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Understanding the Value of Water in Nebraska: Future Expectations and Considerations

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Market Report	Yr Ago	4 Wks Ago	12/10/10
Livestock and Products, ***Weekly Average***			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight	$78.63	$98.11	$100.79
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	103.69	122.87	147.75
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	95.55	111.55	117.00
Choice Boxed Beef, 600-750 lb. Carcass	136.09	157.79	164.40
Western Corn Belt Base Hog Price Carcass, Negotiated	63.63	62.89	65.68
Feeder Pigs, National Direct 50 lbs, FOB	*	*	*
Pork Carcass Cutout, 185 lb. Carcass, 51-52% Lean	67.25	76.63	78.36
Slaughter Lambs, Ch. & Pr., Heavy, Wooled, South Dakota, Direct	90.62	150.50	157.00
National Carcass Lamb Cutout, FOB	244.88	348.65	350.77
Crops, ***Daily Spot Prices***			
Wheat, No. 1, H.W. Imperial, bu.	4.17	5.61	6.74
Corn, No. 2, Yellow Omaha, bu.	3.67	5.10	5.71
Soybeans, No. 1, Yellow Omaha, bu.	10.18	12.26	12.71
Grain Sorghum, No. 2, Yellow Dorchester, cwt.	6.05	8.37	9.27
Oats, No. 2, Heavy Minneapolis, MN , bu.	2.54	3.34	3.99
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	*	170.00	140.00
Alfalfa, Large Rounds, Good Platte Valley, ton.	87.50	75.00	72.50
Grass Hay, Large Rounds, Premium Nebraska, ton.	*	*	*
Dried Distillers Grains, 10% Moisture, Nebraska Average.	115.00	160.25	181.50
Wet Distillers Grains, 65-70% Moisture, Nebraska Average.	40.00	56.00	58.50

***No Market**

Nebraska's water resources are cost-effective insurance for harnessing the productive potential of cropland. During the last 30 years, intensive irrigation development in Western Nebraska has led to regulations to prevent or reduce the over-use of Nebraska's share of both surface and groundwater. Despite regulations affecting the amount of available water, farmers have been able to manage water in ways that lead to an acceptable net return, with little impact on land values. However, as stricter regulations are put in place to limit the amount of water that can be withdrawn each year per irrigated acre, it is quite possible that the market value of irrigated land will be significantly affected.

Determining the economic value of water is sometimes confused with calculating the cost of water. In Nebraska, the cost of water is usually the pumping cost associated with attaining the water for use. This is an acceptable pricing method for crop budget analysis and other financial calculations; however, it should not be misconstrued as the value of the water resource. The true value of irrigation water is determined by its worth in production, and often the value of the water and the cost of the water are very different values. This analysis is concerned with determining an estimate of the value or "worth" of the water.

Two main methods of economically valuing irrigation water are the "Land Value Method" and the "Residual Returns Method." The Land Value Method, an inductive valuation technique, is based on comparing land market transactions of irrigated and non-irrigated land. This method is most appropriate when water is used for a purpose that produces a time stream of income such as irrigation. Assuming all buyers and sellers are well informed about possible income flows and act rationally, the Land Value Method is an excellent way of determining the value of water. The Residual Returns Method of determining the value of water is a deductive method that can be applied using a representative farm model such as Water Optimizer.

This model determines the optimal cropping pattern for an average farm and its associated future income stream using crop growth production functions, average weather, crop prices and inputs. The residual income flow to the land is the income which is left after all non-land costs are paid. The value of the irrigation water is the difference in net returns to the optimal cropping pattern with and without the water (Young 2005).

In Nebraska, the best source of current property values is the annual *Nebraska Farm Real Estate Market Survey*. Collected and produced by the University of Nebraska-Lincoln, Department of Agriculture Economics, this survey annually collects land rental data, land sales data and other market characteristics and perceptions for the state of Nebraska (Johnson, 2010). Data is reported for each of the eight Nebraska Statistical Reporting Districts and includes information on the average value of different types of agriculture land, average annual rental rates and capitalization rates (Table 1, end of article). While the data collected is not actual sales data, it is an objective view of the market by a panel of experts.

