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Evaluation of Water Policy Alternatives for Intertemporal Allocation of Groundwater in the Southern High Plains of Texas

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Evaluation of Water Policy Alternatives for Intertemporal Allocation of Groundwater in the Southern High Plains of Texas

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Texas groundwater law is based on the rule of capture with recent legislation providing groundwater conservation districts increasingly restrictive policy alternatives to manage groundwater aquifers. The Ogallala Aquifer underlies portions of eight states of the Great Plains regions of the central United States. The southern portion of the Ogallala Aquifer underlies over 30 counties of the Southern High Plains of Texas and eastern New Mexico. This region of the aquifer is characterized by very low recharge and relatively high withdrawal rates for agricultural irrigation that account for over 90% of the groundwater used in the region.

Enactment and implementation of effective water conservation policies can extend the life of the Ogallala Aquifer in the Southern High Plains of Texas. With the passage of Texas Senate Bill 2 in 2002, Texas underground water conservation districts were given the authority to modify the rule of capture by restricting a landowner's use of water and imposing water use fees. Restricted water use would likely result in fewer irrigated cropland acres planted and an extended aquifer life, making water available for future use by municipalities, industries, and agriculture. The objective of this study was to develop models to analyze the conservation effects and economic impacts on agricultural producers of water conservation policy alternatives that are currently available for use by groundwater conservation districts in the Southern High Plains of Texas.

A nonlinear dynamic programming framework was used to measure the impact of water conservation policy alternatives on the saturated thickness of the aquifer and the net farm income for the Southern High Plains of Texas. Models were developed for a 50-year planning horizon to estimate aquifer decline and the net present value of net income to agricultural producers in a 19-county study area within the Southern High Plains of Texas. The models included a baseline scenario using current management practices and three policy alternatives. The three water policy alternatives that were developed were (1) a water use fee of $1 per acre foot of water pumped, (2) an annual restriction of the quantity of water pumped to a level of 75% of the 10-year average use, and (3) a restriction on the cumulative decrease in the aquifer's saturated thickness to 50% of the initial level over the planning horizon.

The results of this study suggest that imposing limits on water use, on either an annual use basis or on a cumulative use basis, would result in greater water conservation over 50 years than imposing production fees at the maximum level currently allowed. The analysis of net present value of net income suggests that a policy that imposes a small production fee has the least agricultural cost as measured by the lowest level of decreased agricultural net present value of net income over the planning horizon, followed by restricting the decrease in the level of the aquifer, and finally by restricting annual water use. Overall, it was found that the policy scenarios that restrict groundwater pumping conserved more water than the production fee scenario but at a higher cost to agricultural producers.

Determination of the socially efficient water conservation policies requires that decision makers know both the economic cost and conservation benefit of each potential policy. Findings reveal that imposing a small production fee, at the maximum allowed by Texas Senate Bill 2, does not significantly conserve water relative to the baseline scenario and only imposes small economic costs on agriculture relative to the other policies. Scenarios that restrict groundwater pumping conserved more water than the production fee scenario but at a higher agricultural cost. A comprehensive long-run modeling approach, like the one presented, allows decision makers to comprehensively investigate the cost-effectiveness and policy impact a conservation policy will have on irrigated agriculture. Moreover, it provides the necessary data to calculate the minimum user fee that must be imposed to satisfy a given conservation goal.