



Potential Economic Impacts from Groundwater Regulation in the Republican Valley

**By
Ray Supalla and Scott Nedved
Department of Ag Economics, UNL**

**With funding from consortium of public power
districts, bankers and farm supply firms**

Purpose

To analyze the on-farm and off-farm consequences of reduced irrigation in the Republican Valley.

To provide economic information for water policy decision making and for general economic planning.

Methodology

Policy Scenario

**Crop Production Changes
(assumes profit maximizing adjustments)**

**Change in Value
of Crop Production**

**Change in Net
Returns to Agriculture**

**Change in Crop
Input Use**

**Input/Output Model
(Regional Economy)**

**Change in Total
Value Added**

**Change in
Economic Output**

**Change in
Employment**

Important Inputs and Assumptions

Irrigated Acres Estimates Used in Analysis

Upper Republican	Certified Acres
Upland Sprinkler	368,970
Quick Response – Sprinkler	51,301
Quick Response – Gravity	<u>28,446</u>
Total Upper Republican	448,717
Middle Republican	
Upland Sprinkler	135,169
Upland Gravity	64,243
Quick Response – Gravity	<u>112,588</u>
Total Middle Republican	312,000
Lower Republican	
Upland Sprinkler	132,185
Upland Gravity	36,562
Quick Response – Gravity	<u>161,253</u>
Total Lower Republican	330,000

Baseline Pumpage (1998 - 02 Average)

	Acre-Feet	Inches/Acre
Upper Republican		
Upland – Sprinkler	428,896	13.95
Quick Response – Sprinkler	66,537	15.56
Quick Response – Gravity	37,190	15.69
Middle Republican		
Upland – Sprinkler	134,816	11.97
Upland – Gravity	64,074	11.97
Quick Response – Gravity ^a	139,045	14.82
Lower Republican		
Upland – Sprinkler	101,713	9.23
Upland – Gravity	28,133	9.23
Quick Response – Gravity ^a	131,502	9.79

^a Includes some sprinkler

Crops Considered

Irrigated

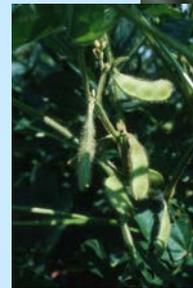
Corn

Soybeans

Alfalfa

Wheat

Grain Sorghum



Dryland (on former irrigated land)

Corn – Fallow – Wheat Rotation

Crop Prices*

Corn

\$2.60



Wheat

\$3.75



Grain Sorghum

\$2.52



Alfalfa

\$74.14



Soybeans

\$5.50



*** Based on short-term forecast by FAPRI, University of Missouri and Iowa State University.**

Crop Production and Irrigation Costs

- **Based on University of Nebraska Coop Extension Service Budget calculator.**
- **Costs considered include only items that will be impacted by regulations. Items such as overhead and management charges, land costs and some depreciation is not estimated.**
- **Irrigation costs based on electric pumps, average lift and pressure requirements.**

Irrigation Costs

	Feet of Head (Lift & Pressure)	\$/Acre-Inch*
--	---	----------------------

Upper NRD

Upland Sprinkler	193.5	6.11
Quick Sprinkler	75.9	5.00
Quick Gravity	75.9	3.02

Middle NRD

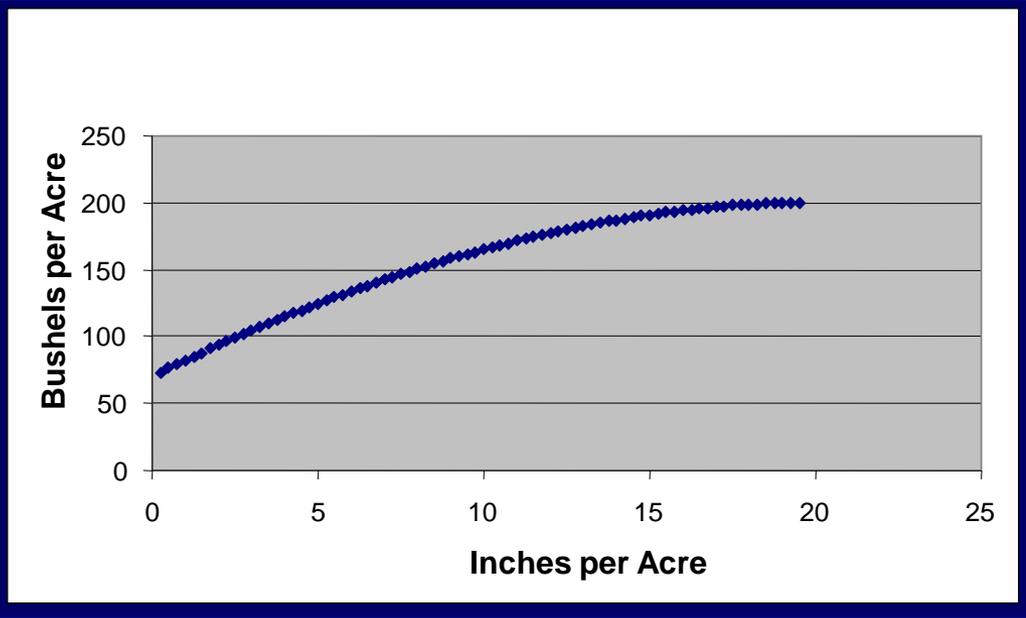
Upland Sprinkler	241.7	6.57
Upland Gravity	241.7	4.58
Quick Gravity	112.2	2.92

Lower NRD

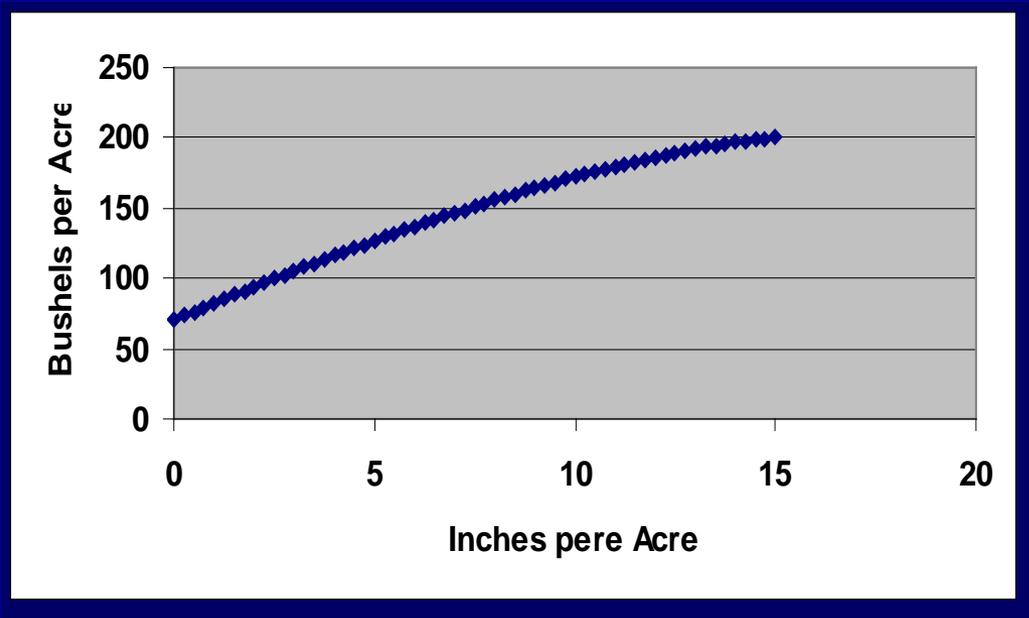
Upland Sprinkler	176.8	5.96
Upland Gravity	176.8	3.97
Quick Gravity	72.1	2.98

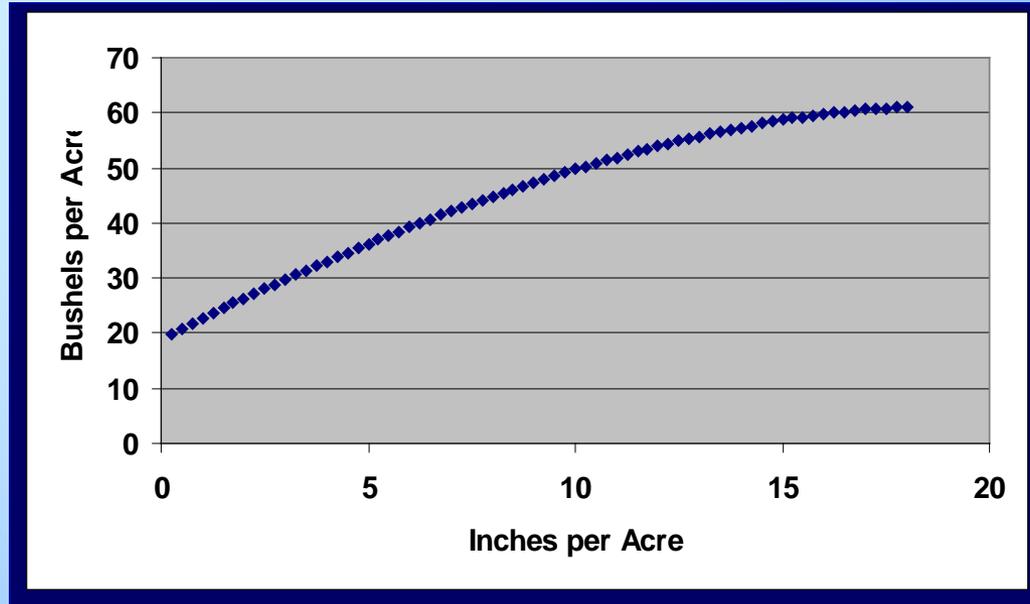
*Includes all costs that vary with amount pumped: Energy, Labor, Maintenance, Use Related Depreciation

