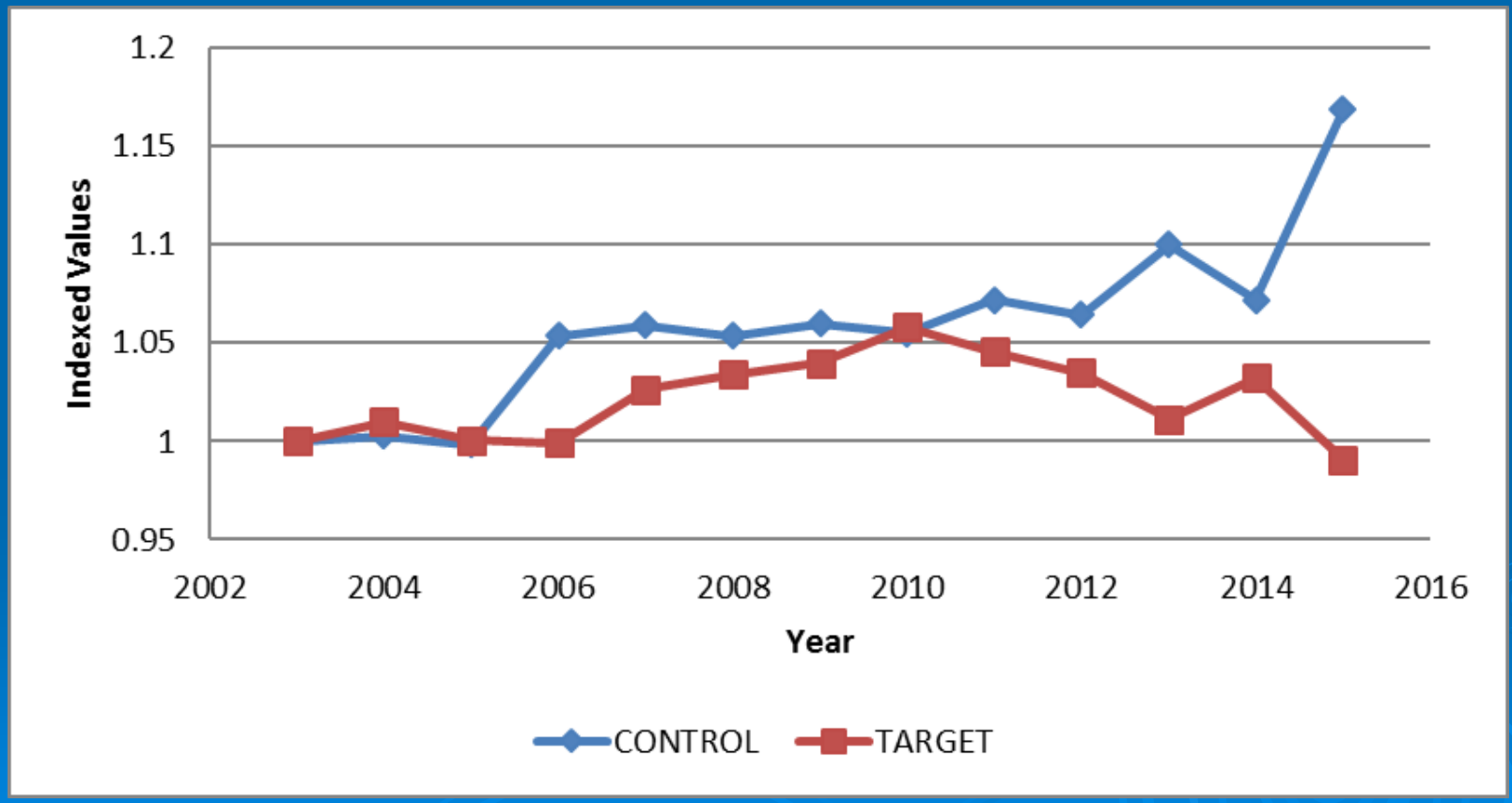
Results

Rainfall



Results

Total Irrigated Acreage (all crops)

