

Hydrogeologic Investigation of the Willcox and Douglas Basins, Rural Watersheds in Southeastern Arizona

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Communities within the Willcox and Douglas Basins in Southeastern Arizona are predominantly agricultural. Irrigation of crops in these basins is entirely supported through ground-water withdrawals. Populations in these communities are growing slowly relative to other locations in Arizona; however, the population in Mexico on the other side of the border from the Douglas Basin is growing much more rapidly. Declining ground-water elevations within each basin are an indication of overdraft of the ground-water system. These declines can lead to consequences such as increased pumping lift, land subsidence, and deterioration in water quality. There is also concern about the future availability of water for agricultural, municipal, domestic, and thermoelectric power uses. Because of these concerns the U.S. Geological Survey, in cooperation with the Arizona Department of Water Resources, began an investigation of the geology and hydrology of the Willcox and Douglas Basins as part of the State of Arizona's Rural Watershed Initiative (RWI) program (fig. 1). The purpose of this study is to assess existing ground-water elevation monitoring networks and to improve understanding of the hydrogeologic framework.

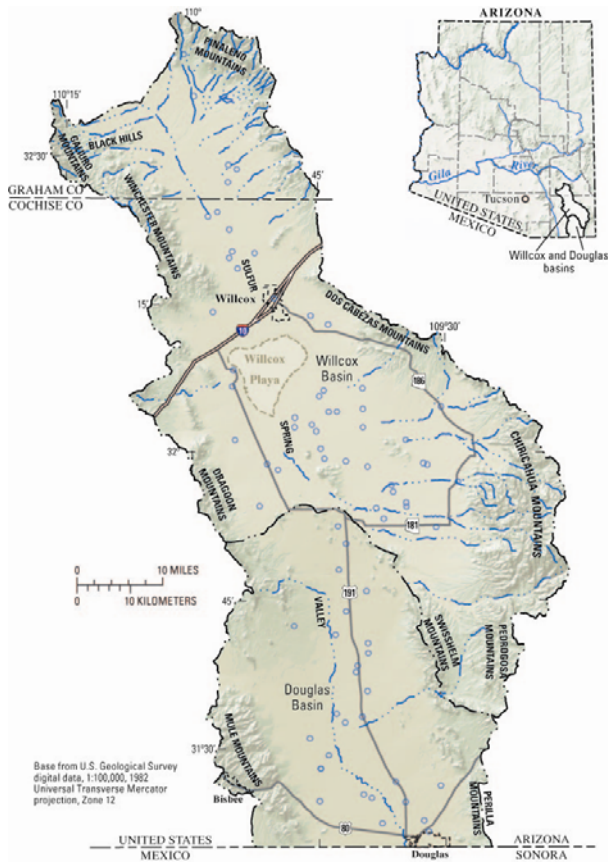


Figure 1. Map of the Willcox and Douglas basins.

To achieve the objectives of this study geophysical and remote sensing methods are being used in addition to water-level elevation data to increase understanding of basin structure and hydrogeology. Geophysical reconnaissance surveys include airborne electromagnetic surveys and ground-based transient electromagnetic surveys. These surveys have already been completed and are providing information on depth to bedrock and distribution of basin-fill sediments. Absolute and relative gravity methods will be used to measure ground-water storage change. A network of these sites will be established to increase areal coverage of the existing monitoring network, particularly in areas where ground-water levels cannot be obtained. Subsidence in the Willcox Basin is

being studied using Interferometric Synthetic Aperture Radar (InSAR) (fig. 2). Land use patterns and ground-water elevation data will be used to determine if sufficient data are being collected to document ground-water conditions and trends in the system. Because ground-water is used predominately for agriculture a current estimation of withdrawals has been completed. Irrigated acreage has been delineated according to location, areal extent, irrigation method, and crop type. A combination of methods was used to conduct this delineation using Landsat imagery, aerial photography, and field verification.

The RWI program is increasing monitoring of the ground-water system in an effort to improve the current understanding of the system for water resource managers. This investigation is focused on the regional hydrogeologic system in the selected ground-water basins including the water budget components and land subsidence. Results of this project will be useful to parties interested in hydrological issues in Southeastern Arizona.