**Corn, Middle NRD,
Gravity Irrigated**



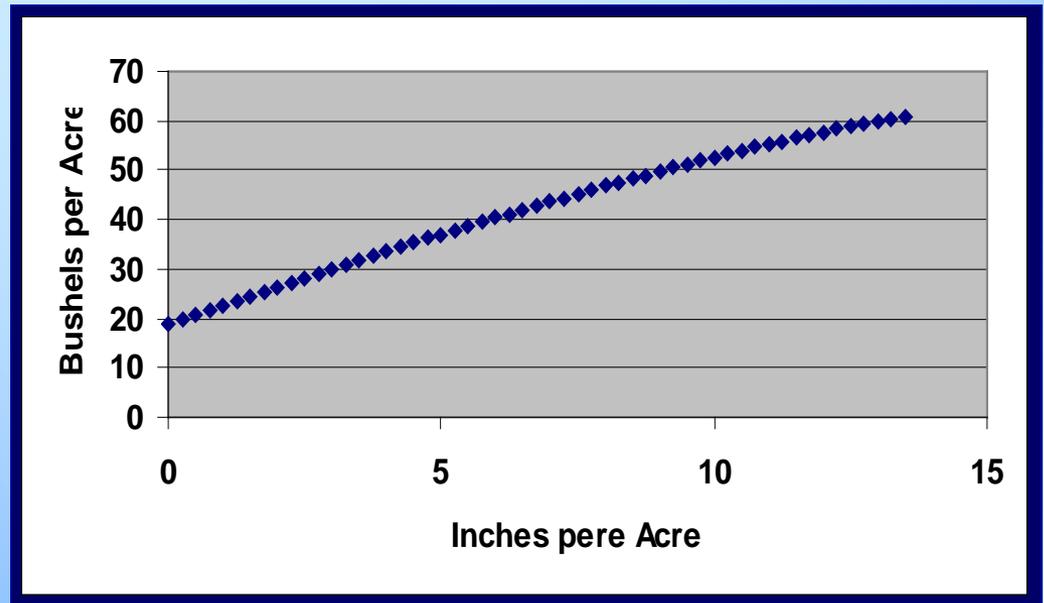
**Corn, Middle NRD
Sprinkler Irrigated**



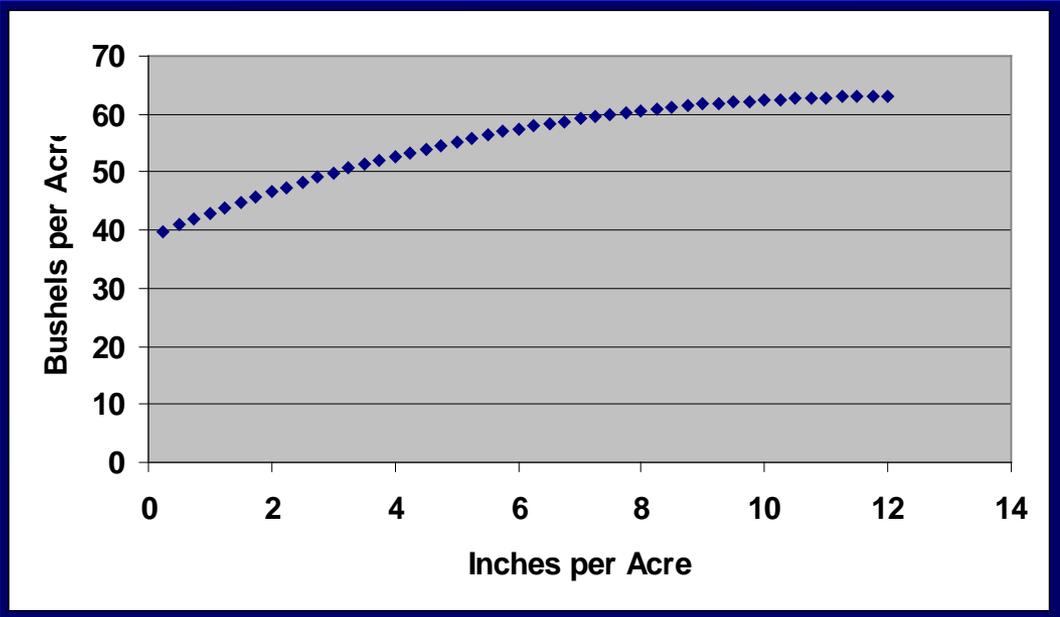


**Soybeans, Middle NRD
Gravity Irrigated**

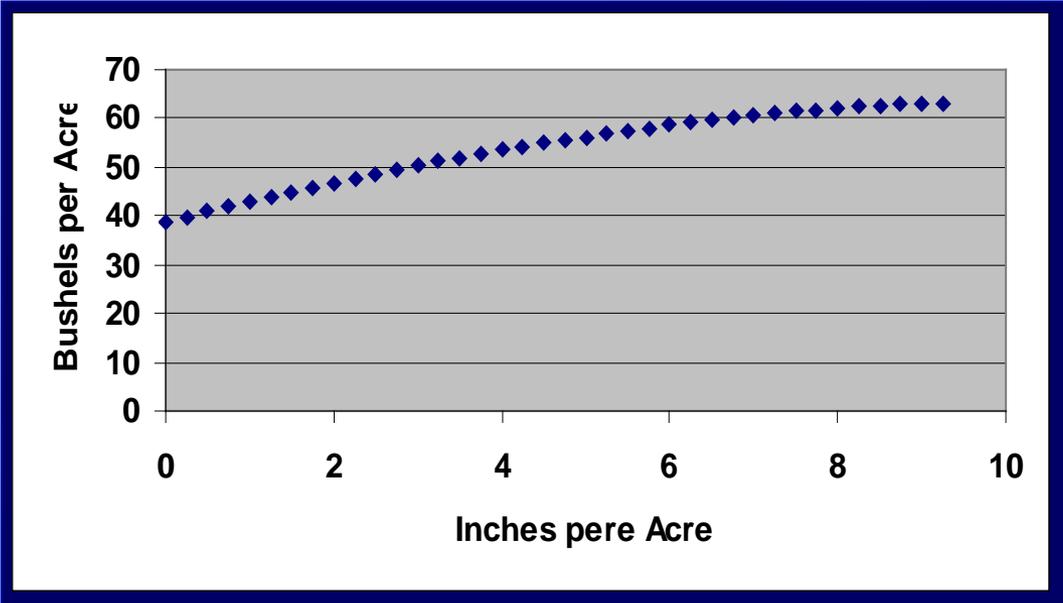
**Soybeans, Middle NRD
Sprinkler Irrigated**



Wheat, Middle NRD, Gravity Irrigated



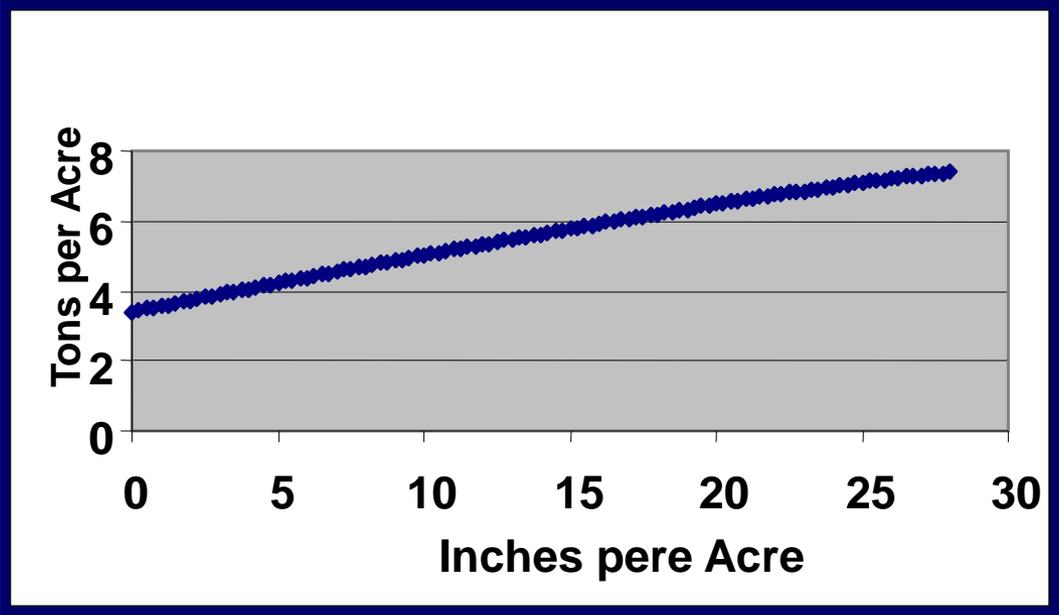
Wheat, Middle NRD Sprinkler Irrigated



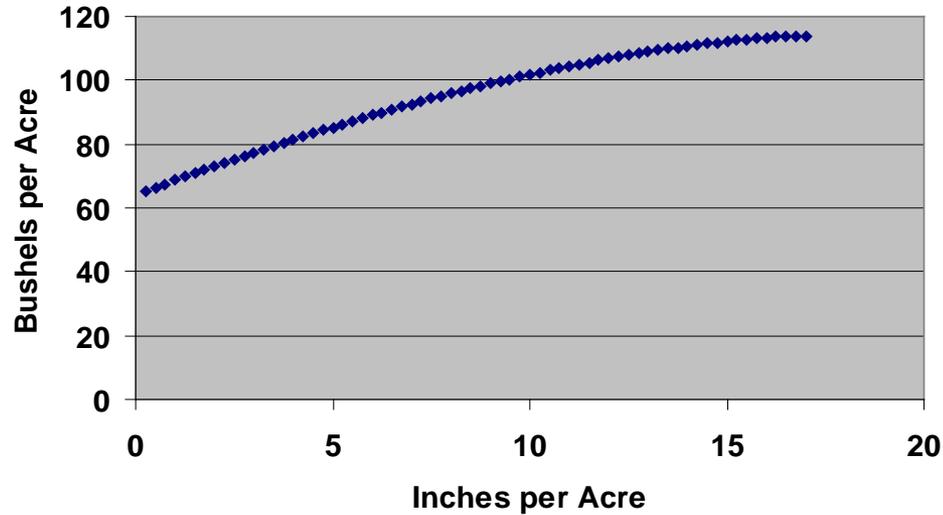
**Alfalfa, Middle NRD,
Gravity Irrigated**



