CONSERVING AND EXTENDING THE HIGH PLAINS AQUIFER

Issue Statement

The High Plains aquifer is the largest, most economically important groundwater source in Kansas, and is the primary water source for western and south-central Kansas. It consists of the Ogallala aquifer in western Kansas, and the Great Bend aquifer and Equus Beds in south central Kansas. The High Plains aquifer is heavily developed, particularly for irrigation, with most of the Ogallala portion in long term, serious decline (Fross et al., 2012). The state goal is to Conserve and Extend the High Plains aquifer. Specific goals are being determined by Groundwater Management Districts (GMD).

Why this is important to Kansas:

The High Plains aquifer is vital to the economy, environment, and well-being of Kansans who rely on it. The aquifer supports an extensive agricultural complex of irrigated corn and other crops, a large cattle and dairy industry, meat packing, and biofuel plants. The top five counties in agricultural sales represent 24% of the state's total, and all are in western Kansas. The value of water, as measured in revenue generated, continues to increase for irrigated crops (Golden, 2011) with more efficient crop water management, higher yielding crops, and higher prices. Other uses of water also generate high levels of economic growth. The ethanol industry in western Kansas provides significant economic contributions; the ethanol plant in Gove County generates $139 million annually in economic activity. The economic future of western Kansas depends on water. Many regions over the High Plains aquifer face real risks of economic limitations, environmental damage, and community declines if enough water isn't available for future needs. Even a 20% reduction in water use, while lowering corn/cattle production to levels of 15 or 20 years ago, would extend peak production and allow production far longer than without water .

Gaps to meet this Goal:

Decline Rates The Kansas High Plains aquifer is heavily developed, with water levels in most regions in decline. Projections of how many more years the aquifer will support a particular level of withdrawal indicates large areas that have less than 25 to 50 years at current usage rates. Some regions in Haskell County may have a decade or less of large scale withdrawals (Butler et al., 2013). Widespread, significant conservation measures must occur to extend the useful life of the aquifer.

Common Pool An aquifer is a common pool resource. While the High Plains aquifer flows slowly through saturated sand, silt and clay deposits, the thicknesses and interconnections of the deposits, and the pressures created by gravity, pumping and other forces determine where the water flows. In general, regional conservation efforts will lead to more water remaining in the aquifer in that region. Water right allocations indicate specific quantities and uses, and who gets the water when there isn't enough to meet all demands. Individuals have incentives to use all they are entitled to from a common pool, to reap short term benefit, when the negatives (water declines) are spread across many users. However, common pool resources have been successfully managed by and for those that rely on it, particularly with a locally developed plan that has clearly defined goals and rules.

Legal Framework Each water right permit application must be approved by the Chief Engineer, KDA-DWR. After approval, a perfected water right can continue in perpetuity as long as it is in good standing and not impairing a more senior right. Over-appropriations must be addressed within the legal framework.

Economics Reducing the amount of irrigation water will, at least in the short term, reduce crop yield. Although there are economic advantages to conserving water for future use, as well as consideration of future generations' needs, many producers use their water rights to maximize the current benefit.

Approach to Achieving Goal

LEMA The Local Enhanced Management Area (LEMA) option allows a locally developed groundwater conservation plan to be proposed within a GMD. If recommended by the GMD and ordered by the Chief Engineer, the conservation measures have the force of law. A LEMA has the potential to be highly effective due to local commitment to its success, and GMD and state support in its implementation. The first approved LEMA, in Sheridan County, has a nearly 20% water conservation goal. GMD1 is developing one or more LEMAs. Additional discussions are occurring in localized areas in GMD3, and in Sherman County, GMD4. The LEMA process can be helped by state assistance on logistical costs, verification of compliance, and monitoring of aquifer responses.

Water Bank A water bank is a market based program to provide water conservation and move water rights away from critical decline areas to areas of need, through long term leases of water rights. A water bank has been established in Big Bend GMD5.

