

Impact of Climate Change on Irrigation Water Availability, Crop Water Requirements and Soil Salinity in the San Joaquin Valley, CA

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Executive Summary

Climate change in the western US is predicted to produce significant changes in temperature, precipitation amount and their spatial/temporal distributions. These changes will have profound affects on California's water resources and on both natural and agricultural ecosystems. California, with its limited water supply and the reliance of the State's economy on agriculture, faces enormous challenges in the near future, to analyze and to forecast climate change impacts. A recent series of white papers (California Climate Center, 2005) laid out the impacts of possible climate change scenarios in California resulting from increasing atmospheric concentration of green house gases (GHGs) on coastal sea level, precipitation, water resources, agriculture, public health, forestry, and electricity production and demand. Results were based on three GHG scenarios: lower emission, medium-high emission, and higher emission scenarios, using 3 different GCMs. California's farmers are expected to respond to reducing surface water supplies and/or increasing irrigation water requirements by supplementing available irrigation waters by increased groundwater pumping. However, increased pumping will increase energy costs as hydraulic heads in the aquifers drop, whereas the lesser quality of groundwater will generally increase soil salinity.

The general objective of the proposed study is to apply a recently developed and tested hydrosalinity model to project the impact of climate change on irrigation water availability, crop water requirement (ET) and soil salinity for a representative agricultural area in the San Joaquin Valley. For that purpose, the study by Schoups et al (2005a) provided the relevant hydrological and soil chemical parameters for a 1,400 km² area, west of Fresno, CA, that includes a large part

of Westlands Water District (WWD), Broadview Water District (BWD) and 11 additional water districts. Separate studies have been completed to evaluate climate change impacts on CA's water resources (Vicuna, Maurer et al., 2005). This proposal couples subsurface hydrology with climate change and will provide for a much more integrated approach towards understanding the impact of climate change on CA's irrigated agriculture than was done to date. Specifically, we propose to (1) substitute output variables of GCM's into Penman Monteith's equation to determine the effect of various climate change scenarios on potential crop ET for typical crops in the SJV; and (2) to evaluate the impact of climate change on irrigation water availability, crop water requirement and soil salinity in the 21st century for the 1,400 km² study area in the San Joaquin Valley.

The results of two GCM's for the period 1960-1999 will be compared to daily reference ET as computed from DWR CIMIS data (ET_o). Subsequently, the GCMs output for low, medium and high emission scenarios over the 2000-2100 time period will be used to forecast ET. Subsequently, the hydrosalinity model will use these forecasted ET_o with local crop coefficients for the same 100-year period to evaluate the impact of climate change on irrigation water availability, crop water requirements and soil salinity for the various climate scenarios.