



Measuring Earth with GPS, Unit 4: Groundwater Activity 3 Student Exercise: Additional Data

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Additional data that may help you with your argument (for Question 18)

Given below are quotes from scientific and news articles that contain information and numbers, some of which you will want to use to support your argument.

“The effects of compaction fall into two categories: those on manmade infrastructures and those on natural systems. The greatest effects occur to infrastructures that traverse a subsiding area. In the San Joaquin Valley, the main problems reported are related to water conveyance structures. Many water conveyance structures, including long stretches of the California Aqueduct, are gravity driven through the use of very small gradients; even minor changes in these gradients can cause reductions in designed flow capacity. Managers of the canals...have to repeatedly retrofit their canals to keep the water flowing...albeit at reduced amounts. While water conveyance structures tend to be the most sensitive to subsidence, damage to roads, railways, bridges, pipelines, buildings, and wells also can occur.” (USGS-CWSC, 2017)

“While more focus has been placed on the highly visible infrastructure damage from subsidence, which generally can be repaired, compaction of the aquifer system, sight unseen, may permanently decrease its capacity to store water; subsidence occurring today is a legacy for all tomorrows. Even if water levels rose, compacted sediments would remain as-is; most compaction that occurs as a result of historically low groundwater levels is irreversible. Additionally, as the topography of the land changes by varying amounts in different places, the low areas, such as wetlands, will change size and shape, migrate to lower elevations, or even disappear. Rivers may change course or erosion/deposition patterns to reach a new equilibrium.” (USGS-CWSC, 2017)

“Groundwater meets about 40 percent of California’s water demands in an average year.” (Borchers and Carpenter, 2013)

“Subsidence has caused major impacts to infrastructure and physical features, including the San Joaquin River, Delta Mendota Canal, Friant-Kern Canal, and San Luis Canal, as well as numerous privately owned canals and related infrastructure such as turnouts, bridges, pipelines, and storm sewers. These costs add up to a total estimated cost of more than \$1.3 billion during 1955–1972 (2013 dollars).” (Borchers and Carpenter, 2013)

“According to the U.S. Geological Survey, land subsidence is a phenomenon found across the United States, affecting the land surface of over 17,000 square miles in 45 states....Most subsidence in the United States is a result of groundwater exploitation....Some of the more costly consequences include damage to engineered structures, including buildings, roadways,

pipelines, aqueducts, levees, sewerages, and well casings, as well as increases in flood risk and associated remediation.” (Borchers and Carpenter, 2013)

“Over the last 15 years, lettuce and wheat fields have given way to high-profit, water-intensive crops that are mostly exported to other countries....Exports now account for about \$1 in every \$3 farmers earn.” (Halverson, 2017)

“Eventually, maybe 22 percent of the California’s irrigated farmland—about 2 million acres—could be abandoned as a result of water problems, according to Jay Lund, an environmental engineering professor at the University of California, Davis. These farms provide more than a million jobs in the state, sustaining whole communities, and if the farming sector contracts, so do the livelihoods of the people.” (Halverson, 2017)

“As water levels drop from 100 feet below the surface, down to 200 feet and even further to nearly 600 feet, the amount of electricity needed to pump up hundreds of millions of gallons of water is staggering. Last year, researchers determined that falling groundwater levels were costing farmers \$300 million a year.” (Halverson, 2017)

“The San Joaquin Valley—California’s largest agricultural region, and an important contributor to the nation’s food supply—is in a time of great change and growing water stress. Agriculture is a leading economic driver and the predominant water user. The region’s farms and related manufacturing businesses account for 25 percent of the valley’s revenues and 16 percent of local jobs—and 89 percent of annual net water use.” (Hanak et al., 2017)

“In most years since the mid-1980s, groundwater [in the San Joaquin Valley, California] has been used faster than it is being replenished (“groundwater overdraft”). Over the past three decades, overdraft has averaged nearly 2 million acre-feet per year, or 13 percent of net water use. This has contributed to increased pumping costs, dry wells, sinking lands, and declining reliability of this vital drought reserve.” (Hanak et al., 2017)

References

Borchers and Carpenter (2013) Land Subsidence from Groundwater Use in California. Downloaded from https://water.ca.gov/LegacyFiles/waterplan/docs/cwpu2013/Final/vol4/groundwater/13Land_Sub_sidence_Groundwater_Use.pdf

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