Compliance and Enforcement In 2013, KDA-DWR increased penalties for overpumpers. The penalties increase in severity with the number of offences; the fourth offense is a water right revocation. Meter tampering or intentionally falsifying information may result in a water right suspension or revocation. Compliance and monitoring grows in importance as water resources become scarcer and water users want assurance of fair treatment; this need could be met with increased use of technology and adequate staff.

Water Conservation Programs There are several state and federal programs for groundwater conservation. The state funded Water Transition Assistance Program (WTAP) pays water right owners in targeted areas closed to new water rights, to permanently dismiss all or a portion of their water right. The Upper Arkansas River Conservation Reserve Enhancement Program (CREP) is a state-federal program that pays irrigators to permanently transition acreage out of irrigated production, and temporarily into grass or other conservation practice. The Mobile Irrigation Lab, KanSched, and Crop Water Allocator are KSU Research and Extension products to help producers make the most efficient, economic use of their crop water. NRCS's EQIP program provides producers' assistance to implement water conservation practices.

Crop Insurance A federal crop insurance program is under development for limited irrigated crops, currently not covered by (fully) irrigated or dryland crop insurance. Production tables for corn and soybeans have been developed for expected reduction in yields with various cuts to irrigation water applied. The proposed program is undergoing external review. Depending on the review, USDA Risk Management Agency may offer limited irrigated crop insurance in Kansas by 2015.

Recharge Aquifer recharge is highly variable, influenced by a variety of factors including depth to water, intensity and total quantities of precipitation, temperatures, soils, and land use. Return flows from irrigation have become a major source of recharge. Another important recharge source is the 20,000 plus playa lakes in central and western Kansas. Artificial recharge, diverting surface water flows to groundwater storage for later use, is being successfully used in the Equus Beds near Wichita's well field.

Information Sharing Kansas has very good data on water use, with all water right owners other than domestic required to submit an annual water use report. Additionally, the State has identified long-term trends through annual measurements of water levels in about 1,400 groundwater wells. Drillers' well logs, annual water use, and water levels are all available to the public online. The Kansas Geological Survey has a Master Well Inventory (KGS, 2013) that assembles data from several agency databases. The accessibility of the data and its presentation in the online High Plains Aquifer atlas (Fross et al., 2012) is valuable in developing an awareness of conditions.

Research The pressing question driving ongoing research is determining the aquifer response to reductions in pumping. Hydrologic models have been developed for most of the High Plains aquifer, and one is under construction for GMD1. The hydrologic models help define the current water budget, and allow future management scenarios to be projected (e.g., Liu et al., 2010). Research on drought tolerant and low water crops, crop water management, and irrigation systems also assist farmers as they transition to less available irrigation water. Economic models also provide guidance on transitions to less water use that have the least impact at the farm level and regional economy.

References:

Butler, J.J., Jr., R.L. Stotler, D.O. Whittemore, and E.C. Reboulet, Interpretation of water-level changes in the High Plains aquifer in western Kansas, Groundwater, 51(2), pp. 180-190, 2013.

Fross, D., M.A. Sophocleous, B.B. Wilson, and J.J. Butler, Jr., Kansas High Plains Aquifer Atlas (www.kgs.ku.edu/HighPlains/HPA_Atlas/index.html), Kansas Geological Survey, 2012.

Golden, Bill, 2011, Presentation to the Kansas Water Authority, Hill City, May 19, 2011.

Guerrero, Bridget, B. Golden, S. Amosson, J. Johnson, and L. Almas, 2010, The Impact of Ethanol in Western Kansas. AgriLife Extension, Texas A&M, E-261 10/10.

Liu, G., B.B. Wilson, D.O. Whittemore, and J.J. Butler, Jr., Ground-water model for Southwest Kansas Groundwater Management District No. 3, Kansas Geological Survey Open-file Rept. 2010-18, 2010.

Steward, David, P. Bruss, X. Yang, S. Staggenborg, S. Welch,and M. Apley, 2013, Tapping unsustainable groundwater stores for agricultural production in the High Plains Aquifer of Kansas, projections to 2110. Proceedings of the National Academy of Sciences, 26 August 2013.

Kansas Geological Survey, 2013,Master Well Index: http://hercules.kgs.ku.edu/geohydro/master_well/index.cfm