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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

Pistachios

Pistacia vera (Anacardaceae)


Photo: USDA ARS

Pistachios are native to western Central Asia and are in the same family as mangoes and cashews. Pistachios were brought to California in 1907, but commercial production began in the late 1970s [1]. Pistachios are wind-pollinated and dioecious; thus, pistachio orchards are a careful blend of male and female plants of different varieties [3]. Pistachios are usually grafted onto disease-resistant rootstocks (e.g., *P. integerrima* or *P. atlantica*).

The rise of pistachios has been meteoric: driven by high prices and consumer demand, total pistachio acreage (bearing plus non-bearing) went from 196,288 acres in 2008 to 294,467 acres in 2014 – a gain of more than 50% in only the past six years [4] (Figure 1). This rapid increase, coupled with the fact that pistachio trees take five years to start producing and three to five more years to reach full bearing, means that California's pistachio production could double in the next five years even if few or no new acres are planted [5].

Pistachio production occurs mainly in the San Joaquin Valley [1]. California produces 99% of the nation's pistachios; the small remainder comes from Arizona and New Mexico. Pistachios have relatively high annual chilling requirements of about 800-900 hours [6] and an annual irrigation demand of about 40 inches, comparable to that of walnuts and almonds [7].

Temperature: Pistachios' relatively high chilling requirement (800-900 hours) is cause for concern in a warmer climate (Table1). Luedeling et al. [8] predicted that by 2060, areas receiving above 800 chill-hours per year will nearly disappear from the Central Valley. Although this does not bode well for pistachios in the coming century, there may be scope to develop low-chill cultivars [6]. The existing diversity of pistachio cultivars in California is quite limited, and development or introduction of new cultivars (e.g., from Iran) could help to address a variety of current production problems [3].

Furthermore, the effect of climate on pistachio yields is not fully understood. A study examining historical data between 1980 and 2003 found no significant relationship between pistachio yields and climate variability [9]. Complicating such analyses is the fact that pistachios are an alternate-bearing crop, tending to produce heavily one year and lightly the following year. The alternate-bearing pattern is generally independent of environmental conditions (though it can be reset by climatic extremes such as freezes that destroy the year's crop).

Water: Under optimal conditions, pistachios use about as much water as almonds and walnuts; however, pistachios tend to fare relatively well under deficit irrigation, which can cut water use from about 40 to about 30 inches per year [7]. Under duress, pistachio trees can even survive completely unirrigated for a year [5], though yields will be minimal. Pistachios are also relatively salt-tolerant, making them a promising option for areas of the Central Valley with

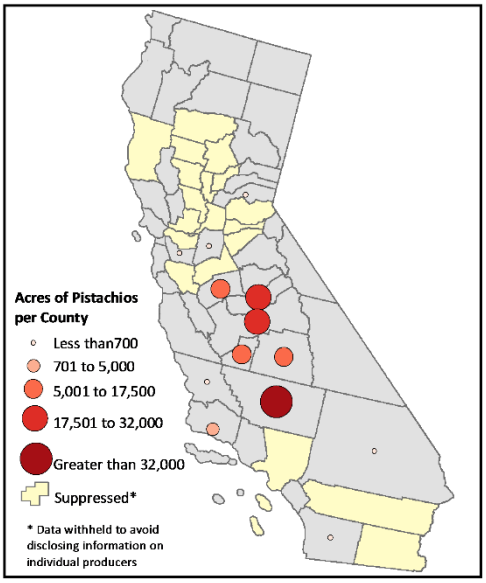

Figure 1. Acres of pistachios grown in CA in 2012 (182,000 bearing acres). [2]

poor-quality groundwater. Further work is needed on how to best balance efficient irrigation with acceptable yields – especially considering the rapid rise in pistachio acreage and accompanying increase in water consumption.

Other factors: Under damp conditions, pistachios are susceptible to foliar and fruit fungal diseases, such as Botrytis blossom and shoot blight [10]. Climate change may increase or decrease the prevalence of pistachio diseases, depending on the exact patterns of humidity and temperature change. Major pistachio pests, such as the navel orangeworm (*Amyelois transitella*), may grow more quickly under warmer temperatures, requiring adjustment of IPM guidelines [10].

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

Exposure	Sensitivity	Adaptive Capacity
• Temperature: Moderate change (Central Valley likely to see 2-3°C (3.6-5.4°F) rise by 2060). • Water: Decreased water availability very likely. • Extreme events: heat waves, fewer frosts, large storms.	• High demand for chill hours; high sensitivity to loss of chill-hours (if below threshold). • Moderate sensitivity to water limitation: Irrigation-dependent, but fare well under deficit irrigation. • Not sensitive to heat; may benefit from less frost. Excess water can promote disease.	• Temperature: Unknown, but possibly moderate to high if low-chill cultivars can be developed. May benefit from fewer frosts. • Water: moderate to high. Further efficiency gains in irrigation may be possible.

References

1. Starrs, P.F. and P. Goin, *Field Guide to California Agriculture*. 2010, Berkeley, CA: University of California Press. 475.
2. National Agricultural Statistics Service, *2012 Agricultural Census*. 2014, US Department of Agriculture: Washington, DC.
3. Kallsen, C.E., et al., *New pistachio varieties show promise for California cultivation.* California Agriculture, 2009. **63**(1).
4. Administrative Committee for Pistachios. *2014 Pistachio Bearing Acreage, Production, and Yield Per Acre*. 2015 January 2015 January 23, 2015]; Available from: http://www.acpistachios.org/pdf/2014Statistics.pdf.
5. Castellon, D., *Farmers and consumers are going nuts for pistachios*, in *Visalia Times-Delta*. 2014: Visalia, CA.
6. Pope, K.S., *Climate Change Adaptation: Temperate Perennial Crops*, in *CDFA Climate Change Consortium*. 2012: Modesto, CA. p. 34.
7. UC ANR. *Crop Irrigation Strategies: Individual Crop Deficit Irrigation Information*. 2014 December 13, 2014]; Available from: http://ucmanagedrought.ucdavis.edu/Agriculture/Crop_Irrigation_Strategies/.
8. Luedeling, E., M. Zhang, and E.H. Girvetz, *Climatic Changes Lead to Declining Winter Chill for Fruit and Nut Trees in California during 1950–2099.* PLoS ONE, 2009. **4**(7): p. e6166.
9. Lobell, D., K.N. Cahill, and C.B. Field, *Historical effects of temperature and precipitation on California crop yields.* Climatic Change, 2007. **81**: p. 187–203.
10. UC Davis. *Year-round IPM Program for Pistachio*. 2014 October 2014 January 23, 2015]; Available from: http://www.ipm.ucdavis.edu/PMG/C605/m605yi01.html.

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