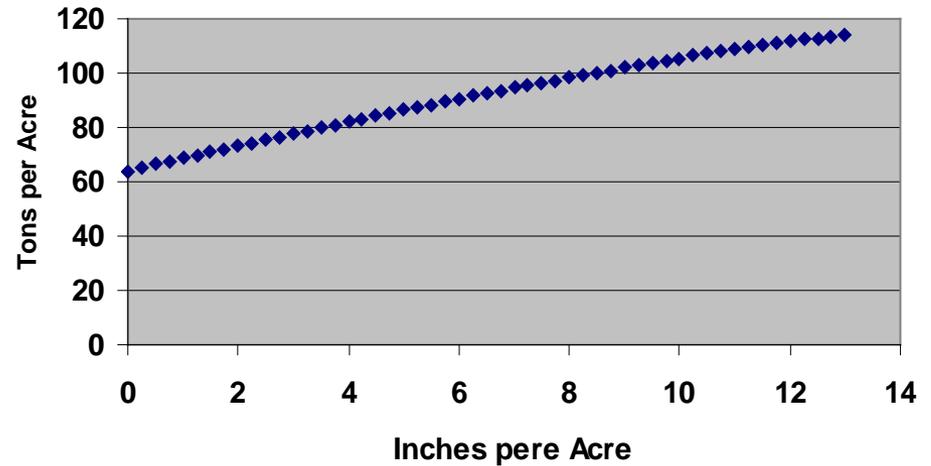
**Alfalfa, Middle NRD,
Sprinkler Irrigated**



Grain Sorghum, Middle NRD, Gravity Irrigated



Grain Sorghum, Middle NRD, Sprinkler Irrigated



**Description
of the
Regional Economy**

Republican Valley Economy

(Counties Included)

Chase

Frontier

Franklin

Dundy

Furnas

Hitchcock

Hayes

Harlan

Gosper

Red Willow

Phelps

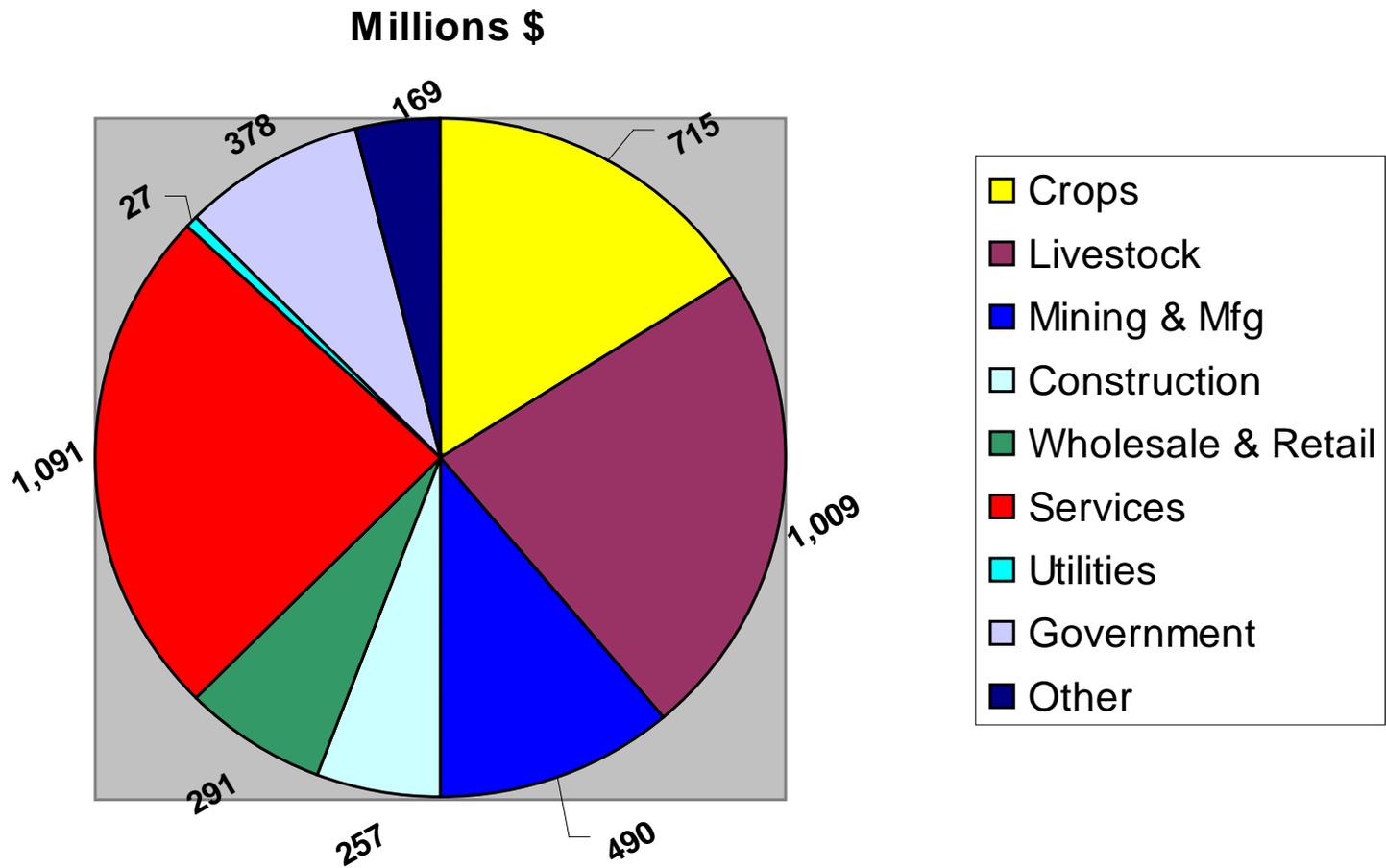
Nuckolls

Lincoln

Kearney

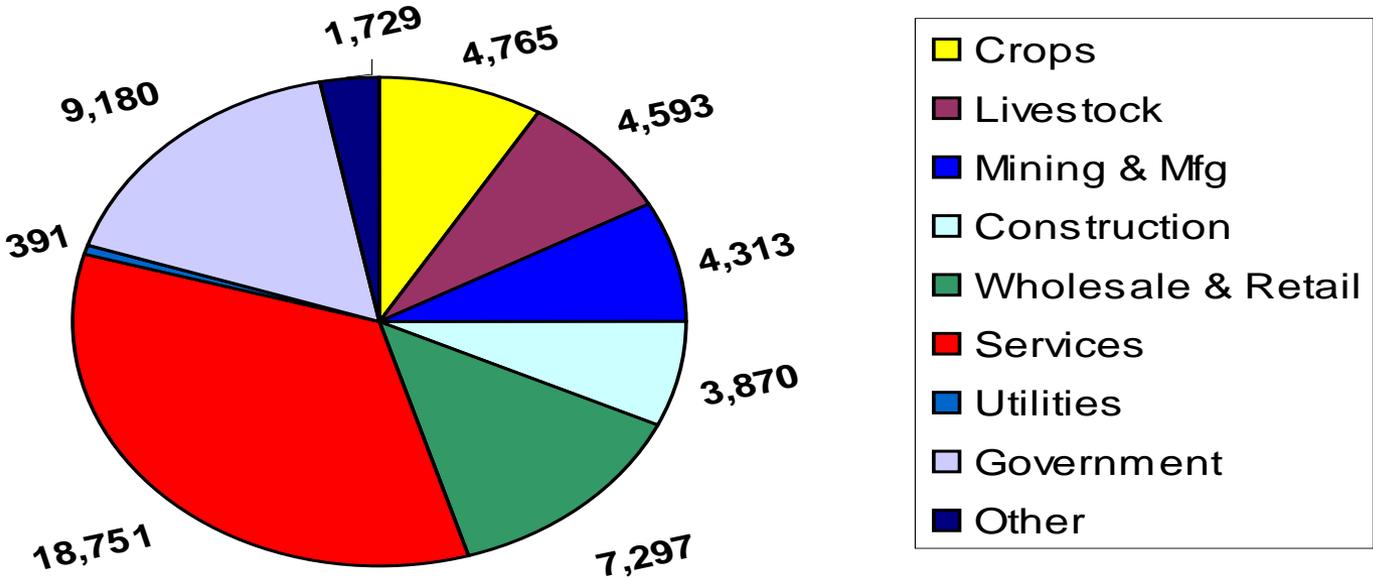
Webster

Republican Valley Industry Output



Total Industry output = \$4,425,000,000

Republican Valley Employment



Total Employment = 54,887

Regulatory Scenarios

I. 10% reduction in pumping, all situations

II. 20% reduction in pumping, all situations

Major Assumptions:

a) Administered on 3 to 5 year average to account for rainfall variability.

b) Separate allocations for upland and quick response wells.

c) Little if any pooling within an ownership unit for Lower and Middle NRD's. Upper continues current policy practices.

