# Raising groundwater keeps valleys from sinking: Santa Clara Valley, Calif.

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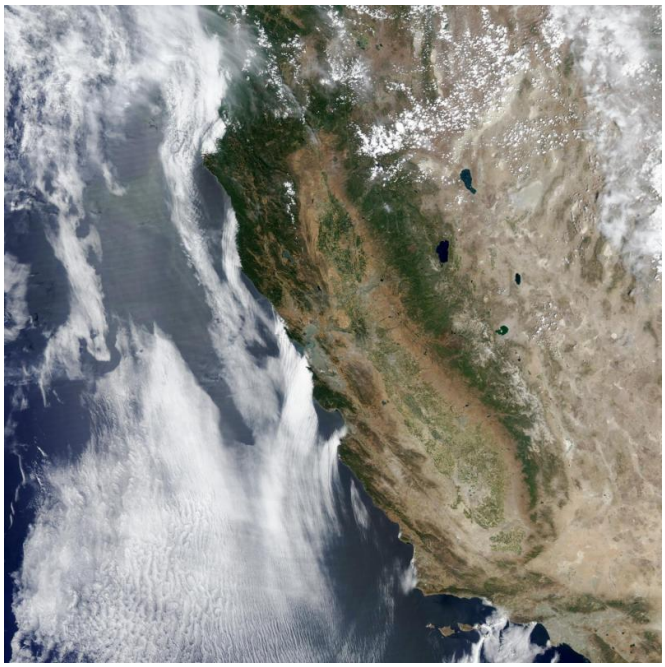

Santa Clara Valley, California, USA. Credit: NASA's Earth Observatory

California and other parts of the western U.S. are experiencing extended severe drought conditions. Varying groundwater levels in valleys throughout the state, balanced by water imported, for instance, via the State Water Project and the federal Central Valley Project make understanding the state's underlying hydrologic framework all the more important. This paper by R.T. (Randy) Hanson of the U.S. Geological Survey focuses on California's Santa Clara Valley.

In the introduction to his paper, Hanson provides a succinct history of the area, as paraphrased here: Santa Clara Valley is a long, narrow (240 square miles), trough-like coastal watershed that borders the southern end of San Francisco Bay, extending about 35 miles southeast from there. The watershed principally drains parts of Santa Clara and San Mateo counties. Santa Clara Valley has experienced the typical evolution of land- and water-use development in the western United States, with a transition from an agricultural and ranching economy to one based on urban services and industry. In the first half of the twentieth century, the valley was intensively cultivated for fruit and truck crops, but subsequent development has included urbanization and industrialization, so that the area is now commonly known as "Silicon Valley."

Hanson says that the valley underwent extensive groundwater development from the early 1900s through the mid-1960s. This development caused groundwater level declines of more than 200 feet and induced regional subsidence of as much as 12.7 feet from the early 1900s to the mid-1960s. As with other coastal aquifer systems, Hanson notes, "the possibility exists that the combined effects of land subsidence and seawater intrusion will result in large water-level declines."

The San Francisco Water Department started delivering imported water to several north county cities in the early 1950s. In the 1960s, the Santa Clara Valley Water District (SCVWD) began importing surface water into the valley to help meet growing demands and to reduce the area's dependence on groundwater. The combination of reduced groundwater pumping and this artificial recharge has caused groundwater levels to recover to near their predevelopment levels, and this, in turn, has arrested the land subsidence, says Hanson, noting, "Currently, the water purveyors in the Santa Clara Valley, in conjunction with SCVWD, would like to meet the water demand in the basin while limiting any potential for additional land subsidence."

Even though extensive studies have been completed in the Santa Clara Valley, there were no comprehensive three-dimensional hydrologic, geologic, and geochemical data that would allow the delineation of the hydrologic framework that

controls the distribution and movement of the water resources in the Santa Clara Valley. Hanson's article summarizes the hydrologic framework of the valley using data obtained from nine new monitoring-well sites and various supply wells in combination with a detailed groundwater-surface-water model.

The synthesis of this framework is based on a sequence of interdisciplinary studies between the U.S. Geological Survey and the Santa Clara Valley Water District. The framework components, as summarized in Hanson's article, include the hydrogeologic structure of the valley, groundwater budgets, the role of climate cycles, the nature of stream-aquifer interactions, distribution and nature of groundwater pumpage, effects of land subsidence, the distribution of artificial recharge, geochemical characteristics of the aquifers and wells, and the overall water-resource management issues relevant to the sustainable and conjunctive use of the groundwater and surface water resources of the Santa Clara Valley.

**More information:** Hydrologic framework of the Santa Clara Valley, California, R.T. Hanson, U.S. Geological Survey, San Diego, California, USA. Published online on 13 May 2015; http://dx.doi.org/10.1130/GES01104.1. Themed issue: A New Three-Dimensional Look at the Geology, Geophysics, and Hydrology of the Santa Clara ("Silicon") Valley.

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