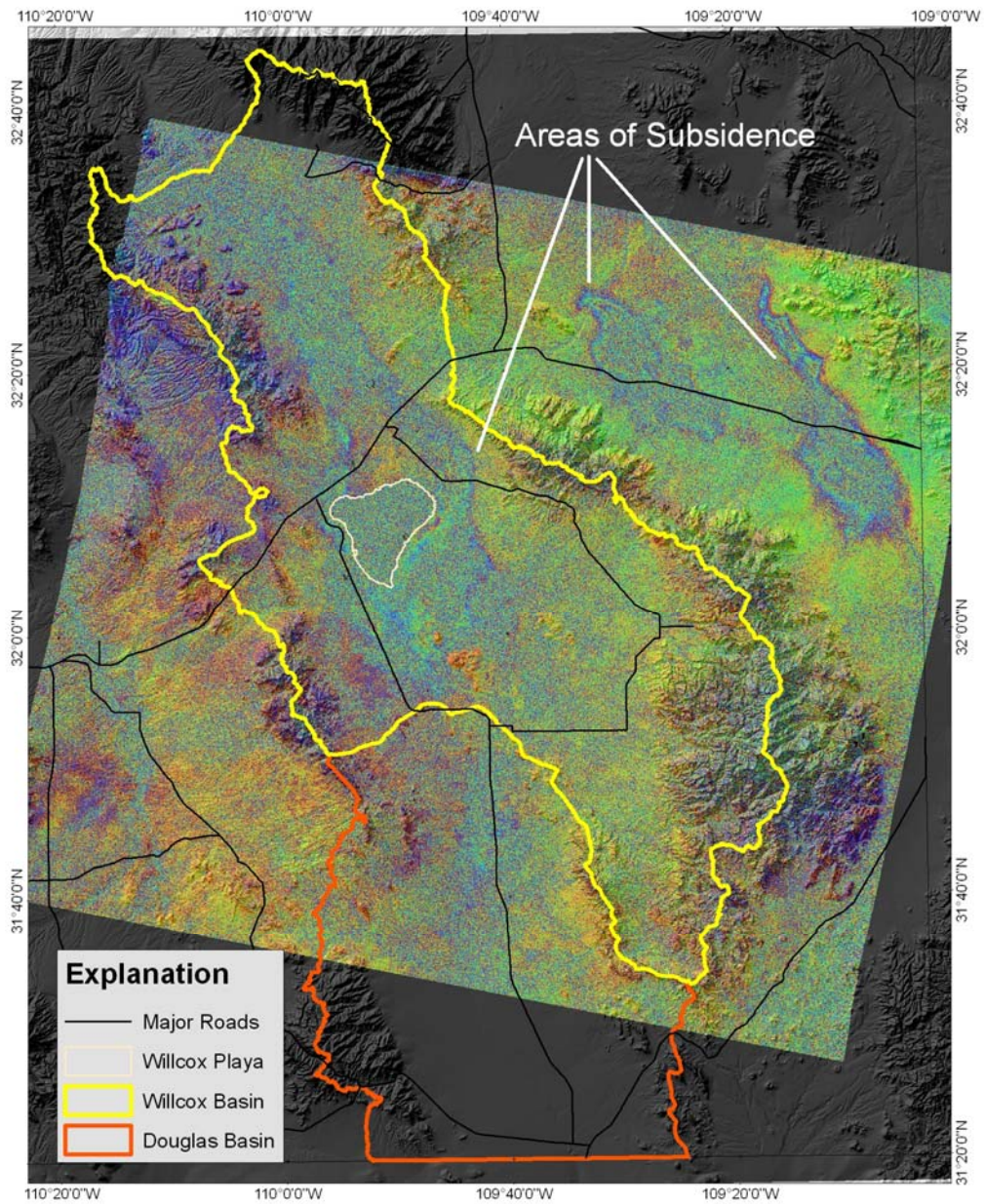


Figure 2. InSAR scene comparing surface elevations between November 1992 and December 1995. Elevation change in alluvial areas is indicated by ramping of color through the spectrum: the shorter the distance over which the ramp occurs, the greater the elevation change. This scene indicates significant subsidence in the Willcox Basin especially along its eastern margin in the vicinity of the playa.