Regulatory Scenarios

III. Drought Case

Upper NRD

Upland-Sprinkler	13% reduction
QRW-Sprinkler	13% reduction + 34,000 acre-feet
QRW-Gravity	13% reduction + 18,800 acre-feet

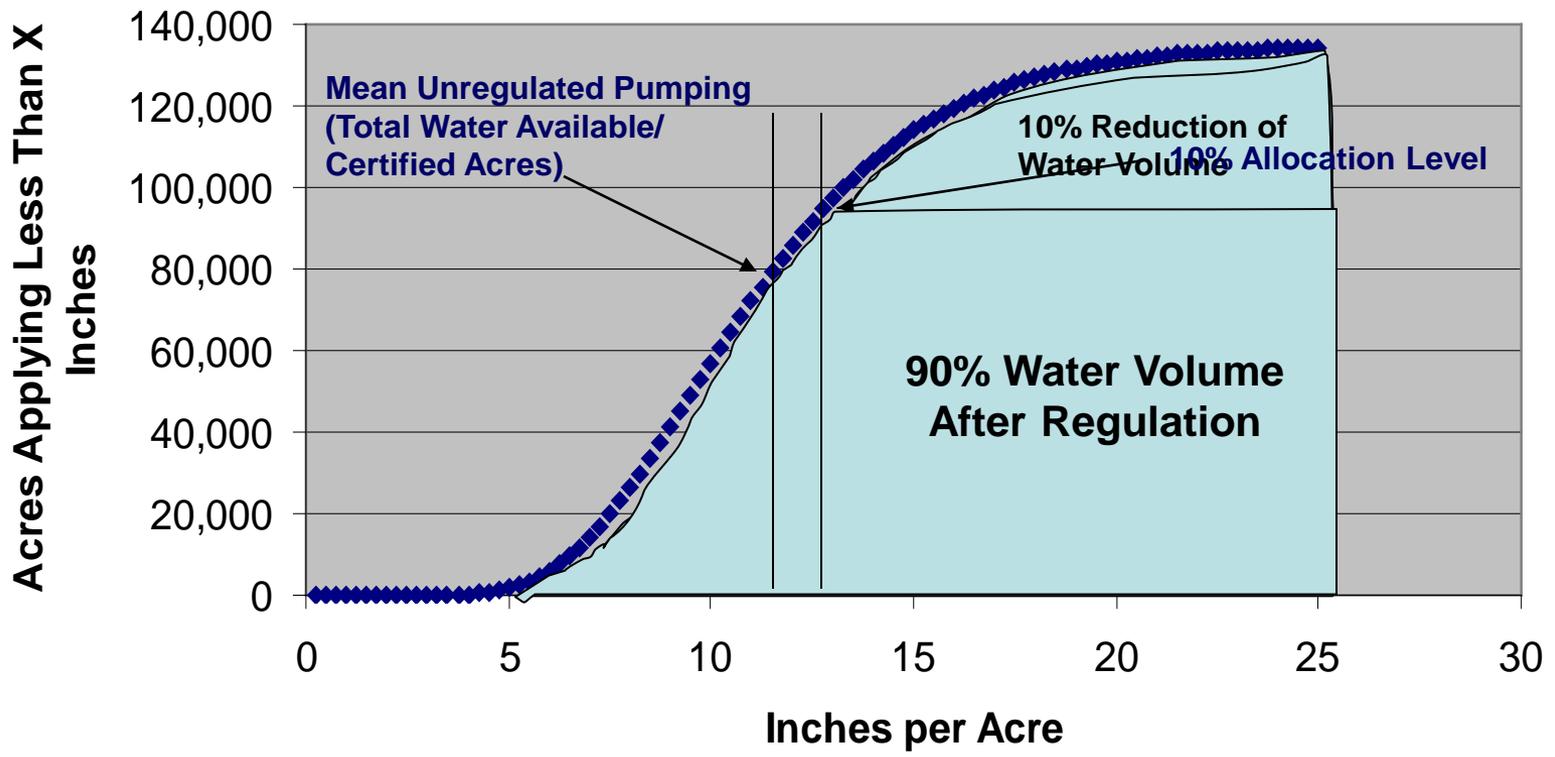
Middle NRD

UL-Sprinkler	13% reduction
UL-Gravity	13% reduction
QRW-Gravity	13% + 36,000 acre-feet

Lower NRD

UL-Sprinkler	13% reduction
UL-Gravity	13% reduction
QRW-Gravity	13% + 31,200 acre-feet

Pump Distribution, Middle NRD, Uplands



Regulation Levels

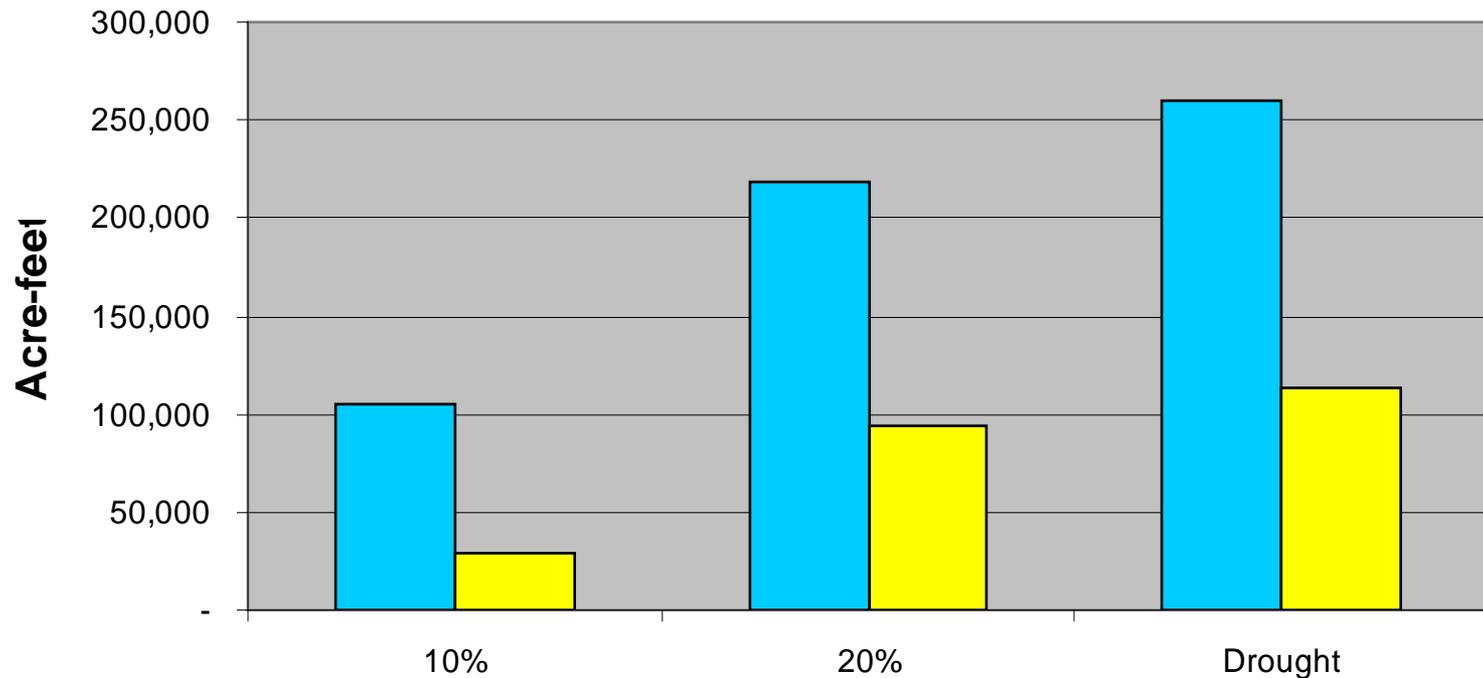
	Inches Per Acre			
	Baseline Average	10%	20%	13% and 40K
Upper NRD				
Upland-Spk	13.95	13.83	11.43	12.92
QRW-Spk	15.56	15.24	12.87	5.38
QRW-Grv	15.69	15.29	12.97	5.97
Middle NRD				
Upland-Spk	11.97	13.17	10.80	12.41
Upland-Grv	11.97	13.17	10.80	13.12
QRW-Grv	14.82	15.86	13.38	9.56
Lower NRD				
Upland-Spk	9.23	10.32	8.32	9.50
Upland-Grv	9.23	10.32	8.32	9.50
QRW-Grv	9.79	10.54	8.94	6.38

Acres Impacted by Regulations

	Percent of Total Irrigated Acres		
	10%	20%	13% and 40K
Upper NRD			
Upland-Spk	59	78	66
QRW-Spk	60	78	100
QRW-Grv	60	78	100
Middle NRD			
Upland-Spk	49	62	53
Upland-Grv	49	62	53
QRW-Grv	52	68	91
Lower NRD			
Upland-Spk	48	63	54
Upland-Grv	47	59	52
QRW-Grv	53	67	88

