18. Economic Impact of Water Use Changes in Southwest Kansas

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Bill Golden assists farmers, policy makers, and other stakeholders throughout Kansas in developing and implementing policies associated with the State's natural resources. He also works extensively with land-water-related issues such as valuing irrigation water rights. Current research and extension efforts are evaluating producer and community impacts associated with alternative water conservation policies and the impacts of climate change on our water resources.

Abstract/Summary

As we move into the 21st century, societal goals for our water resources are gradually changing. Concerns over aquifer decline rates in southwest Kansas suggest the need for water conservation. The Kansas Water Office, the Kansas Department of Agriculture, the Kansas Geological Survey, the Southwest Kansas Groundwater Management District number three, and Kansas State University researchers combined efforts to analyze the situation. This report summarizes the research and compares the economic impacts of policy alternatives aimed at achieving various levels of water conservation.

Potential Economic Impact of Water Use Changes in Southwest Kansas

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Southwest Kansas Groundwater Management District 3

Kansas Water Office

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Governor´s Ogallala Aquifer Initiative #2

2. Support legislation to provide a process for proactive conservation plans (called Local Enhancement Management Plans, or LEMAs).

LEMAs are to be:

- Proactive
- Supported by the Groundwater Management District (GMD)
- Have corrective measures that address conservation needs
- May include mandatory water use reductions; and
- Approved by the Chief Engineer

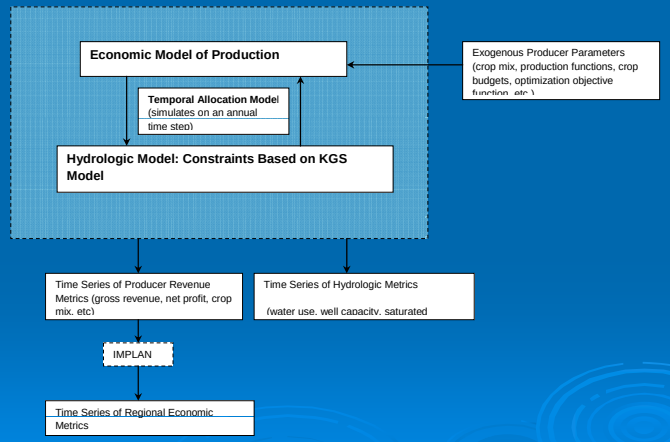
Research Focus

- Impacts of LEMAs on:
  - Producers
  - Rural economies
  - Ogallala aquifer
  - The value of conserved groundwater
- Research Tools
  - Inter-temporal simulation models
  - Basic econometrics
  - IMPLAN

Modeling Example

- 3 subareas in Southwest Kansas
- KGS supplied the hydrology information
- GMD#3 approving the assumptions

Inter-Temporal Simulation Model



Major Differences Between Subareas

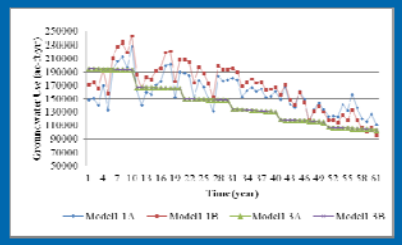
- S.Q. Rainfall (17.9", 21.2", 18.6")
- Starting Well Capacity
- Dryland Crop Mix

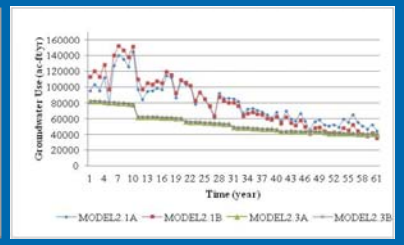
Table 6. High Priority Subarea Assumed Future Dryland Crop Mix

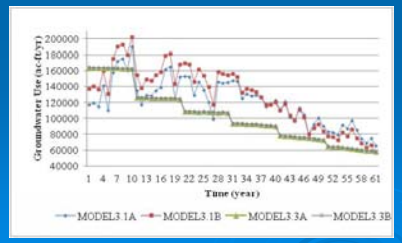
	Crop				
High Priority Subarea	Corn	Sorghum	Wheat	Fallow	Pasture
1	4.2%	13.1%	28.3%	15.2%	39.4%
2	3.0%	9.5%	20.4%	11.0%	56.2%
3	6.6%	20.6%	44.6%	23.9%	4.3%