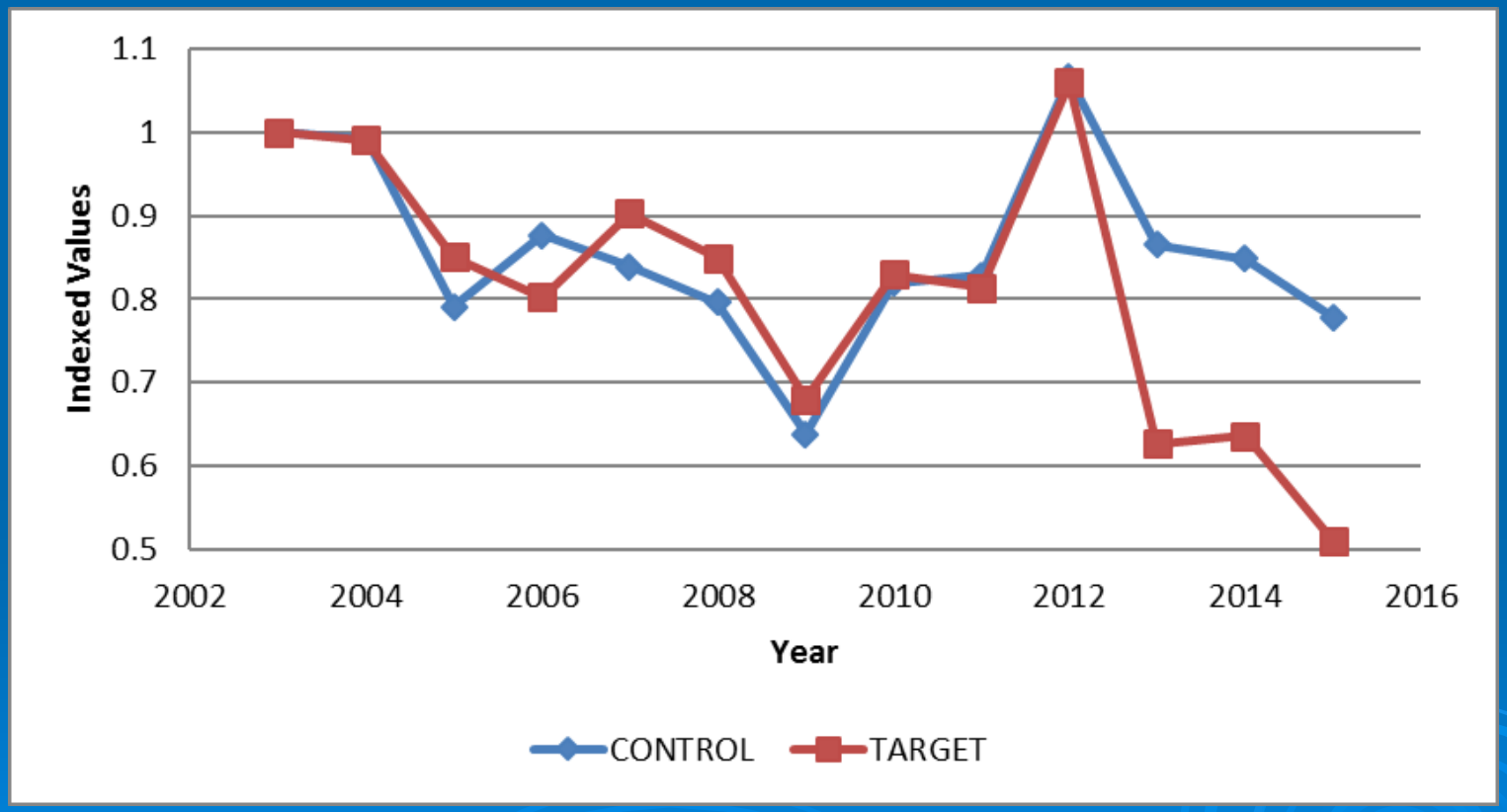


Approximately 8.5% reduction; statistically significant

Based on KDA water use reports

Results

Total Water Use (all crops)

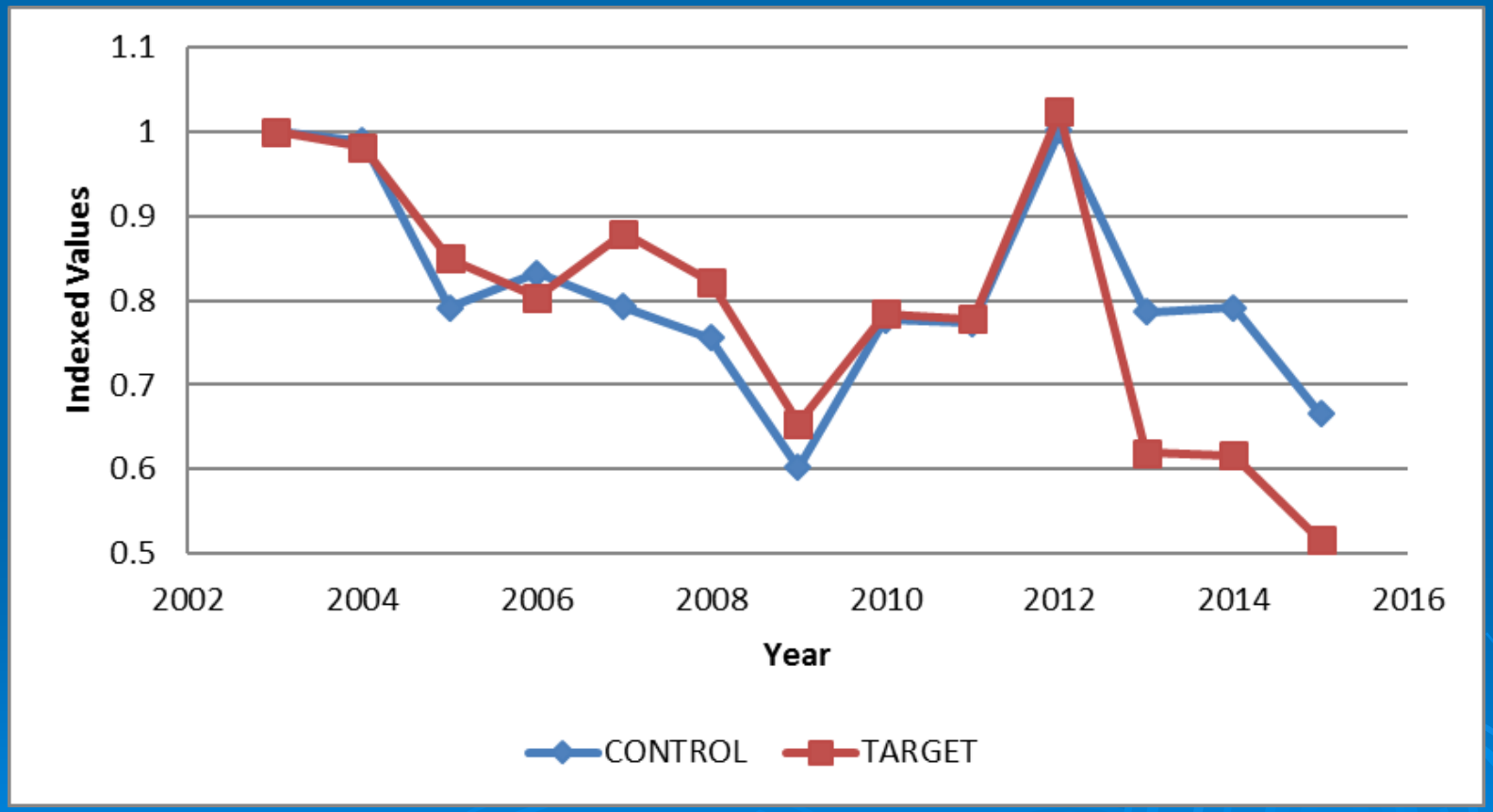


Approximately 25.3% reduction; statistically significant

Based on KDA water use reports

Results

Average Water Use per Acre (all crops)