Results

Reduction in Volume Pumped and Consumptive Use

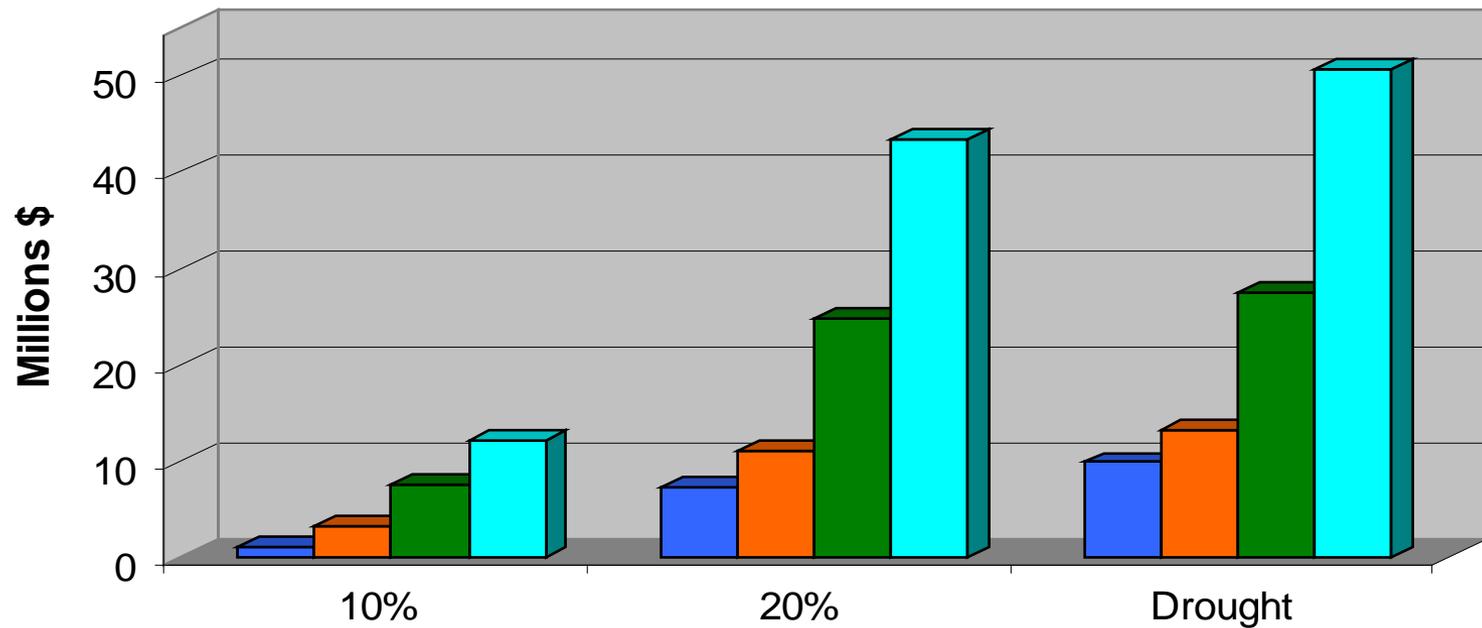


■ Basin-wide Reduction in Pumping ■ Basin-wide Reduction in Consumptive Use

Farm Management Responses to Limited Water

- **First: Reduce per acre application to wheat, grain sorghum, and alfalfa significantly.**
- **Second: Reduce water applied to corn and soybeans slightly, depending on initial starting point.**
- **Third: Convert wheat and sorghum acres to a dryland rotation**
- **Fourth: Slight reduction in irrigated corn acres to dryland**

Reduction in Value of Crop Production



■ Lower Republican ■ Middle Republican ■ Upper Republican ■ Basin-wide

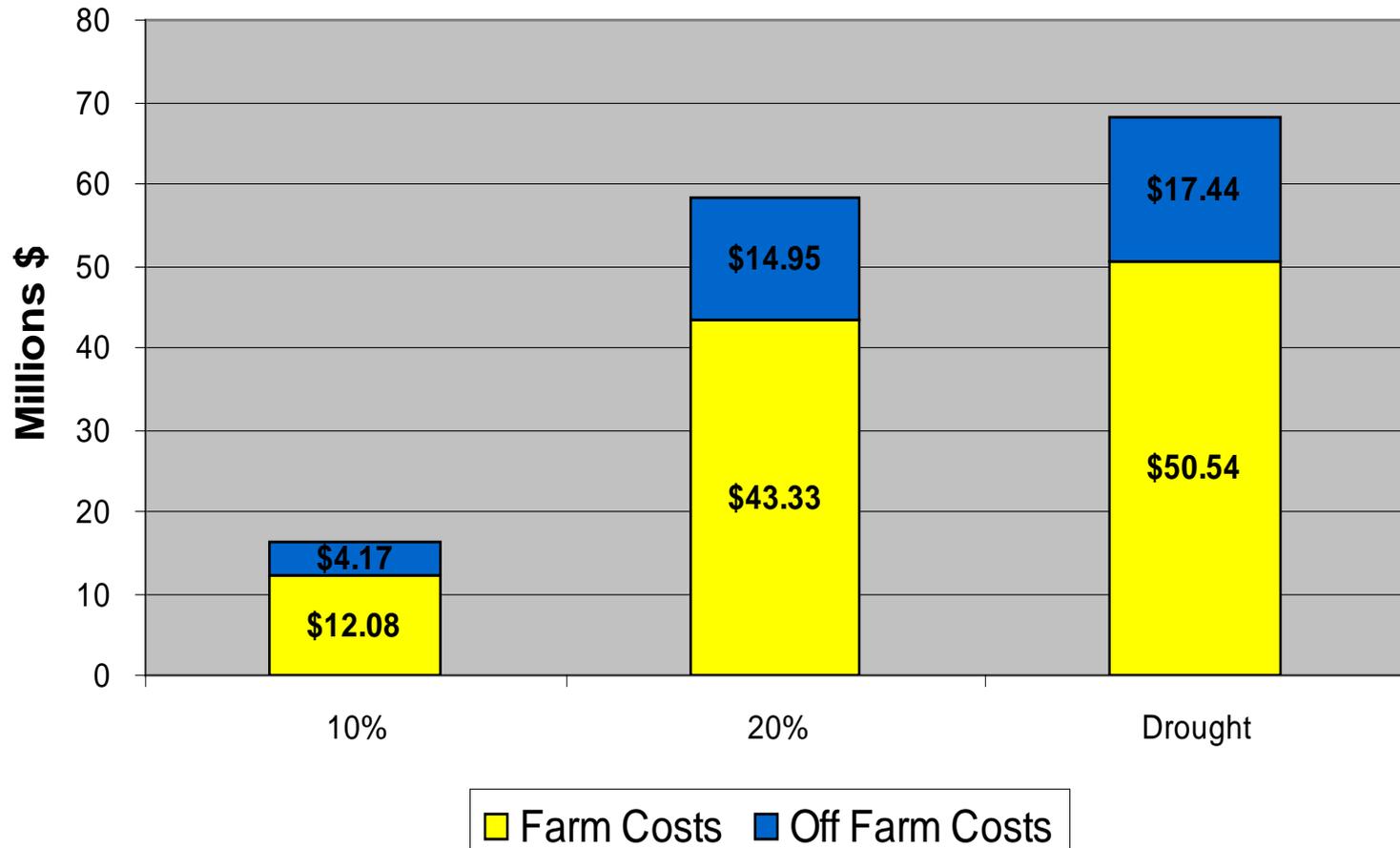
Basin-Wide Changes in Crop Production

	10%		20%		13% and 40K	
Corn (bu)	-3,690,935	-2.3%	-15,471,987	-9%	-17,310,279	-11%
Wheat (bu)	2,434	0.1%	885,002	32%	770,414	28%
Grain Sorghum (bu)	-51,205	-4.6%	40,171	4%	100,190	9%
Alfalfa (ton)	-28,423	-8.8%	-78,395	-24%	-93,044	-29%
Soybeans (bu)	-47,170	-0.8%	-129,620	-2%	-323,115	-5%

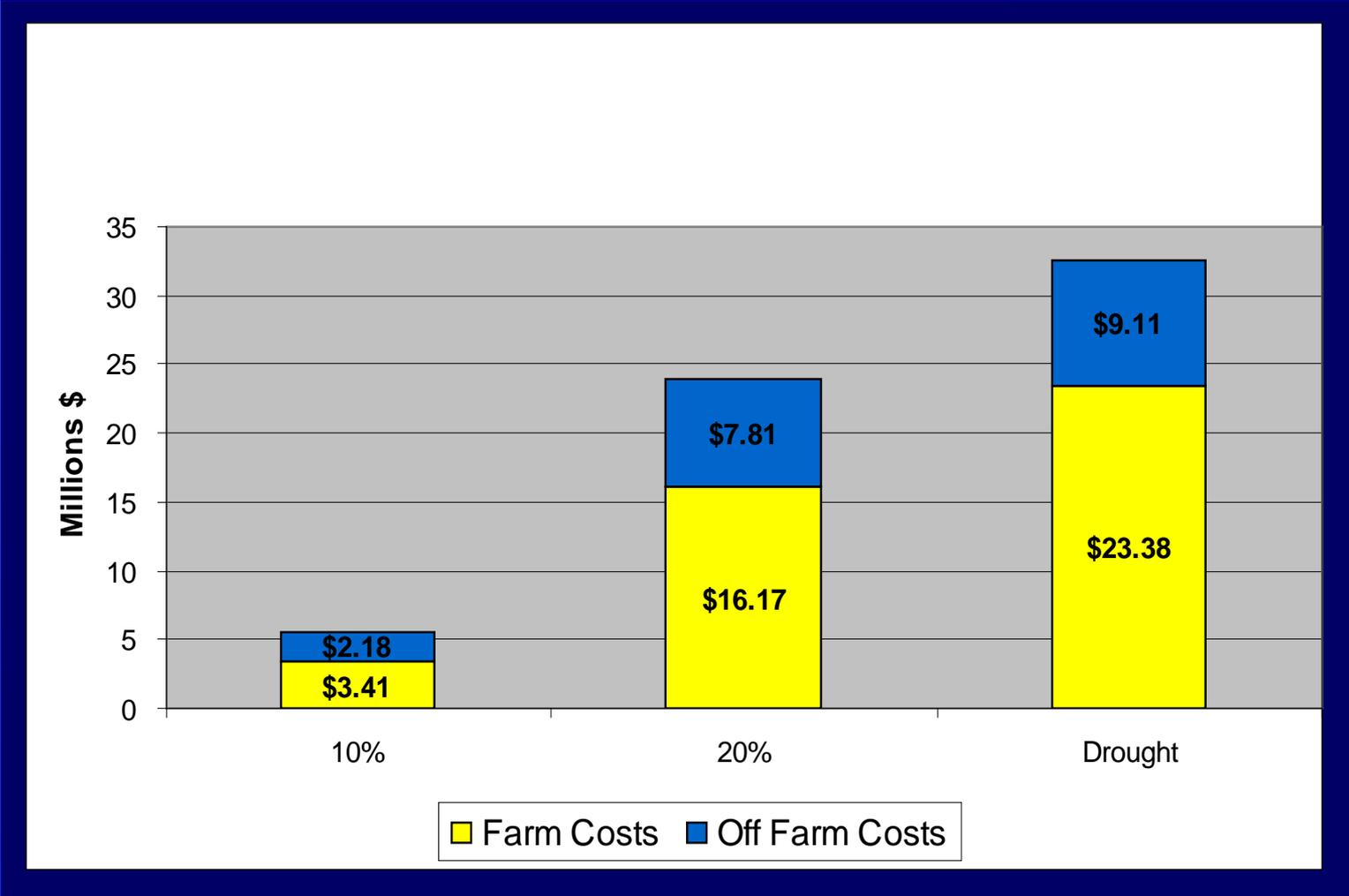
Basin-Wide On-Farm Costs for Pumping Reductions

