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Crop Fact Sheet series

Excerpted from **The Southwest Regional Climate Hub and California Subsidiary Hub Assessment of Climate Change Vulnerability and Adaptation and Mitigation Strategies** *(July 2015)*

This report describes the potential vulnerability of specialty crops, field crops, forests, and animal agriculture to climate-driven environmental changes. In the report vulnerability is defined as a function of exposure to climate change effects, sensitivity to these effects, and adaptive capacity. The exposure of specific sectors of the agricultural and forestry industries varies across the region because the Southwest is climatically and topographically diverse. The purpose of this analysis is to describe regional vulnerabilities to climate change and adaptive actions that can be employed to maintain productivity of working lands in the coming decades.

The report can be accessed here: http://swclimatehub.info/files/Southwest-California-Vulnerability-Assessment.pdf

Tomatoes

Solanum lycopersicum (Solanaceae)

Native to the Andes and first cultivated in Mexico, the tomato has become a staple worldwide. California produces one-third of the fresh tomatoes and 95% of the processed tomatoes in the U.S. [1] (Figure 1). Production is concentrated in the Central Valley in the summer months, but Southern California makes significant contributions in the spring and fall. Processing tomatoes are always mechanically harvested, while fresh-market tomatoes are usually hand-picked. Both types of tomatoes include many varieties with a diversity of fruit shapes and sizes, flavors, shelf lives, disease tolerances, and climatic requirements [3]

Tomatoes are relatively heat-tolerant. Optimal daytime temperatures for most tomato varieties are 23.9-35°C (75-95°F) [4] and optimal nighttime temperatures are 12.8-21.1°C (55-70°F) [5], with cold-induced injury possible when nighttime temperatures drop below 10°C (50°F) [3]. Tomatoes are least tolerant to departures from their ideal temperature during the critical developmental stages of pollination and fruit set. Even brief extreme heat events can reduce tomato yields if they come during flowering: e.g., temperatures above 40°C (104°F) can cause flower abortion in a matter of hours [5] (Table 1).

The water use of tomatoes varies considerably depending on the type of irrigation, the variety of tomato, and the location. Processing tomatoes tend to use between 23 to 40 inches of irrigation water in a growing season [6]. Water-use efficiency in California's processing tomato crop has improved by about 40% since early 1970s, which has been facilitated by site-specific breeding [6] and widespread adoption of drip irrigation. However, further efficiency gains are still possible, especially for fresh-market tomatoes, where drip irrigation is less prevalent. Tomatoes in California can even be dry-farmed (no additional irrigation after establishment), though this results in much lower yields and is not viable for most commercial farming operations [7].

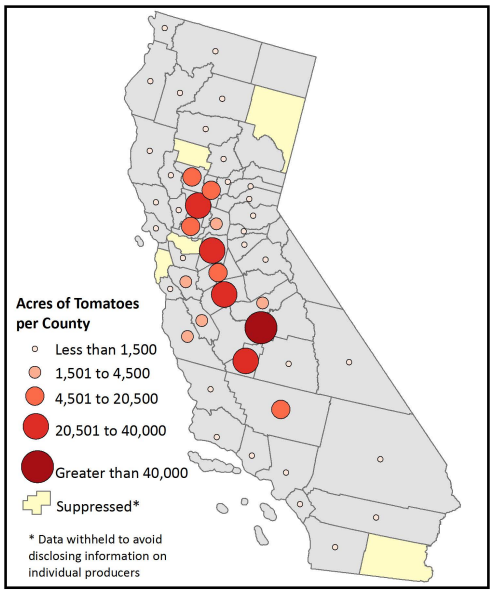

Figure 1. Acres of tomatoes grown in CA in 2012 (295,247 acres). [2]

Temperature: Lobell et al. [8] analyzed historical California climate and yield data and concluded that warmer temperatures favored tomato production up to about 32.2°C (90°F). Lee et al. [9] estimated that climate change would have no effect on tomato yields in the Central Valley by 2050, while Medellín-Azuara et al. [10] predicted that by 2050 climate change would actually cause tomato yields to increase by 2.4% in the Sacramento Valley and 1.1% in the San Joaquin Valley. Jackson et al. [11] predicted that tomato acreage would increase by 2050 in response to more favorable climatic conditions.

Water: Tomatoes are less sensitive to suboptimal water quality and quantity than many other crops. Substantial water savings can be achieved in certain soil types either through cutback (slightly reduced watering throughout the season) or cutoff (normal watering followed by an early cessation of watering). For example, in an experiment on processing tomatoes in western Fresno

County on deep clay-loam soil, when irrigation was cut off 40 days before harvest instead of the standard 20, there was no loss in yield; and even when the cut off was at 80 days, yields were still 81% of the control [12]. There is room for additional improvement in irrigation timing and technology, especially if water becomes costly enough that tomato farmers are willing to accept slight yield reductions in order to achieve major water savings.

Table 1. Vulnerability of tomatoes to climate change in California.

Exposure	Sensitivity	Adaptive Capacity
• Temperature: Moderate exposure (Central Valley likely to see 2-2.5°C (3.6-4.5°F) rise by 2060). • Water: Decreased water quantity and quality likely. • Extreme events: heat waves, large storms.	• May benefit from increase in average temperatures within tolerance range; some yield reduction likely outside that range. Can be sensitive to extreme heat events depending on timing and crop growth stage. • Moderate sensitivity to reduced irrigation (fresh market tomatoes are more sensitive to water deficits); moderate sensitivity to salinity.	• Temperature: Moderate. In some places it may be necessary to replace current tomato cultivars with more heat-resistant ones; choose cultivars with extended field storage characteristics; or change planting dates to avoid fruit set during the hottest summer periods. • Water: moderate to high. Further efficiency gains in irrigation are possible in some cultivars.

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