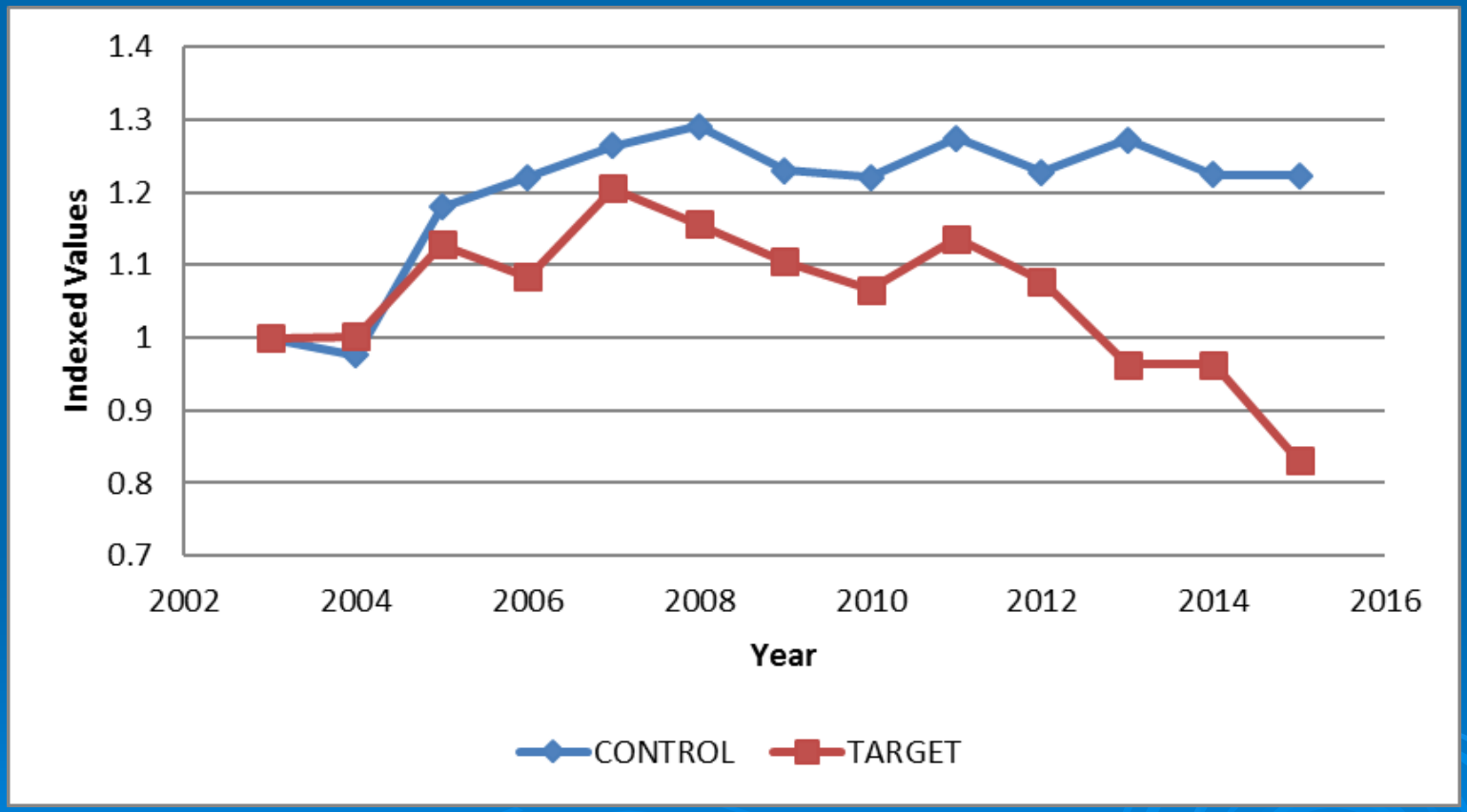


Approximately 19.0% reduction; statistically significant

Based on KDA water use reports

Results

Total Irrigated Corn Acreage

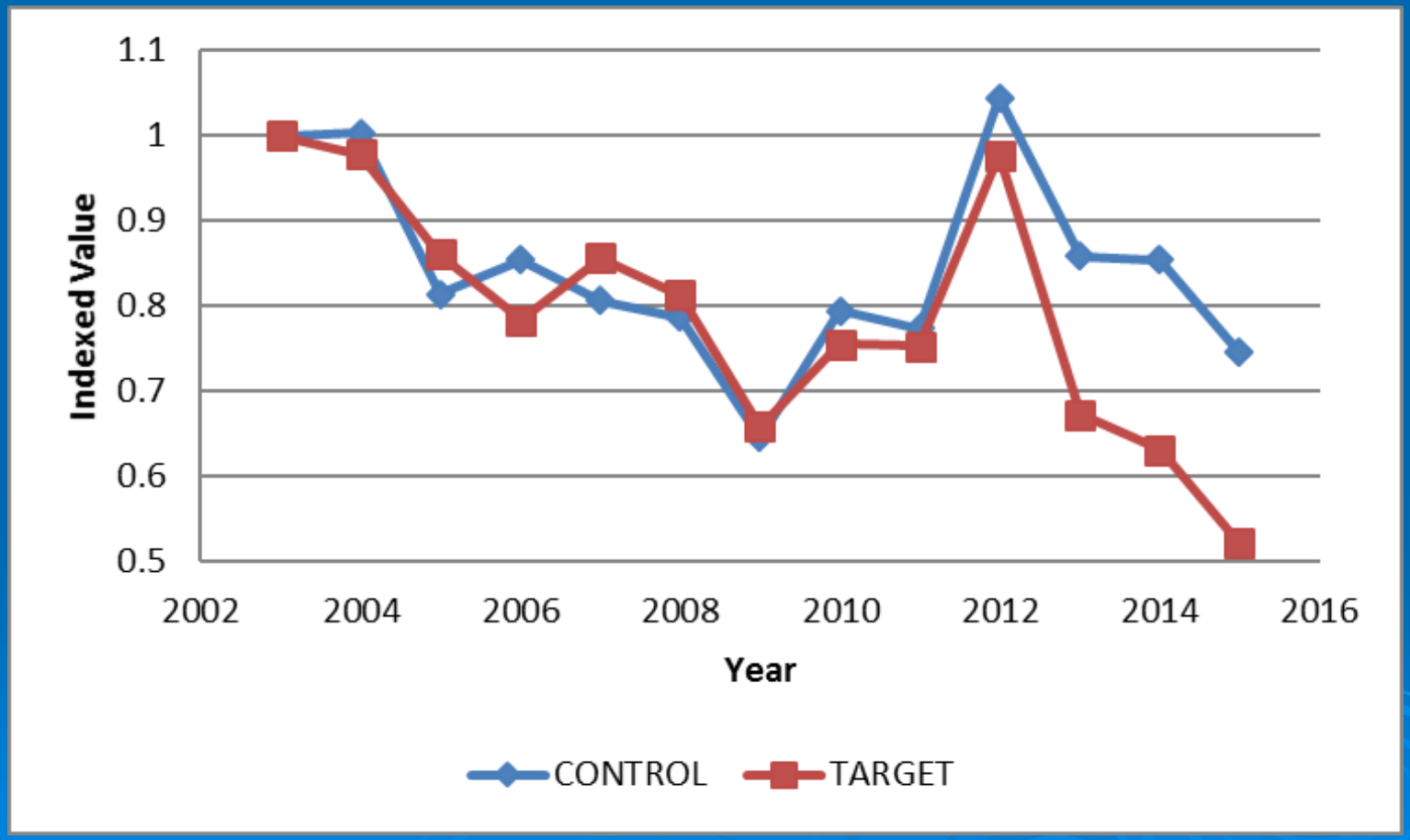


Approximately 22.8% reduction; statistically significant

Based on KDA water use reports

Results

Irrigated Corn Acreage Water Use

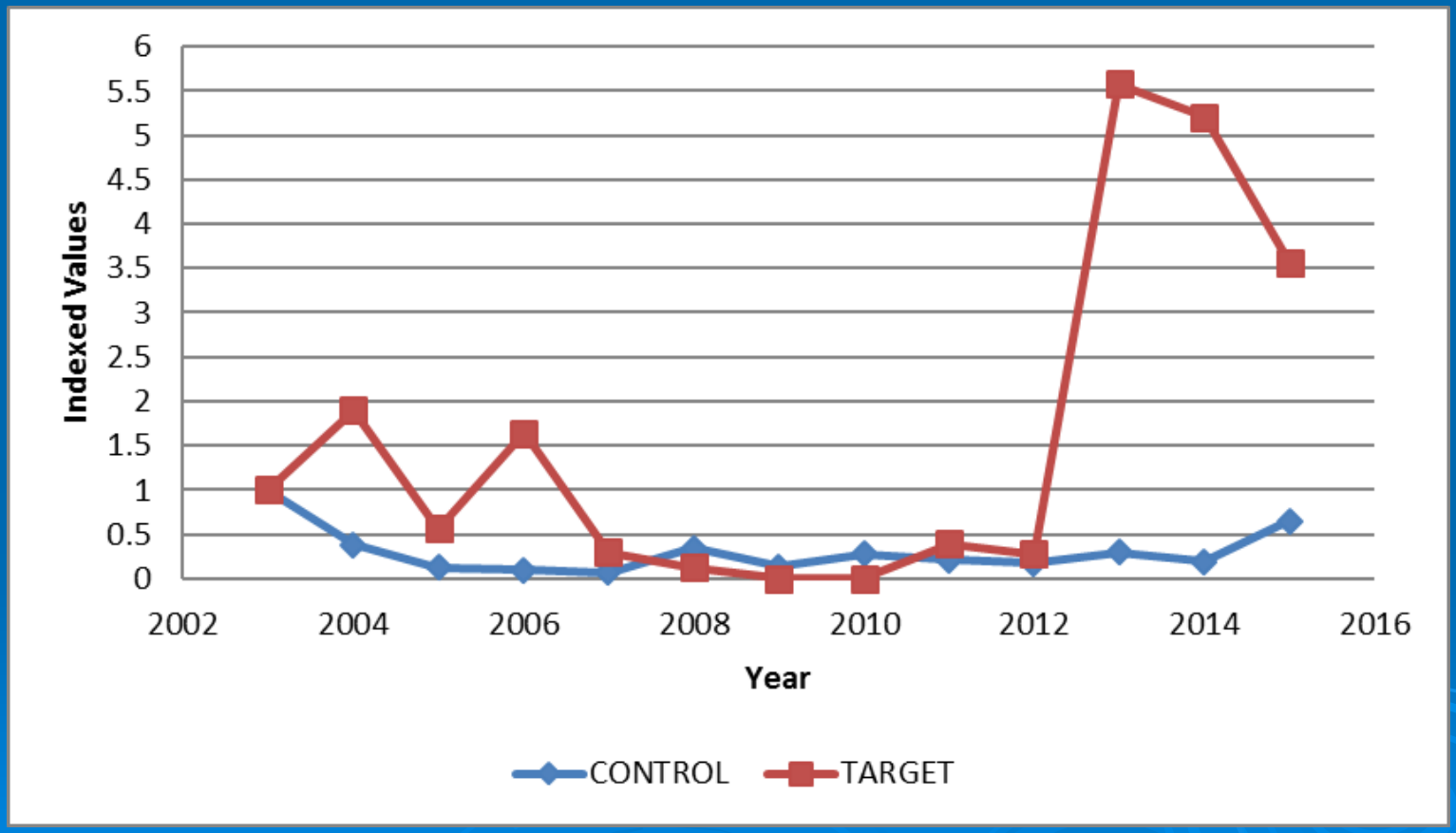


Approximately 20.2% reduction; statistically significant

Based on KDA water use reports

Results

Total Irrigated Sorghum Acreage



Approximately 400.6% reduction; statistically significant

Based on KDA water use reports

2013 Economic Results

Item	Observations	Water Use (in/ac)	Yield (bu/ac)	Cash Flow ($/ac)	Cash Flow ($/in)
Corn Weighted Average - Inside LEMA	6	11.1	198.0	$403	$36
Corn Weighted Average - Outside LEMA	4	13.8	211.6	$397	$29
Sorghum Weighted Average - Inside LEMA	2	4.1	152	$434	$107
Sorghum Weighted Average - Outside LEMA	0	NA	NA	NA	NA
Soybeans Weighted Average - Inside LEMA	2	10.3	63.8	$418	$41
Soybeans Weighted Average - Outside LEMA	2	11.3	68	$412	$36

- Cash Flow = Revenue less variable expenses less land rent
- This is not a statistically valid sample
- This table may change as new producer financial data is obtained