Scenario	Cost per Irrigated Acre	Cost Per Affected Acre
10%	\$3.00	\$6.00
20%	\$15.00	\$21.00
13% and 40K	\$21.00	\$30.00

Reduction in Economic Output in Republican Valley Economy



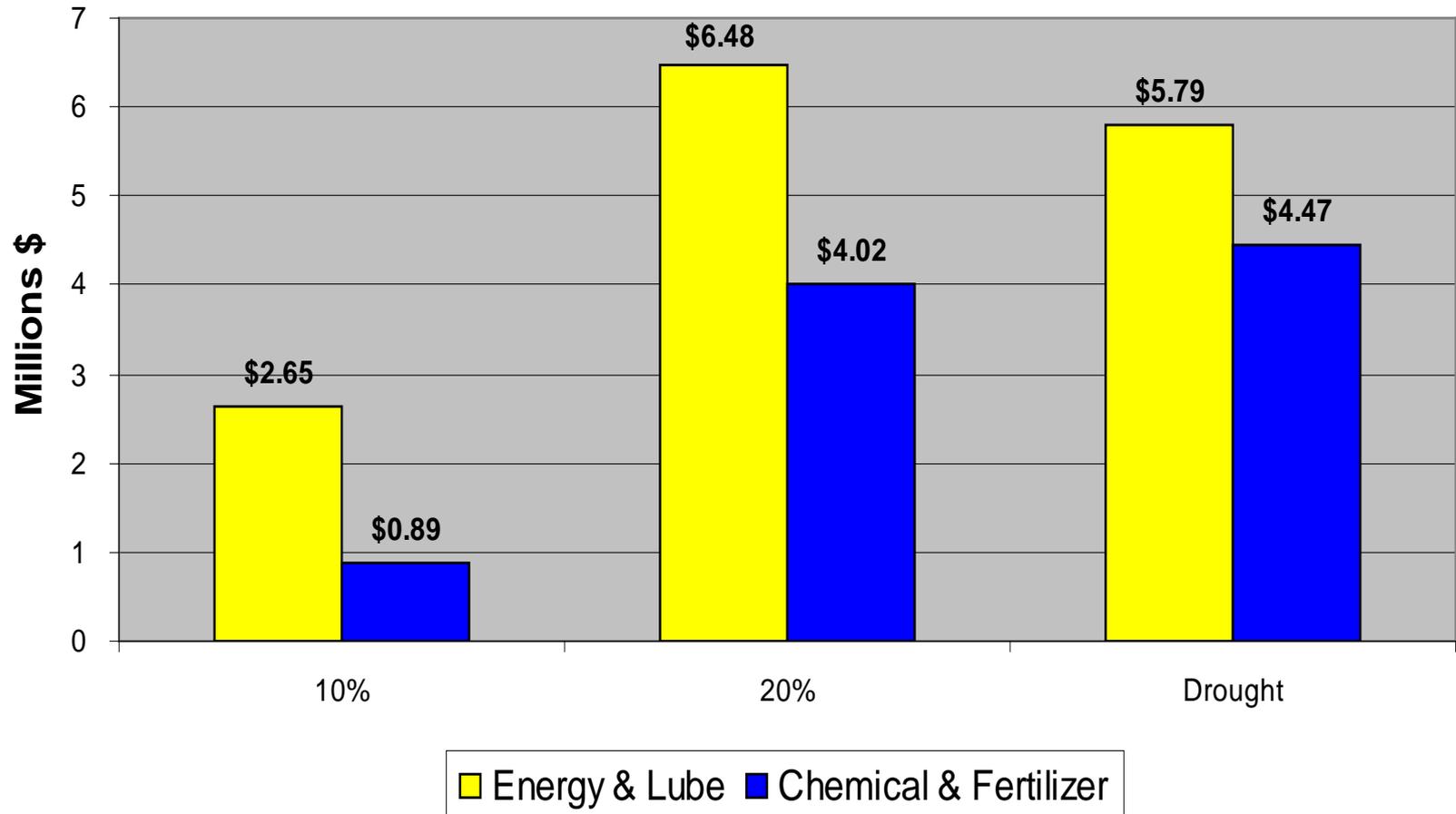
Reduction in Value Added in Republican Valley Economy



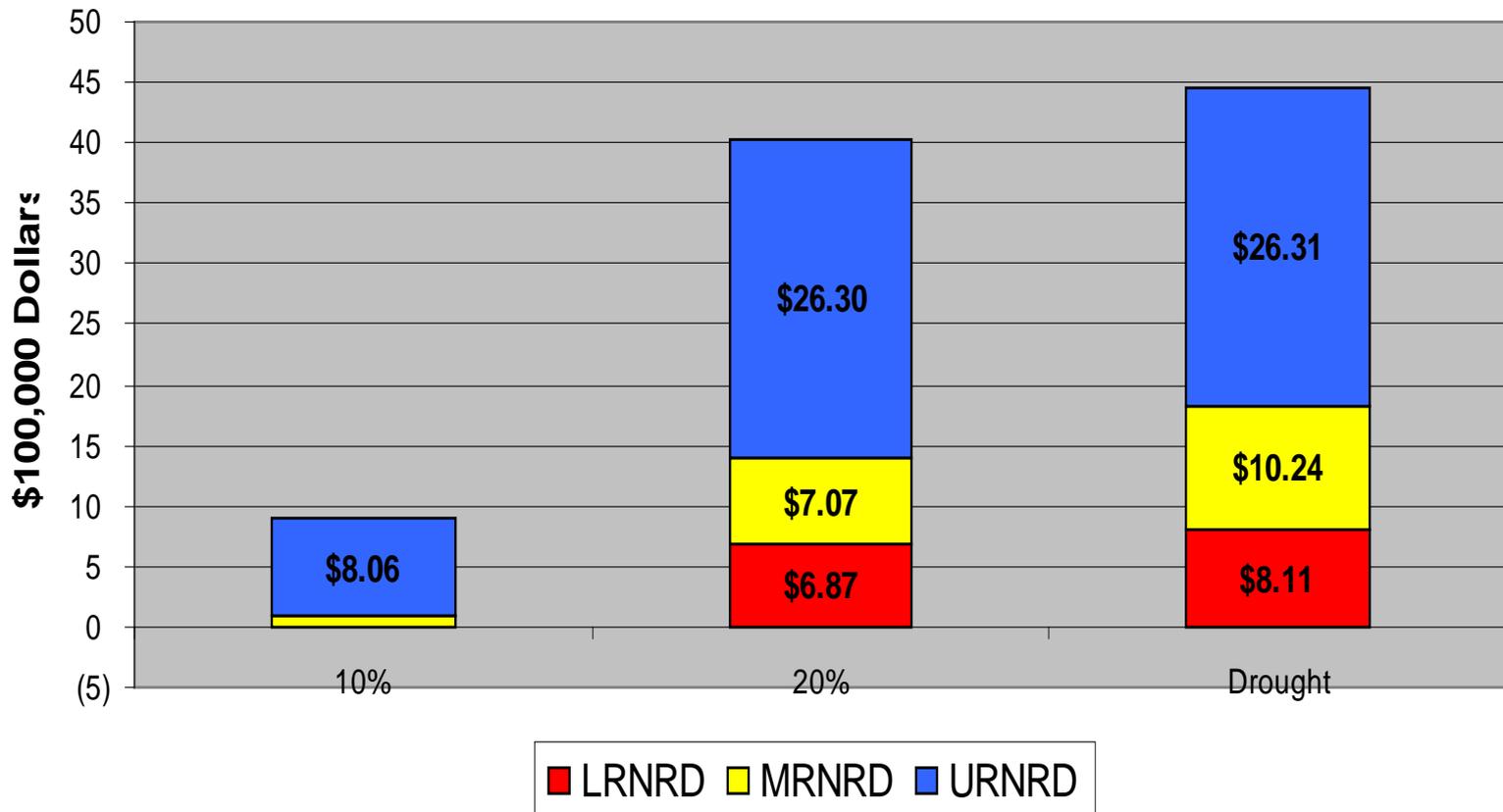
Employment Impacts

- **Basin-wide employment impacts range from 150 jobs for the 10% scenario to over 600 for the worst case drought scenario.**
- **Total employment in the regional economy is over 55,000. Hence, even the worst case impact is only 1.1 percent of the total.**