- S.Q. Water Use Reduction (9.5%, 31.7%, 14.7%)
- Non Uniform Hydrology (KGS Model)
  - Different rates of dryland conversion
  - Different rates of well capacity decline

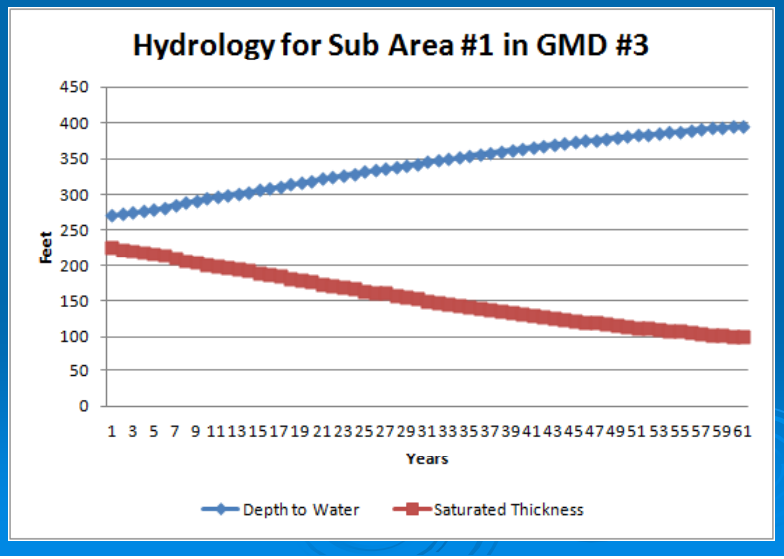
Ground Water Use Constraints (KGS Model)



