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U.S. Geological Survey's Research Activities in a Highly Stressed Regional Aquifer, the High Plains Aquifer, USA

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Abstract

The High Plains Aquifer located in the central United States is one of the world's largest freshwater aquifers (about 450,700 km²) supporting about 27% of United States agricultural production and yielding about 30% of all the ground water pumped for crop irrigation in the United States. The sustainability of the High Plains Aquifer is in question given the continued water-table declines and deteriorating water quality. Human development of the aquifer since the 1950s has caused ground-water withdrawals to greatly exceed recharge in many areas. Aquifer depletions are affecting well production rates, surface streamflow, and ecosystem health in addition to increasing costs associated with agricultural production. Head reversals at the base of the aquifer and the application of agricultural chemicals and irrigation water at the land surface have lead to impaired ground-water quality. Variations in climate that affect precipitation, aquifer recharge, chemical transport, and soil retention also have important implications for future aquifer sustainability. The U.S. Geological Survey has a substantial research effort in the High Plains Aquifer that strongly supports the goals of the GRAPHIC Project. This presentation will review the physical and cultural characteristics of the High Plains Aquifer; describe the design and implementation of research activities under the U.S. Geological Survey's High Plains Regional Ground-Water Study (including ground-water-quality assessments, recharge measurements, chemical and water fluxes in the unsaturated zone, and effects of declining ground-water storage); and discuss recent findings on the effects of human development on water quality and its availability. The High Plains Regional Ground-Water Study provides an example of an integrated an aquifer with multiple stressors that could provide a template for other large-scale regional aquifer assessments.