The data in Table 1 can be used to derive the value of irrigation water from the land market. The value of the irrigation right in dollars per acre, is the difference between the average value for irrigated land and the average value of dryland without irrigation potential. Additionally, the survey reports annual cash rental rates which allow us to calculate the annual value of irrigation water, expressed as dollars per acre per year. The annual value of irrigation water, when based on the cash rental market is equal to the irrigated cash rent less the dryland rent, less the difference in property taxes. One can also use the land market data to compute the implied capitalization rate for returns to water. The capitalization rate for water is equal to the difference in cash rents, adjusted for taxes and divided by the land value difference.

Water Optimizer can be used in much the same way to deduce the average annual value of irrigation water. By calculating net returns in an irrigated scenario and comparing them to dryland returns for the same land, the difference is the annual value of irrigation water (Table 2, end of article). By capitalizing this annual value using the capitalization rate for irrigated land derived from the market, we can compute the value of water in perpetuity and compare these results to the average value of water collected in the survey.

Note that the two methods produce very different estimates of the value of water. Originally, these differences were attributed only to a mis-interpretation of the value of water by participants in Nebraska's real estate market. However, further analysis of future expectations can explain and reconcile the differences. It appears that participants in the Nebraska agriculture land market are quite conservative regarding expected future conditions when purchasing land. By modifying the price and yield inputs in Water Optimizer, we can explore the effect on returns to water that would be realized if crop price expectations were, for example, 15 percent less than current average conditions, and/or if yields were 15 percent less.

As one can see from Table 3 (end of article), that modifying the default conditions of Water Optimizer reconciles the differences between the market derived value of water and the calculated value of water. If the changing crop price expectations of market participants are 15 percent less than the baseline inputs in Water Optimizer, for example, then the calculated values are only slightly higher (Northwest is actually less) than what is implied in the land market. Yield would have a slightly smaller effect.

These effects show that the willingness to pay for irrigation water in Nebraska is highly sensitive to a variety of variables, most of which are very hard to predict. Uncertainty leads market participants to act conservatively when bidding for land. Contrary to conventional wisdom, the land market indicates that investing in irrigated land may be more risky than investing in dryland, because price affects irrigated returns more than dryland returns, and perhaps also because of uncertain water supplies.

References:

Johnson et al., *Nebraska Farm Real Estate Market Highlights*. June 2010. www.agecon.unl.edu/realestate.html

Young, Robert. "Determining the Economic Value of Water - Concepts and Methods." *Resources for the Future*, Washington DC. 2005.

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Last Issue of the Year.
Have a Safe and Happy Holiday!!!

Table 1. Dryland and Irrigated Land Values and Rents Compiled from 2010 Land Market Survey

	Dryland*			Irrigated		
Regional Reporting District	Annual Cash Rent	Value of Cropland	Capitalization Rate	Annual Cash Rent	Value of Cropland	Capitalization Rate
South	$74	$1,640	4.51%	$198	$3,545	5.59%
Central	$83	$1,585	5.24%	$193	$3,205	6.02%
Southwest	$41	$735	5.58%	$162	$2,390	6.78%
Northwest	$31	$510	6.08%	$140	$2,000	7.00%

* Dryland without irrigation potential

Table 2. Land Market Derived and Calculated Water Values

	Market Derived			Water Optimizer		
Regional Reporting District	Annual Value of Water	Value of Water into Perpetuity	Capitalization Rate of Water	Annual Value of Water	Value of Water into Perpetuity	Difference Between the Two Methods
South	$162	$1,905	8.51%	$187	$3,355	**$1,450**
Central	$142	$1,620	8.79%	$178	$2,961	**$1,341**
Southwest	$154	$1,655	9.31%	$215	$3,169	**$1,514**
Northwest	$139	$1,490	9.32%	$179	$2,554	**$1,064**

Table 3. Effects of Crop Prices and Yields on Water Value Comparison

	Market Derived	Water Optimizer		
Regional Reporting District	Value of Water into Perpetuity	Calculated Using Baseline Crop Prices and Yields	Calculated Using Crop Prices 15% Less than Baseline	Calculated Using Crop Yields 15% Less than Baseline
South	$1,905	$3,355	$2,045	$2,231
Central	$1,620	$2,961	$1,793	$1,961
Southwest	$1,655	$3,169	$1,972	$2,140
Northwest	$1,490	$2,554	$1,386	$1,546