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Hydro-economic analysis of groundwater pumping for irrigated agriculture in California's Central Valley, USA

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Abstract

As in many places, groundwater in California (USA) is the major alternative water source for agriculture during drought, so groundwater's availability will drive some inevitable changes in the state's water management. Currently, agricultural, environmental, and urban uses compete for groundwater, resulting in substantial overdraft in dry years with lowering of water tables, which in turn increases pumping costs and reduces groundwater pumping capacity. In this study, SWAP (an economic model of agricultural production and water use in California) and C2VISim (the California Department of Water Resources groundwater model for California's Central Valley) are connected. This paper examines the economic costs of pumping replacement groundwater during drought and the potential loss of pumping capacity as groundwater levels drop. A scenario of three additional drought years continuing from 2014 show lower water tables in California's Central Valley and loss of pumping capacity. Places without access to groundwater and with uncertain surface-water deliveries during drought are the most economically vulnerable in terms of crop revenues, employment and household income. This is particularly true for Tulare Lake Basin, which relies heavily on water imported from the Sacramento-San Joaquin Delta. Remote-sensing estimates of idle agricultural land between 2012 and 2014 confirm this finding. Results also point to the potential of a portfolio approach for agriculture, in which crop mixing and conservation practices have substantial roles.