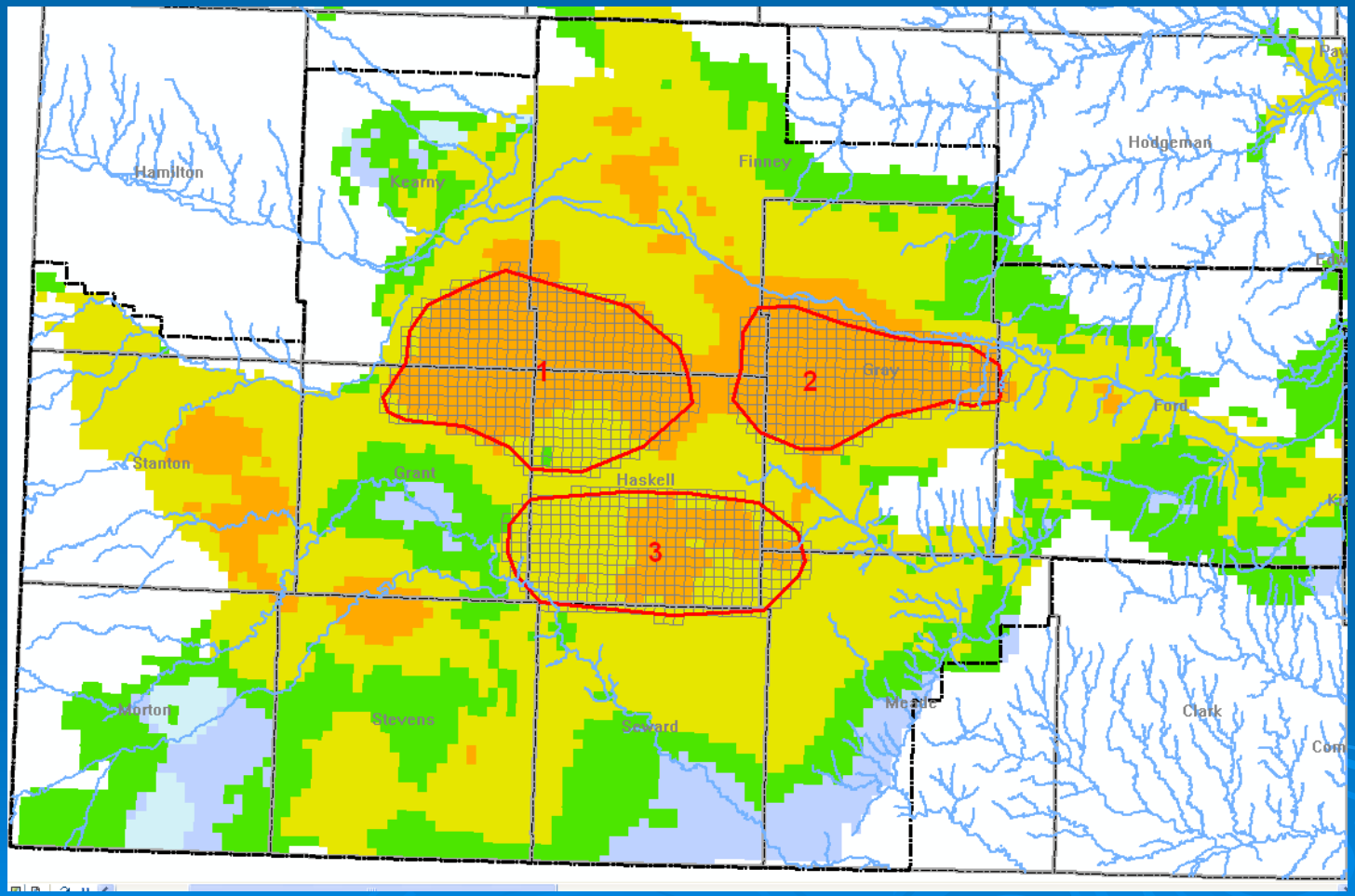
2014 Economic Results

Item	Observations	Water Use (in/ac)	Yield (bu/ac)	Cash Flow ($/ac)	Cash Flow ($/in)
Corn Weighted Average - Inside LEMA	5	10.0	229.5	$449	$45
Corn Weighted Average - Outside LEMA	1	19.7	272.0	$507	$26
Sorghum Weighted Average - Inside LEMA	1	6.0	152	$438	$73
Sorghum Weighted Average - Outside LEMA	0	NA	NA	NA	NA
Soybeans Weighted Average - Inside LEMA	2	9.0	60.7	$262	$29
Soybeans Weighted Average - Outside LEMA	1	6.7	70	$388	$58

- Cash Flow = Revenue less variable expenses less land rent
- This is not a statistically valid sample
- This table may change as new producer financial data is obtained

The Economics of Modeled Water Use Reductions in SW Kansas

Model Area:
Three High Priority Areas



Major Differences Between Subareas

- Rainfall (17.9”, 21.2”, 18.6”)
- Starting well capacity
- Dryland crop mix

Table 6. High Priority Subarea Assumed Future Dryland Crop Mix

	Crop				
High Priority Subarea	Corn	Sorghum	Wheat	Fallow	Pasture
1	4.2%	13.1%	28.3%	15.2%	39.4%
2	3.0%	9.5%	20.4%	11.0%	56.2%
3	6.6%	20.6%	44.6%	23.9%	4.3%

- Non uniform hydrology (KGS Model)
  - Different rates of dryland conversion
  - Different rates of well capacity decline