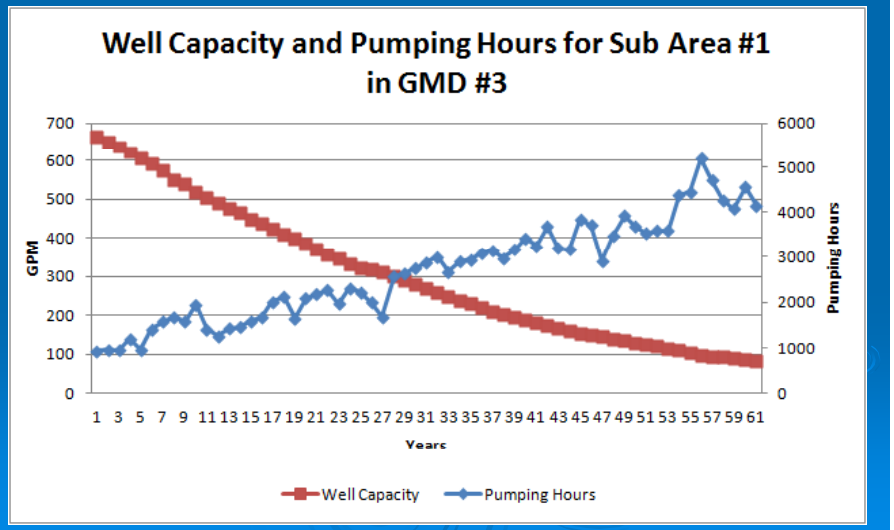




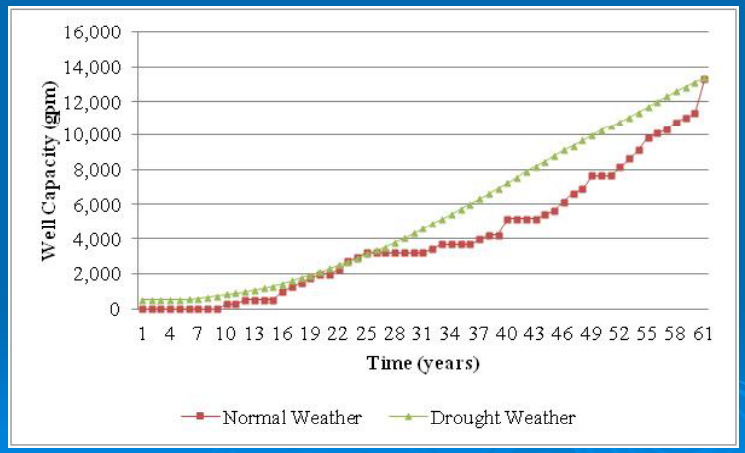
Ground Water Use Constraints



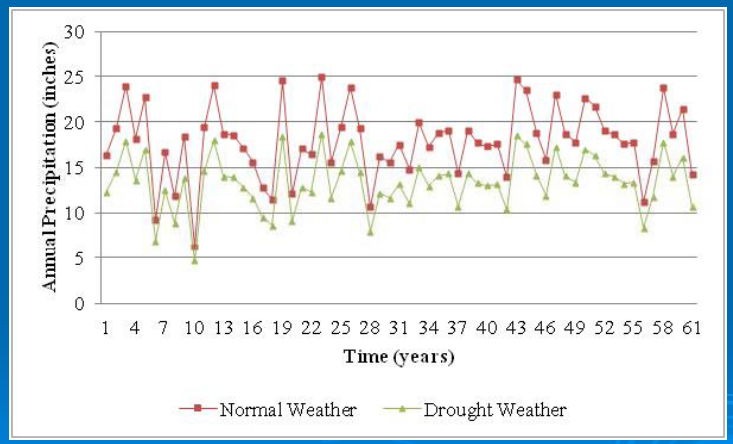
Ground Water Use Constraints



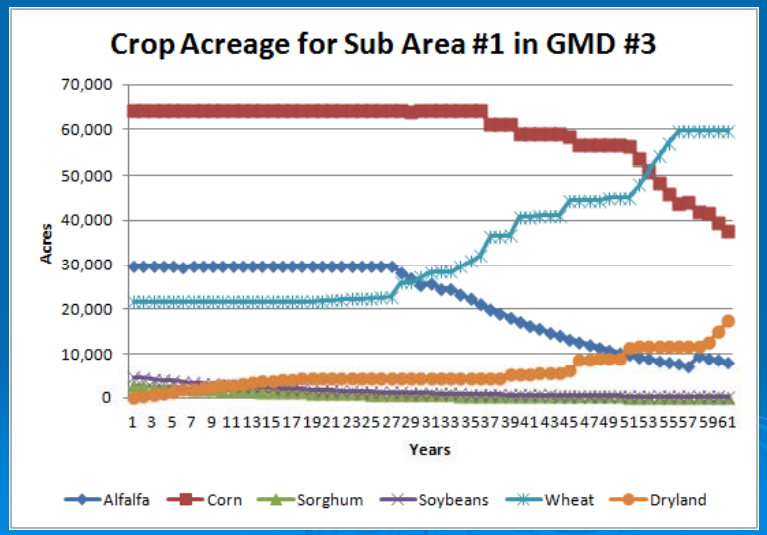
Dry Acreage Constraint



Weather Constraint



Simulation Results



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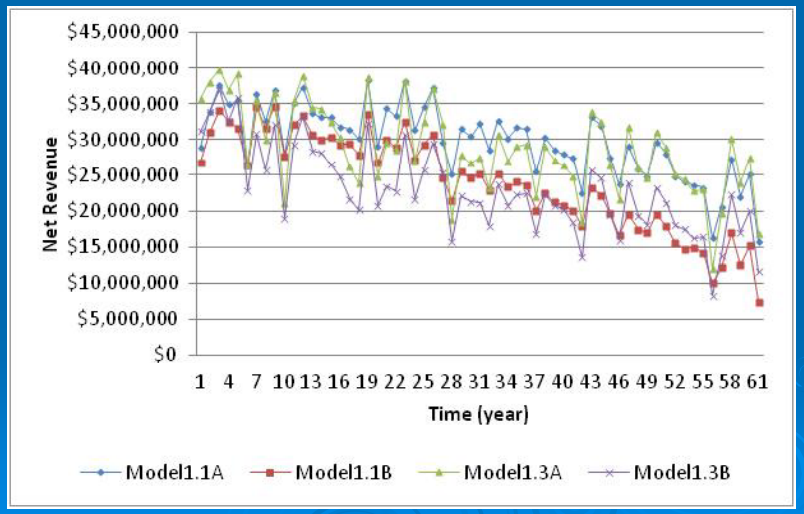


