Programmed Effects of Surface Water Price Levels on U.S. Agricultural Water Use and Production Patterns: Comment

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In a 1981 *Journal* paper, Morton, Christensen and Heady state that U.S. agriculture will face increased real prices for irrigation water. They further state that a need exists to identify and quantify the impacts of these increased costs on U.S. agriculture. I agree. However, the authors fail to consider the most likely possibilities in the area of increased costs for irrigation water.

In their analysis, the authors have chosen to portray the effects of increasing surface water prices and constant ground water prices — the most unlikely possibility for foreseeable changes in the cost of irrigation water. The cost of pumping ground water has been increasing dramatically [Sloggett]. Some surface water used for irrigation in the West is priced under long-term Bureau of Reclamation contracts [Bureau of Reclamation]. Private irrigation organizations supply much of the remaining surface water used for irrigation. Most of this water is priced at a fixed price plus a charge for operation and maintenance of canals and equipment. These costs have risen much more slowly than the cost of pumping ground water.

Some of the assumptions used in the model do not appear reasonable. The authors have chosen to allow considerable substitution of ground water for surface water as the price of surface water increases. Some surface water irrigation areas do not have a ground water alternative. Also, they show in Table 1 an increase of over 5 million acre feet of ground water being used as the price of surface water doubles. Most of that increase is coming from the Great Plains states. Colorado, Kansas, and New Mexico have rather strict institutional restrictions on ground water irrigation development, and Nebraska is beginning to restrict ground water development for irrigation [Sloggett]. The authors chose to leave institutional constraints out of the model. It appears unlikely that the states with ground water depletion problems will relax constraints on further ground water development.

The model also allows surface water to be transferred among producing areas within river basins where transfers are physically possible. Surface water rights and use have been adjudicated over many years in volumes of court cases [Hutchins]. These rights are closely tied to the land or a point of diversion and stringent criteria must be met if these rights are to be changed, i.e., no damage to other water users or return flow. To assume any significant transfer of surface water among producing areas in the foreseeable future is unrealistic.

The crops chosen by the authors to be exogenous to the model include pasture, orchards, vegetables and truck crops. The justification was that "these crops are high valued in irrigation and will continue to receive water over a wide range of water price increases." Pasture has not traditionally been considered a high value crop. Furthermore, this manuscript addresses changes in surface water prices and their impact on irrigated agriculture. Much of the pasture land irrigated in the U.S. utilizes surface water and there are 5.1 million acres of pasture irri-

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gated within the study area [Census of Agriculture, 1978]. I believe that substantial changes in the empirical results could occur if pasture were endogenous to the model.

In addition to excluding irrigated pasture from endogenous crops, significant quantities of other irrigated land are excluded. Changes in irrigated acreage and cropping patterns displayed in Table 4 are only for 19.5 million acres of endogenous crops. However, there are 23.8 million acres of *exogenous* irrigated land, including pasture, estimated in the National Water Assessment for 1985 [Water Resources Council]. These exogenous acres are the pastures, orchards, etc., that were assumed to remain constant over a wide range of irrigation water prices. One objective of this journal article was to *partially* fill the need to "quantify agricultural water demand." The authors succeed in this by ignoring over half of the acreage in the study area where water is demanded for irrigation.

The quantity of water used is another apparent problem. Table 1 indicates that U.S. water use is included in the tabulations. However, only water use for the western river basins is included. The National Water Assessment reports 175 million acre feet of water diverted in 1985 for all crops and livestock in the western river basins reported in Table 1 [Water Resources Council]. It also reports 96 million acre feet were consumed by crops and livestock in that same area. Table 1 reports only 50 million acre feet of water use by endogenous *and* exogenous crops and livestock in the base solution.

The 96 million acre feet of water consumed is that portion of the 175 million acre feet withdrawn and lost to the atmosphere by evapotranspiration, incorporated into plants, or lost to deep percolation. The amount of water delivered to crops and livestock is the amount of water diverted less conveyance losses. Estimated conveyance losses for the 17 western states were about 20 percent [U.S. Geological Survey]. Thus, water applied to crops and used by livestock was probably close to 140 million acre feet compared to the 50 million acre feet reported in Table 1.

Card Report 101 [Christensen, *et al.*] appears to be the source for this journal article. In this report changes in the price of ground water and surface water are considered independently and conjunctively. The conjunctive changes in ground water and surface water prices, particularly much higher ground water prices accompanied by moderately higher surface water prices, is the most likely change in water prices in the foreseeable future. The authors can be commended for their approach in the CARD report. However, they chose to split the CARD report into two journal articles. One was submitted to the *Western Journal of Agricultural Economics* and the other was submitted to the *Southern Journal of Agricultural Economics*. The WJAE article considered only changes in surface water prices, while the SJAE article considered only changes in ground water prices. Two articles appear with very unrealistic assumptions and accompanying empirical results.

Abstracting journal articles from lengthy research work is an accepted practice. But in this case, one report that takes a realistic approach to the problem (yet suffers from many of the problems discussed in this comment) was divided into two journal articles with unrealistic approaches to an important water resources problem.

References

Bureau of Reclamation. *Water and Land Resources Accomplishments, Project Data Statistical Appendix III*. United States Department of Interior, annual series.

Christensen, Douglas, Andrew Morton, and Earl O. Heady. "The Potential Effect of Increased Water Prices on U.S. Agriculture" *Card Report 101*. Center for Agricultural and Rural Development, Iowa State University. July 1981.

Census of Agriculture, 1978. Bureau of the Census. United States Department of Commerce.

Hutchins, Wells A. "Water Rights Laws in the Nineteen Western States." United States Department of Agriculture, Economic Research Service. 1971.

Morton, Andrew, Douglas A. Christensen and Earl O. Heady, "Programmed Effects of Surface Water Price Levels on U.S. Agricultural Water Use and Production Patterns." *Western Journal of Agricultural Economics*, 6(1981):113-27.

Sloggett, Gordon R. "Prospects for Ground-Water Irrigation." United States Department of Agriculture, Economic Research Service. AER 478. December 1981.

———. "Mining the Ogallala Aquifer: State and Local Efforts in Groundwater Management." Oklahoma State University Experiment Station and United States Department of Agriculture, Economic Research Service. Research Report P-761. November 1977.

U.S. Geological Survey. *Estimated Use of Water in the United States, 1975*. United States Department of Interior, GSC 765. 1977.

Water Resources Council. *The Nation's Water Resources: 1975-2000*. Washington, D.C. 1979.