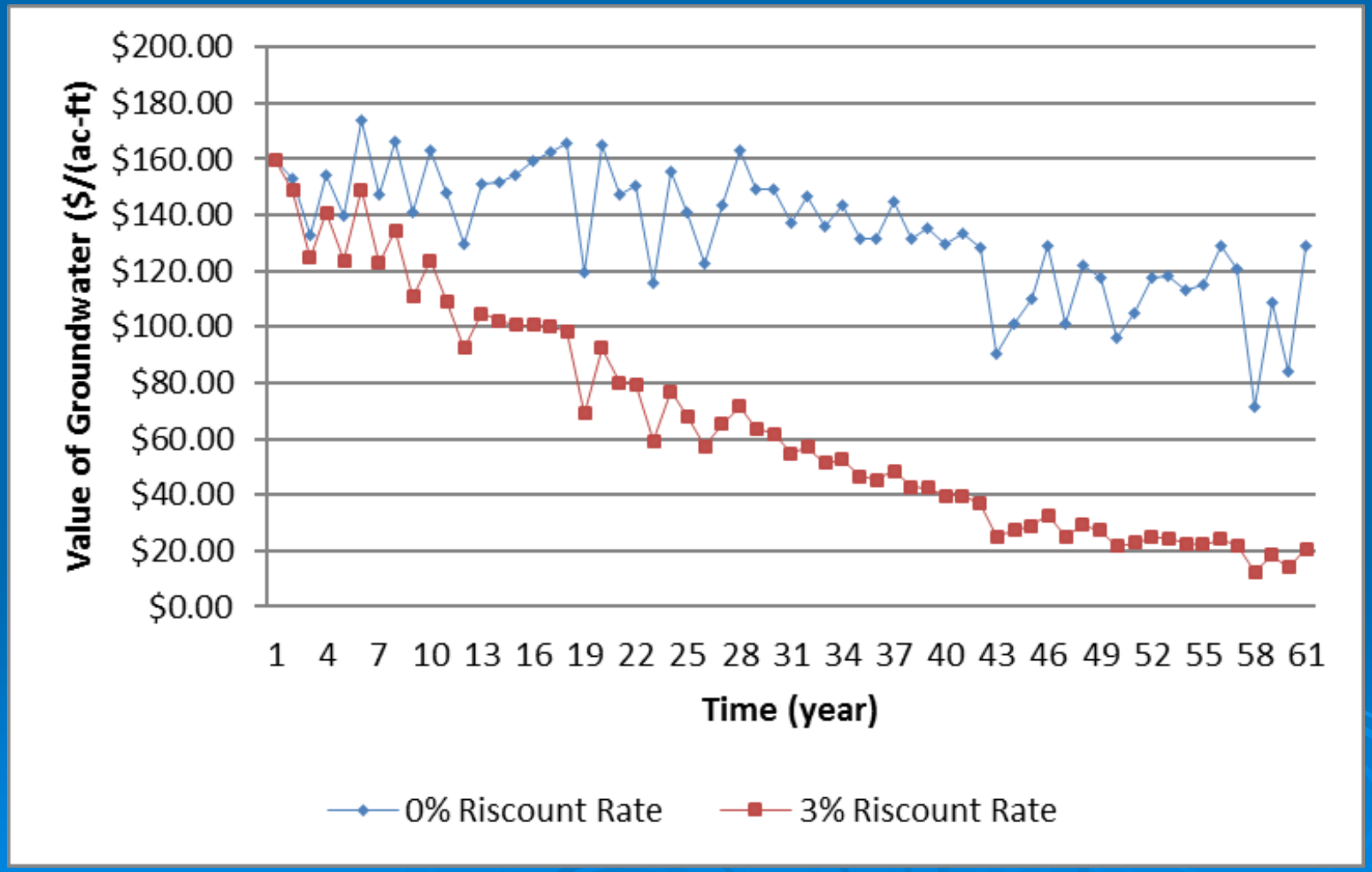
Basic Model Assumptions

- Model 60 years into the future
- Compare a status quo scenario to a conservation scenario
- Assumed 20% reduction in current water-use for the conservation scenario
- Allocate land and water-use, simultaneously assuming the goal of producer profit maximization and the alternative of Regional Value Added maximization.

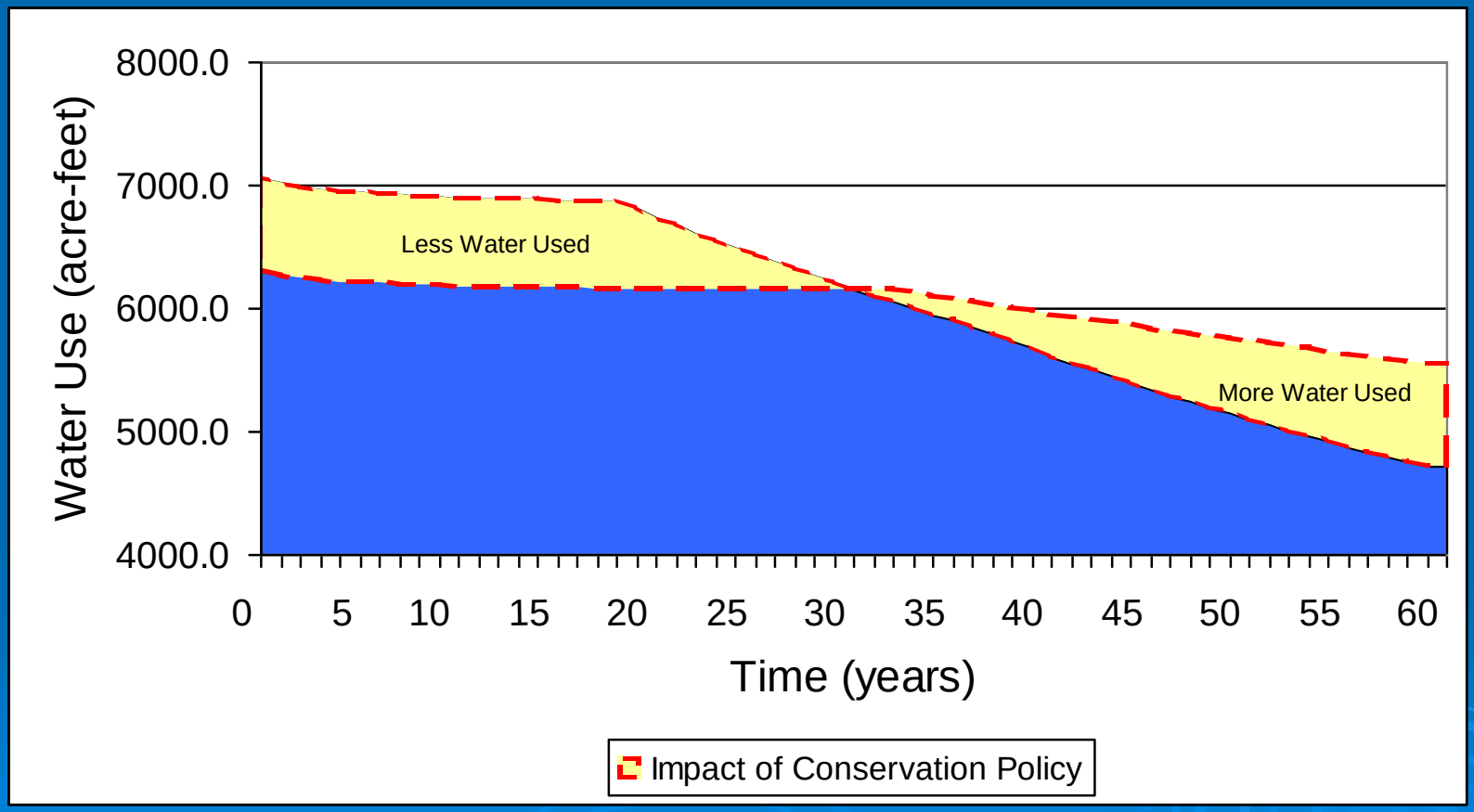
Basic Model Assumptions

- 0% discount rate – economists have different opinions about this.
- Crop specific productivity growth rate – economists have different opinions about this.
- Valuation of conserved groundwater – economist agree this should be done but have not agreed on a method.