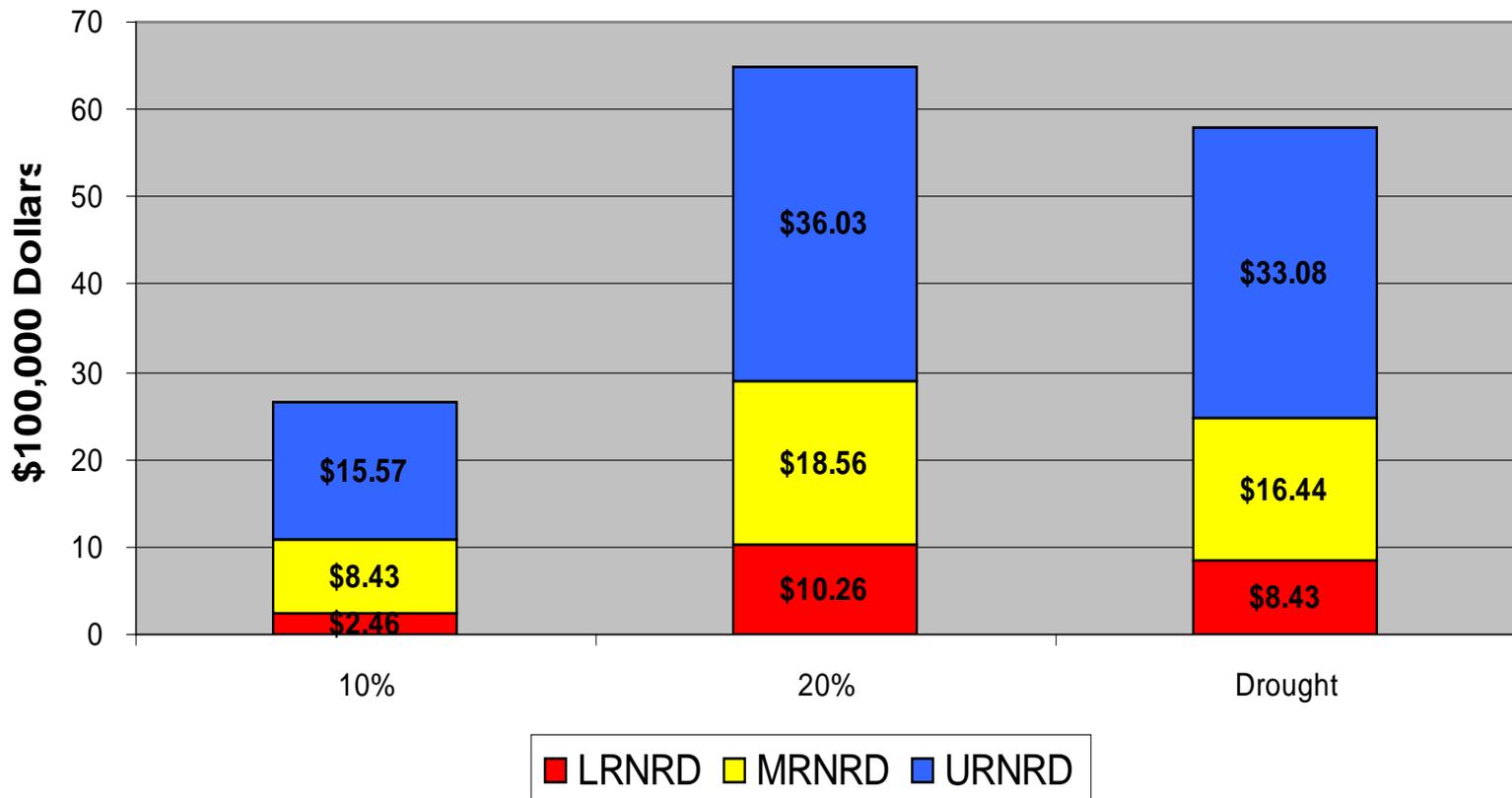
Reduction in Farm Input Use in Republican Valley



Reduction in Chemical & Fertilizer Costs Per NRD



Reduction in Energy & Lube Costs Per NRD



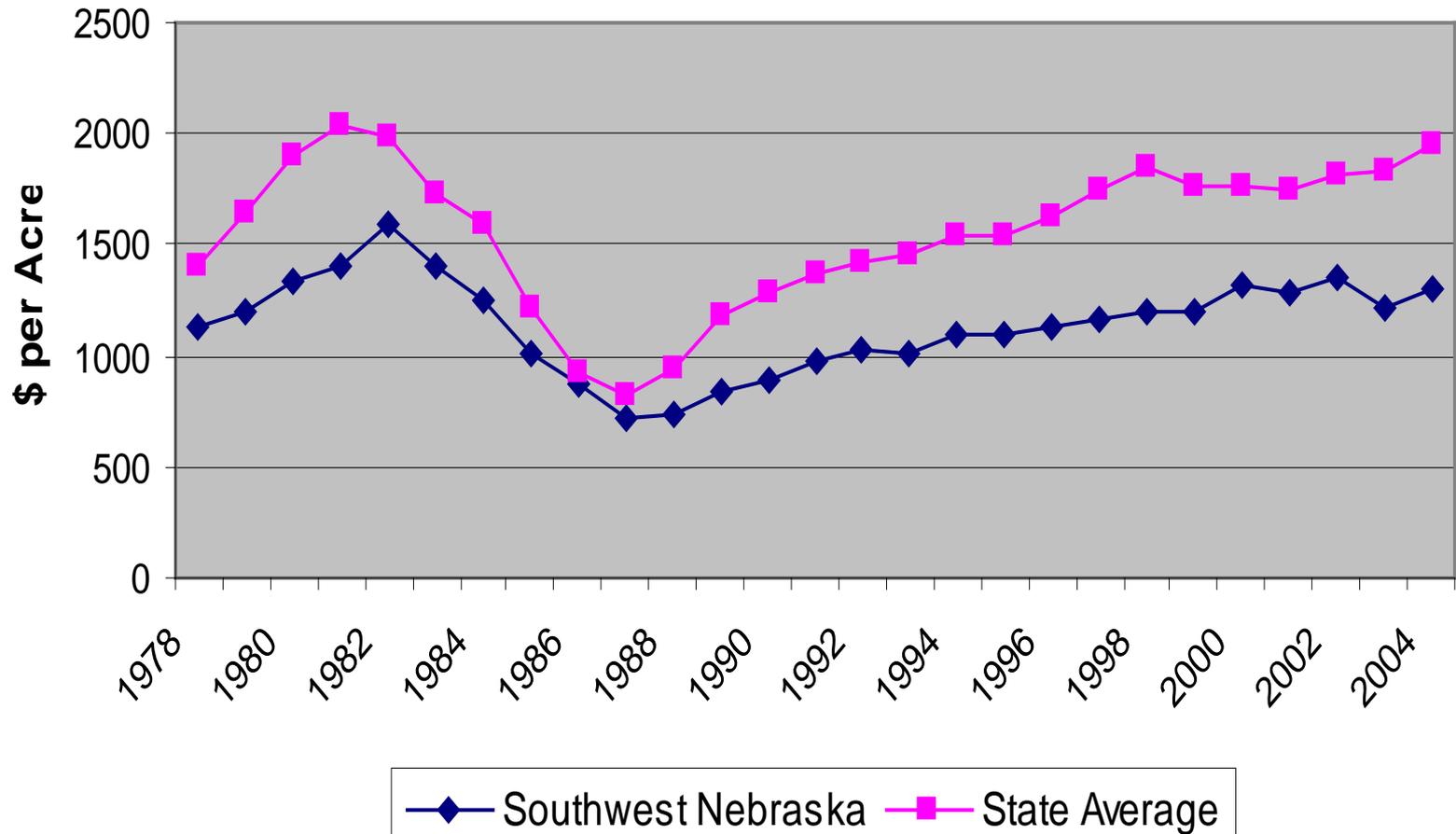
Land Value Impacts

Impact on Land Values

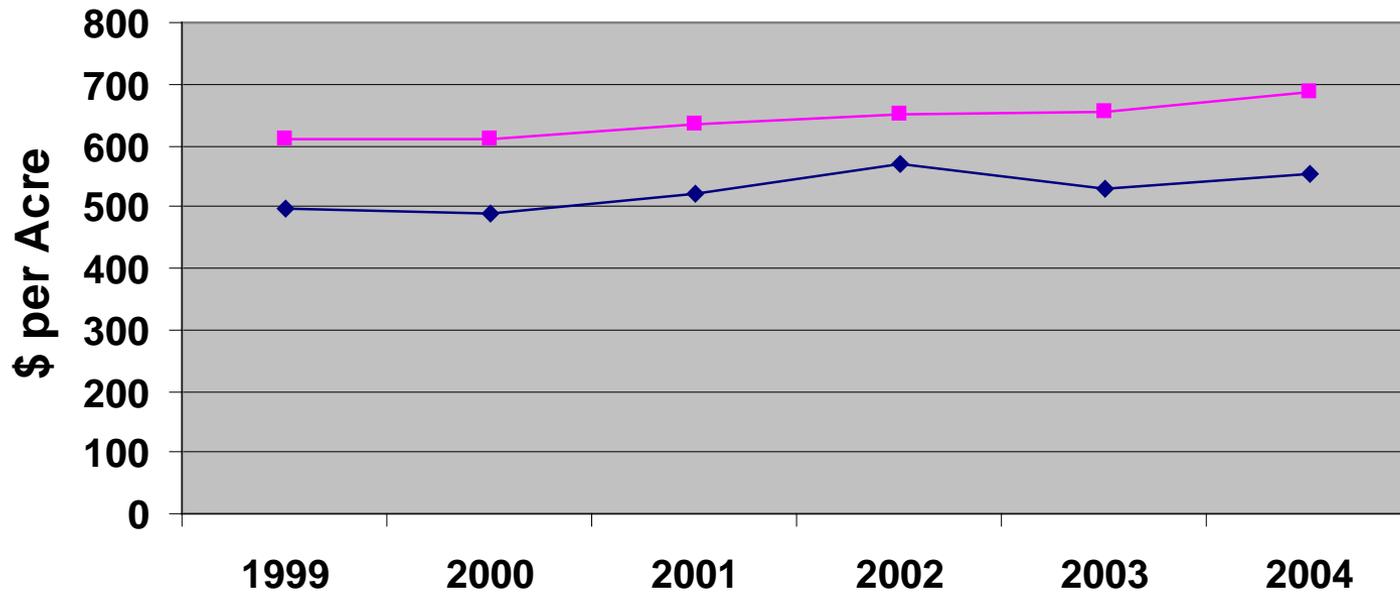
Factors to Consider:

- 1. Changes in net returns to irrigated land.**
- 2. Limits on new well development.**
- 3. Inflation and productivity trends.**
- 4. Market psychology.**

Irrigated Land Value Trends



Land Value Trends, Southwest Nebraska



—◆— Dryland, no irrigation potential —■— Dryland with irrigation potential

Most Likely Land Value Impacts

- **Dryland with Irrigation Potential:**
 - **Likely to decrease by 10 to 15%, but much of this impact may already be reflected in market. (From 1995-2004, value of dryland with irrigation potential in the SW increased by 19%, whereas state average increase was 42%).**