Values of Groundwater

- The Value of Groundwater ($/ac-ft)
  - To Net Profit: $87 - $159
  - To Total Industry Output: $538 - $736
  - To Value Added: $141 - $294

Simulation Results

Table 10. Cumulative Groundwater Use for Subarea 1 Normal Climate Scenarios

Scenario	Cumulative Groundwater Use	Relative Groundwater Use
Status Quo Normal Weather (Model 1.1A)	9,676,404	0
Immediate Conversion to Dryland (Model 1.2A)	0	-9,676,404
Reallocation Model Normal Weather (Model 1.3A)	8,755,644	-920,760

Simulation Results

Table 16. Cumulative Producer Net Revenue for Subarea 1 Normal Climate Scenarios

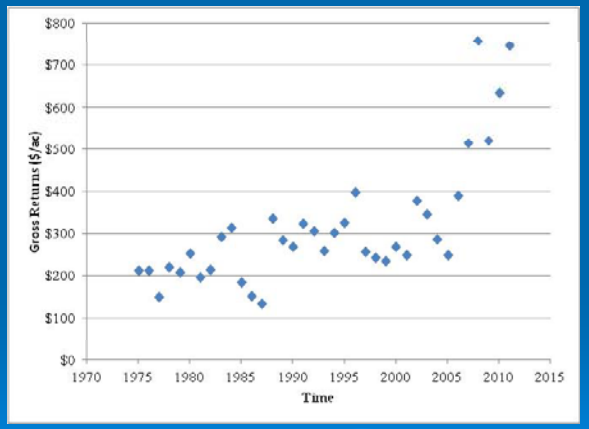
Scenario	Cumulative Net Revenue	Relative Net Revenue	Average Value of Water Used	Value of Remaining Water	Net
Status Quo Normal Weather (Model 1.1A)	$1,815,352,667	$0	$136.85	$0	$0
Immediate Conversion to Dryland (Model 1.2A)	$491,133,674	-$1,324,218,993	NA	NA	NA
Reallocation Model Normal Weather (Model 1.3A)	$1,753,659,762	-$61,692,905	$144.20	$132,769,638	$71,076,733

Summary of Simulation Results

Table 35. Impacts of the GMD#3 Reallocation Scenarios Relative to the Status Quo Scenarios After Valuing the Conserved Groundwater.

Metric	Normal Weather	Drought Weather
Subarea 1: Cumulative Groundwater Use	-9.5%	-14.8%
Subarea 2: Cumulative Groundwater Use	-31.7%	-31.6%
Subarea 3: Cumulative Groundwater Use	-14.7%	-19.6%
Subarea 1 : Cumulative Net Producer Revenue	3.9%	12.2%
Subarea 2 : Cumulative Net Producer Revenue	-5.3%	2.6%
Subarea 3 : Cumulative Net Producer Revenue	-1.6%	1.6%
Subarea 1 : Cumulative Total Industry Output	5.7%	14.0%
Subarea 2 : Cumulative Total Industry Output	2.1%	7.8%
Subarea 3 : Cumulative Total Industry Output	0.5%	2.7%
Subarea 1 : Cumulative Value Added	4.7%	7.5%
Subarea 2 : Cumulative Value Added	-6.2%	-1.0%
Subarea 3 : Cumulative Value Added	-3.0%	-3.9%

Future Direction: Add Growth in Productivity ?



0.4% for1975-1999; 9.7% for 2000-2011; 3.5% for 1975 - 2011

Conclusions

- Impacts of future drought condition can be mitigated by groundwater conservation today.
- When the remaining groundwater is not valued both producers and communities experience negative impacts.
- When the remaining groundwater is valued both producers and communities may experience positive impacts depending on:
  - The magnitude of reductions
  - Dryland options
  - Current hydrology

Conclusions

- Valuation of conserved groundwater is necessary in policy analysis
- The benefits of conservation may be significantly understated if a 0% growth rate in productivity is assumed.
- We need to prepare for a future where wheat is the dominant crop.