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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

Onions and garlic

Allium cepa (onion) and *A. sativa* (garlic); Liliaceae


Photo: USDA NRCS

California produces about one-third of all onions in the U.S., as well as 86% of the nation's garlic. Despite the fame of Gilroy in Santa Clara County as the self-proclaimed "garlic capital of the world," the majority of California's garlic and onions actually come from Fresno County in the San Joaquin Valley [2] (Figure 1). Imperial, Kern, and Monterey Counties are also significant onion producers. California onion production is about evenly split between fresh-market and processing onions. The main differences are that different varieties are used, and fresh onions are harvested by hand while processing onions are harvested mechanically [3].

Onions are primarily cool-season crops that emerge when temperatures reach 12.8°C (55°F) and achieve optimal growth between 20-25°C (68-77°F) [4]. Different onion varieties have a wide range of day length and temperature requirements: there are short-day and intermediate-day onions, which are planted in the fall and harvested in the spring or early summer, and there are long-day onions, which are planted in late winter / early spring and harvested in the late summer / early fall. Onion varieties differ in their capacity to be stored for long periods [4], with the more pungent varieties having a shelf life of 6-9 months [5].

Onions are established with overhead sprinklers and then usually irrigated with drip systems (R. Smith, pers. comm., 23 December 2014). Onions are very shallow-rooted and so they require frequent irrigation (Table 1). An onion crop needs 20 to 30 inches of irrigation water to meet its evapotranspiration demand on average. Demand rarely exceeds 36 inches [3]; some growers, however, apply water in excess of demand, up to 48 inches [4].

Onions are especially vulnerable to weeds because their initial growth is slow. They have a variety of common pests in the field, including nematodes, thrips, and maggots, and they are subject to a number of fungal, bacterial, and viral diseases, including downy mildew and garlic mosaic virus [6], some of which also attack stored onions.

Very little research has been done specifically on the vulnerability of onions and garlic to climate change. Most of the available studies at the time of writing were conducted outside the U.S., largely in tropical countries such as the Philippines and Brazil. Thus, much of this vulnerability summary is speculative and needs further grounding.

Temperature: In general, onions and garlic may be relatively low on the vulnerability spectrum for several reasons: 1) because they are planted in the cool season, they may be less exposed to summer heat waves, and they may be able to achieve the necessary compensation simply by changing planting

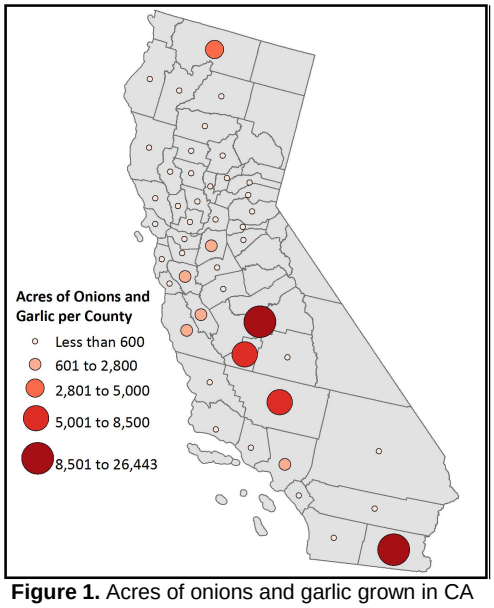

Figure 1. Acres of onions and garlic grown in CA in 2012 (59,003 acres). Not shown: 520 acres in NV [1].

date; 2) their production is widely spread across the Southwest in a variety of microclimates, so if one location becomes less suitable for production, another might be able to compensate.

Water: Onions and garlic may be more at risk with regard to water than to temperature, as they do have shallow roots and fairly high water demand. However, as they are an annual crop that can be fallowed if necessary, they are not in as precarious a position as a tree crop that has the same total annual irrigation needs. More research is needed to determine the greatest opportunities for improvements in water use efficiency in onion and garlic production.

Other factors: Onions are susceptible to a variety of pests and pathogens, especially under damp conditions [4]. Depending on how climate change affects precipitation, it could increase or decrease this problem. Onions are especially susceptible to weeds, which may in turn be influenced by climate change, but the direction of this effect is unclear.

Table 1. Vulnerability of onions and garlic to climate change in California.

Exposure	Sensitivity	Adaptive Capacity
• Temperature: Moderate to high (Central Valley likely to see 2-2.5°C (3.6-4.5°F) rise by 2060; inland Southern CA maybe 3°C (5.4°F) rise). • Water: Decreased water availability very likely. • Extreme events: heat waves, larger storms.	• Moderate sensitivity to increases in average or extreme temperature. • Moderate to high sensitivity to water limitations, due to shallow roots. • Unknown sensitivity to extreme heat events.	• Temperature: Unknown, but possibly high adaptive capacity if planting time and/or location can be adjusted. • Water: unknown, but probably medium to high. More work is needed on strategies to reduce irrigation in onions and garlic.

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