Why Use a 0% Discount Rate



Why Value Remaining Groundwater



If The Goal is the Maximization of Producer Profits

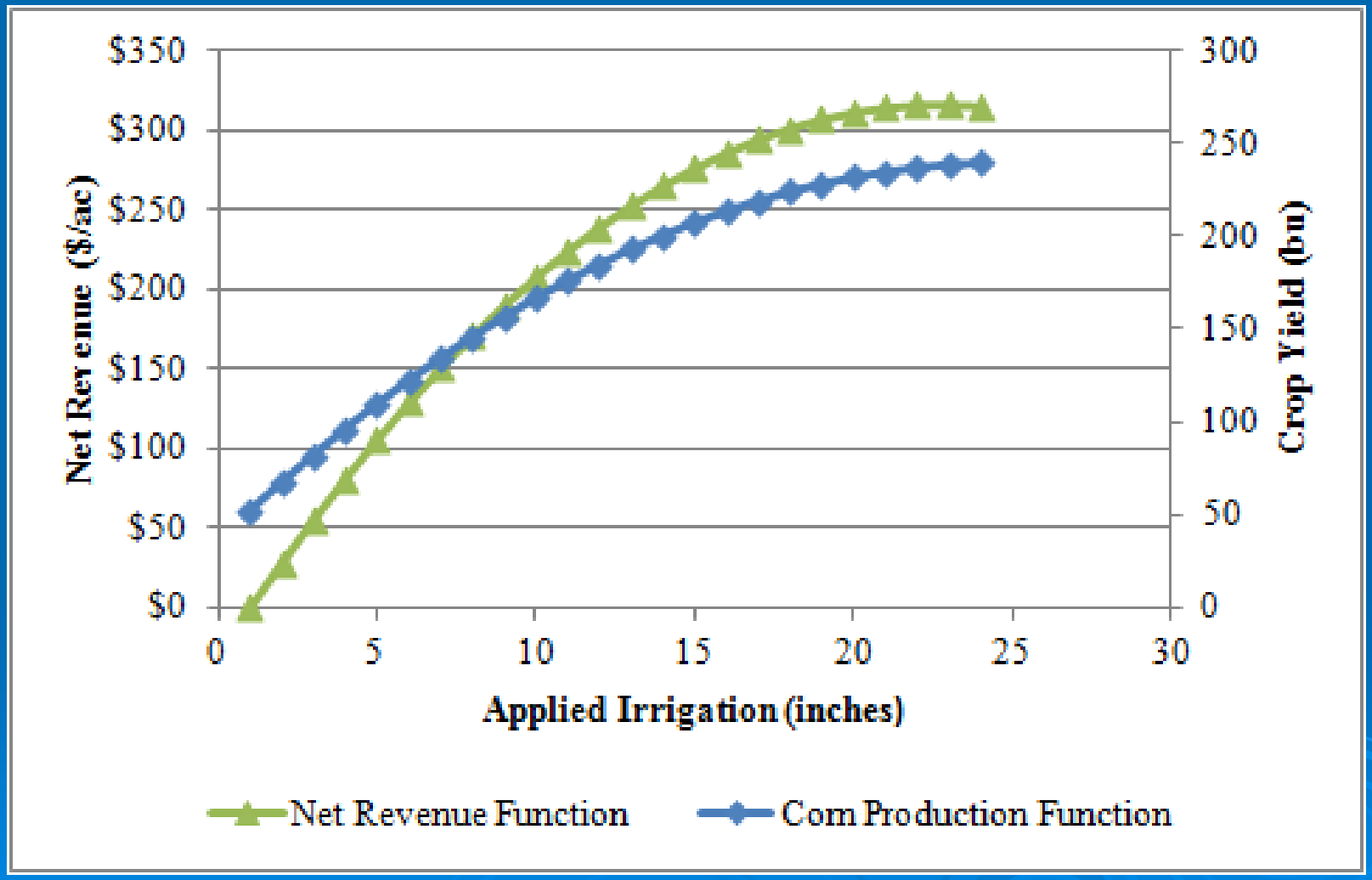
- A 20% reduction in groundwater use will provide benefits to both the agricultural producer and rural communities.
- For Subareas 1, 2, and 3 cumulative net profits increase by 6.3%, 2.1% and 2.7%, respectively.
- For Subareas 1, 2, and 3 cumulative Regional Value Added increase by 8.3%, 2.7%, and 1.8%, respectively.
- The variation in Subarea specific results are due to Subarea specific variations in initial hydrological conditions, current and projected irrigated crop mix, and dryland production options

If The Goal is the Maximization of Regional Value Added

- If Subarea 3 were to manage their groundwater based on maximizing value added, cumulative value added would increase from a 1.8% gain to an increase of 18.7%.

How Efficient Are We?