Most Likely Land Value Impacts

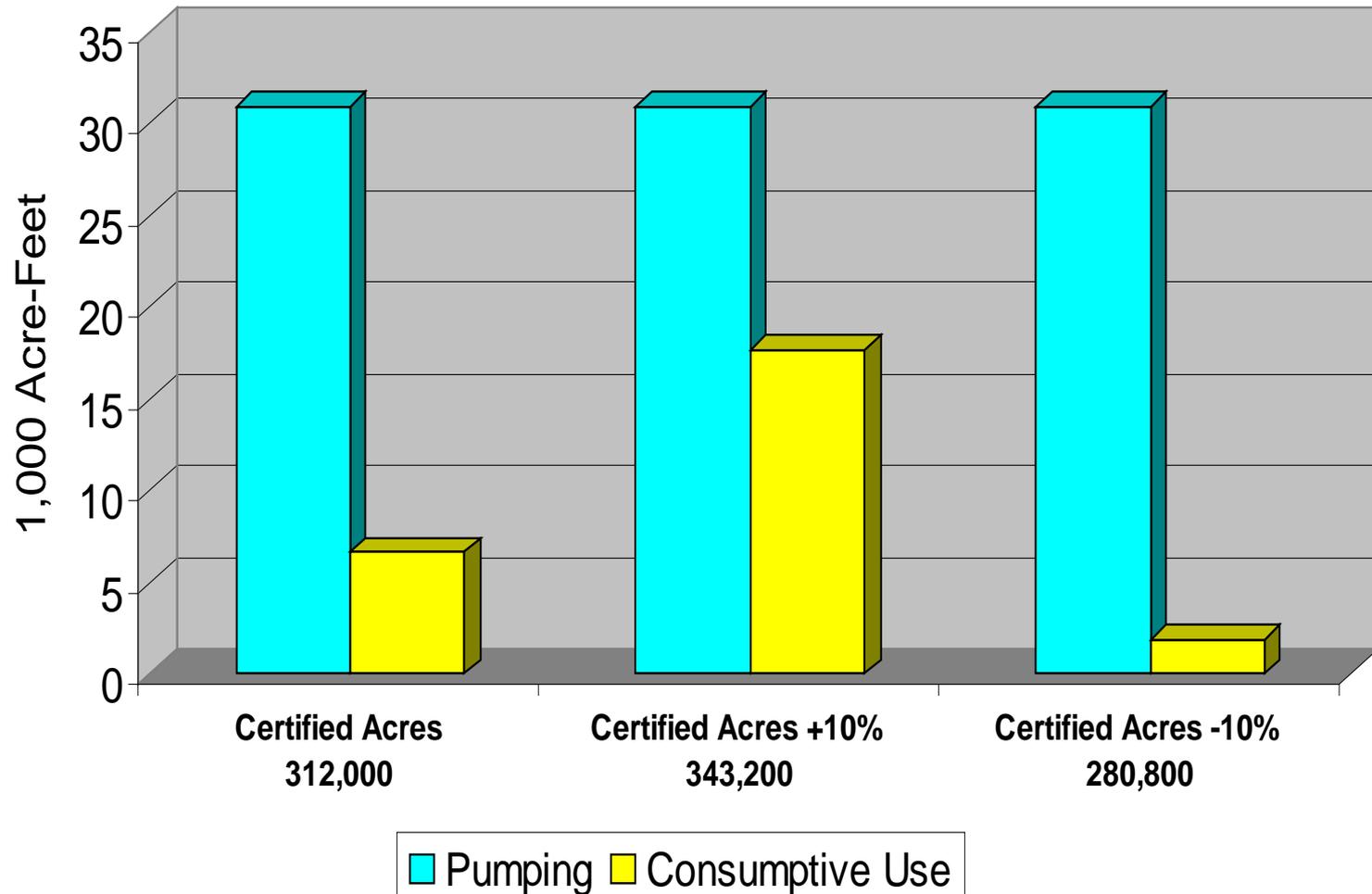
- **Irrigated land values: The 10% scenario implies an average long-term land value effect of \$75 per acre. A 20% scenario implies \$375 per acre.**
- **Absolute land values may not go down – simply increase at a slower rate.**
- **Much depends on community expectations and on the severity and frequency of drought.**

Effect of Different Acreage Estimates on Economic Impacts

Allocation Levels for 10% Reduction in Pumping, Given Varying Acreage Estimates: MRNRD

	Upland Sprinkler	Upland Gravity	Quick Response- Gravity	Total NRD
Certified Acres	135,169	64,243	112,588	312,000
Mean (In/Ac)	11.97	11.97	14.82	12.99
10% Regulation (In/Ac)	13.17	13.17	15.86	14.33
Certified Acres +10%	148,686	70,667	123,847	343,200
Mean (In/Ac)	10.88	10.88	13.47	11.82
10% Regulation (In/Ac)	10.50	10.50	13.65	11.60
Certified Acres -10%	121,652	57,819	101,329	280,800
Mean (In/Ac)	13.30	13.30	16.47	14.44
10% Regulation (In/Ac)	14.60	14.60	20.06	16.12

Effect of 10% Reduction in Pumping on Consumptive Use for Different Acreage Estimates in MRNRD



Effect of Varying Acreage Estimates on Economic Valuation in the MRNRD: 10% Regulation

	Certified Acres	Certified Acres +10%	Certified Acres -10%
Reduction in Net Returns	\$943,923	\$3,327,165	\$172,241
Total Cost/AF Chg Pump	\$30	\$108	\$6
Total Cost/AF Chg ET	\$142	\$188	\$91
Total Cost/Total Acres	\$3.00	\$9.70	\$0.61
Total Cost/Affected Acres	\$6.00	\$14.60	\$1.39

Results From Acreage Analysis

- **If actual acres are under estimated by 10%, but are unchanged, then our estimates understate the true economic impact by 10%.**
- **If actual acres are under estimated by 10% and are changed, then a lower allocation level will be needed to achieve the same change in pumping.**
 - **At this lower allocation level, the economic impacts from a 10 percent change in pumping will be 2 to 3 times what was estimated using certified acres.**

Policy Relevance of Acreage Analysis (Page 1)

- **Do results mean that under estimating NRD acres is advantageous to irrigators (lower acres, higher allocation, less economic injury)?**
- **No, because if allocation per acre is higher it will take a greater reduction in pumping to comply with the Compact?**

Policy Relevance of Acreage Analysis (Page 2)

- **Do results mean that a higher estimate of NRD acres would be advantageous to irrigators (more acres, lower allocation, more economic injury)?**
- **No, unless the baseline pumping estimate and/or the required change in total pumping is also adjusted.**

Policy Relevance of Acreage Analysis (Page 3)

- **Over the long term the real economic impact will depend on how CU needs to change to satisfy the Compact.**
- **The same total effect on CU, and thus the same economic impact, could be produced in several different ways.**

Do Averages Obscure the Pain?

- **Yes. Actual injury will vary due to differences in application efficiency, uniformity, soils, management practices etc.**
- **Those who typically apply less than allocation are not affected at all.**
- **Those who typically apply much more than allocation are affected only slightly more than average, because net returns per inch decrease as more water is applied per acre.**

Potential Mitigation Measures

Economic impacts could be lessened with mitigation measures such as:

- **Voluntary land retirement program (public purchase of irrigation rights)**
- **Alternative land uses**
- **Education programs to improve irrigation management.**

Summary of Results

- **The 10% Scenario Will:**
 - **Reduce pumping by 110,000 AF and consumptive use by 30,000 AF.**
 - **Cost farmers \$6 per affected acre.**
 - **Cost farmers \$3 per certified acre.**
 - **Cost the Republican Valley \$5.6M, which is equal to \$53 per AF change in pumping and \$196 per AF change in consumptive use.**

Summary of Results

- **The 20% scenario will:**
 - **Reduce pumping by 220,000 AF and consumptive use by 95,000 AF.**
 - **Cost farmers \$21 per affected acre.**
 - **Cost farmers \$15 per certified acre.**
 - **Cost the Republican Valley \$24.0M, which is equal to \$110 per AF change in pumping and \$254 per AF change in consumptive use.**

Summary of Results

- **The 13%, 40K drought scenario will:**
 - **Reduce pumping by 260,000 AF and consumptive use by 113,200 AF.**
 - **Cost farmers \$31 per affected acre.**
 - **Cost farmers \$21 per certified acre.**
 - **Cost the Republican Valley \$32.5M, which is equal to \$125 per AF change in pumping and \$287 per AF change in consumptive use.**

Summary of Results

- **Basin-wide impacts from the 13%, 40K drought scenario (most severe) would reduce regional output by 1.5% and employment by 1.1%.**
- **Very recent discussions with state officials suggest that the required normal year reductions in pumping may be closer to 5 than to 10 percent. Drought year reductions likely to be lower also at 5% and 40K instead of 13% and 40K.**

Conclusions

- **Long-term normal year reduction in pumping of 10 to 15% will significantly affect some individual producers, but will not have devastating effect on the regional economy.**
- **Adjustments to meet drought conditions will be significant but not devastating at the regional level; unless continued for multiple years.**

Conclusions

- **Crop prices can substantially mitigate or exacerbate regulatory impacts. For example, the effect on irrigators (basin-wide) of a 20% decrease in pumping is roughly equivalent to a 4.7% decrease in crop prices.**
- **Impacts on grain handling and farm supply firms likely to be less than what has been experienced in recent years from crop shifts (corn to soybeans) and technology (Round-up Ready, Bt corn, etc.), except perhaps for a sustained drought scenario.**

Conclusions

- **Land values will increase a little less in future years than they would have without regulations, but an absolute decline in the property tax base is unlikely.**
- **Regulations based on percentage reductions in pumping across NRD's have differential impacts on a per acre basis, i.e., those in the URNRD pay more than those in the Middle or Lower NRD's.**

Conclusions

- **Economic impacts will be quite different if:**
 - **Mitigation measures are implemented.**
 - **Certified Irrigated acres are erroneous.**
 - **Baseline pumpage is erroneous.**
 - **Crop prices are higher or lower.**

Conclusions

- **There is no easy way for Nebraska to meet Compact requirements, but perhaps this economic information can help the NRD's and the State make the hard choices.**

******* Thanks for Listening *******