AN INTEGRATED MODELING FRAMEWORK FOR WATER POLICY EVALUATION, YAQUI VALLEY, SONORA, MEXICO

Lee Addams (Presenter, Graduate Student), and Steven M. Gorelick, Professor, Stanford University, Stanford, CA

Hierarchical models of water resource management and policy can be extremely beneficial as tools for decision-makers to explore the interplay between water planning agencies and corresponding water users. An analysis of 'optimal' policy should, then, involve both economic and hydrological variables yet should also include examination of institutional rules that will induce the most efficient behavior from water users. In a region where water use is primarily agricultural, the variability of both agricultural prices and climate are additional factors which complicate the identification of a sustainable water resource policy.

The Yaqui Valley, a productive irrigated valley in semi-arid northwestern Mexico and birthplace of the wheat "Green Revolution", is an example of such an agricultural region. With only 24cm annual precipitation, this coastal plain region is highly dependent upon surface runoff from the 72,000 km^2 Yaqui River basin, of which approximately 2800 x 10^6 m^3 is available annually for irrigation of 228,000 ha. The marginally-saline coastal aquifers have historically been a small part of the water supply for the wheat/maize based agricultural region, averaging only around 260 x 10^6 m^3 each year (~10%). However, with persistent drought and continued municipal/industrial growth in the Yaqui Valley, future optimal water resource policy will undoubtedly include the increased use of groundwater mixed with Yaqui River water taking into account salinity levels for acceptable crop yields. Thus, the mixing aspects of conjunctive use must be considered in management scenarios, with maximum benefits occurring where groundwater extraction and quality are managed both spatially and temporally. In addition to these attempts to increase efficiency through system and aquifer *operations*, we explore the potential increase in efficiency through *policies* such as water marketing and interannual reservoir management , by using hierarchical modeling of the water users' decision-making. Our analysis using optimization models and reservoir management models shows that in the Yaqui Valley case, groundwater is currently under-utilized as a resource to buffer inter-annual surface water availability.