What We Think We Know



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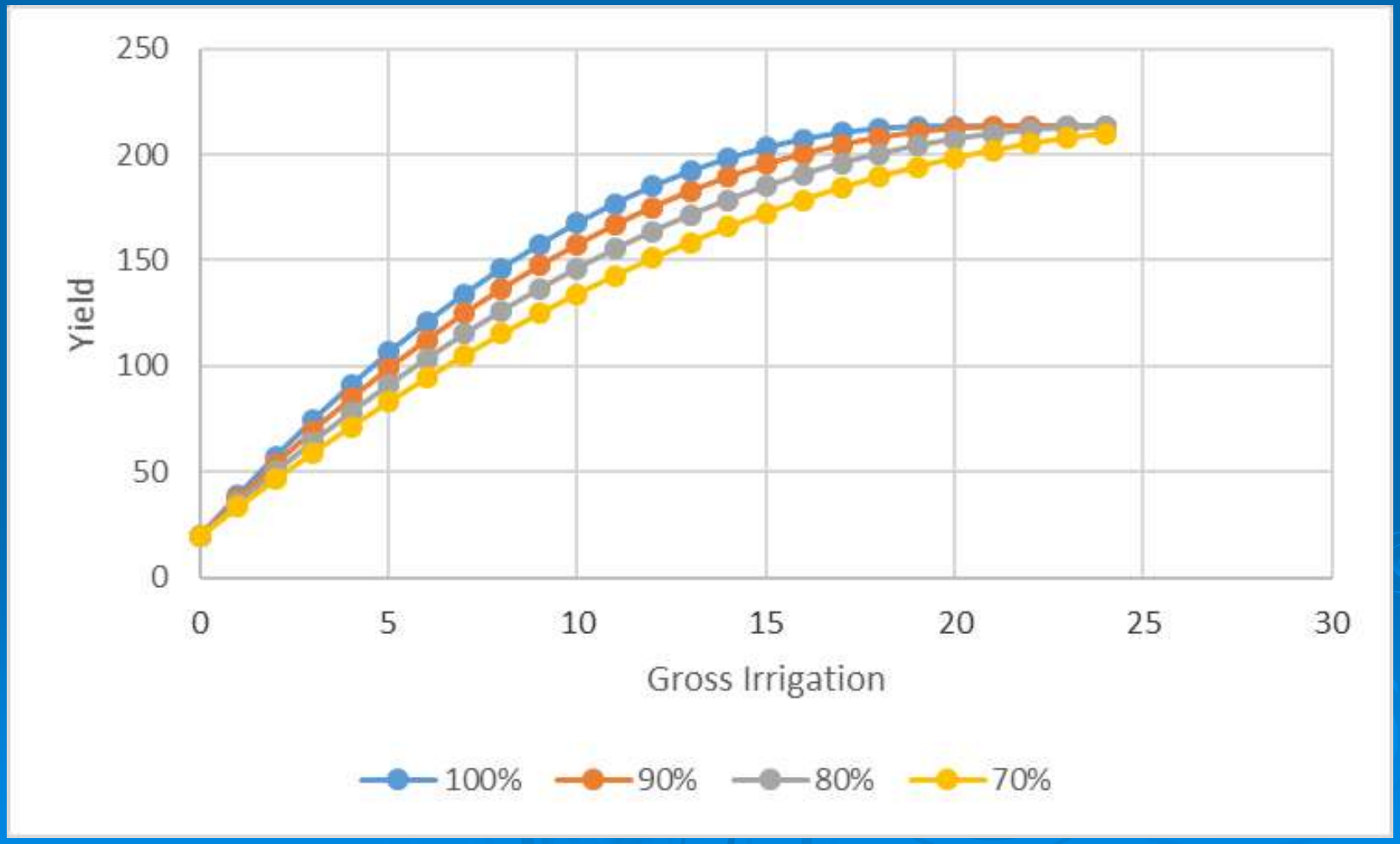
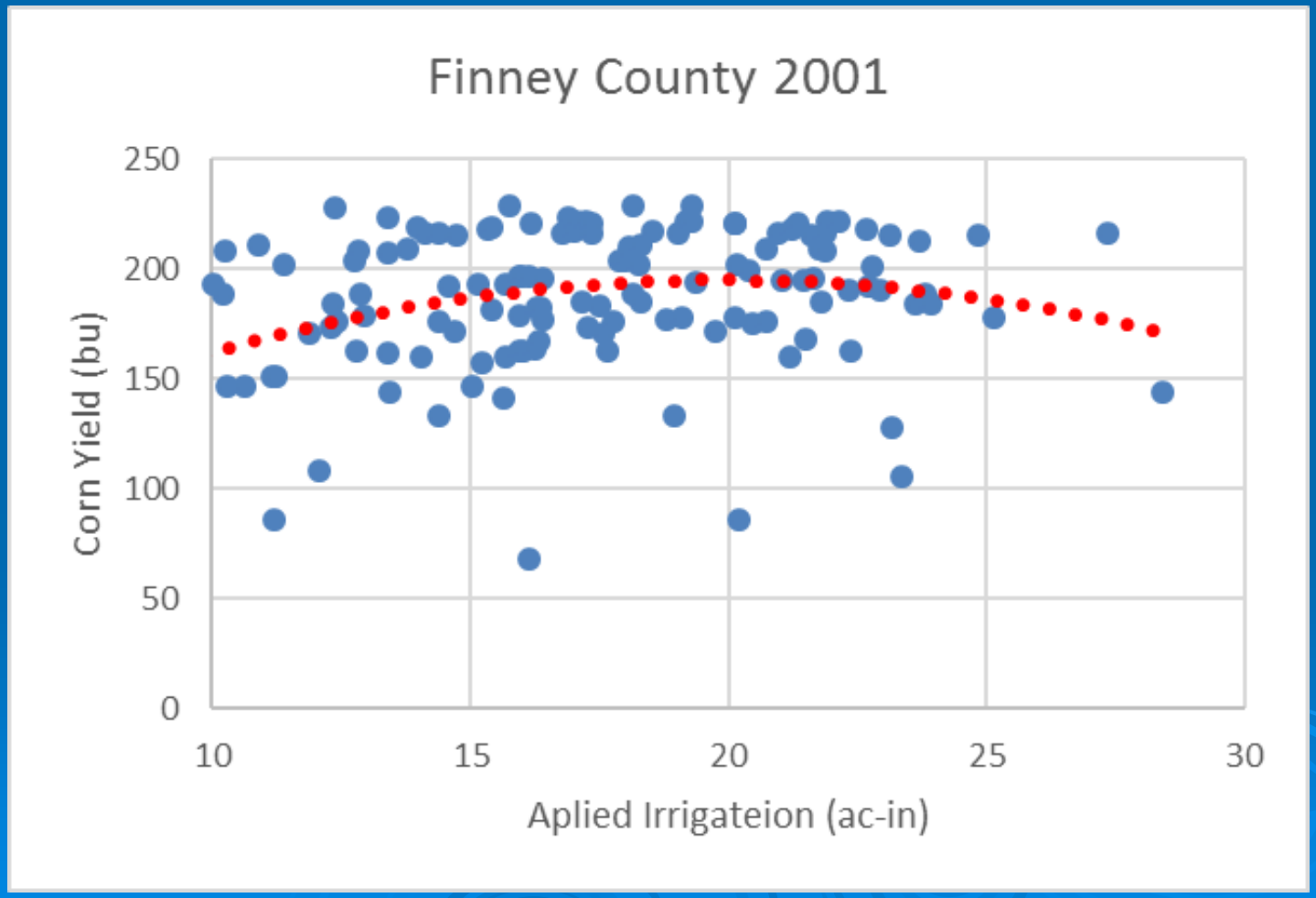
Production Functions vs Efficiency



An Example


Finney County 2001
250
200
150
100
50
0
Corn Yield (bu)
10
15
20
25
30
Aplied Irrigateion (ac-in)

Questions

- The full reports can be found at http://www.agmanager.info/policy/water/default.asp