



RESEARCH BRIEF

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Climate Adaptation and Agriculture: Impacts on Perennial Crops

Perennial crops such as nuts, grapes and citrus fruits that are vital elements of California's economy face unique threats from a changing climate. Strategies are needed that both address the challenge of perennial crop production in today's climate conditions as well as in the conditions projected to arise during the course of their lifespan.

Background

Agriculture is an important component of California's economy, landscape and culture, and is also among the sectors most vulnerable to impending climate changes. And perennial crops are among the most valuable of California's diverse agricultural products. They are also potentially the crop most influenced by information on future climate shifts, since the perennial's lifespan commonly extends for more than 30 years. However, prime agricultural areas of California – as well as similar regions across the United States that are currently favorable to specific perennial crops – may become unfavorable during the lifespan of a single orchard or vineyard. This makes the choice of selecting a cultivar for a particular region more complicated as growers now must face the risk that the best variety for the current climate may be poorly suited for future climates.

POINTS FOR POLICY MAKERS

Most research on the agricultural impacts of climate change has focused on major annual crops like corn, soybeans and wheat. Yet, perennial cropping systems are less adaptable than annuals and potentially more susceptible to climate-related damage due to the longer time scales required for the growth and production ability of most orchards and vineyards (~25 years). In regions like California, where the success of perennial crops such as tree nuts (almonds, walnuts and pistachios), grapes (wine and table) and citrus (oranges and lemons) has significant economic as well as socio-cultural impacts, improved assessments of yield responses to future climate are needed to help growers identify and prioritize adaptation strategies.

- ▶ **Climate science should be more effectively integrated with agricultural practice.** Climate change effects should be an important factor in selecting perennial varieties and deciding whether and where perennials should be planted.
- ▶ **Further research is needed to better understand the full potential of adaptation strategies.** Possible adaptation measures include developing heat and drought resistant varieties of almonds or relocating crops to other regions to reduce the effects from climate change.
- ▶ **If no action is taken, future economic losses of perennial crops may be substantial and leave regions vulnerable to food scarcity issues.** Adaptation research and mitigation efforts will likely involve significant up-front costs and growers may incur short-term revenue losses from replanting or relocating an existing vineyard or orchard, but major crop losses coupled with resulting declines in agricultural and production facility jobs as well as tourism revenues would have devastating effects on local communities.

In addition to the predicted rapid rise in temperatures due to climate change (from +0.2 to +0.4°C) over the next 20-50 years, shifts in extreme weather events like drought, flooding or freezing add another layer of complexity to analyses of perennial cropping. As perennials are slower growing, must endure through all seasons and take longer to reach peak production levels, severe changes to crop yields could likely occur during the estimated 20-year plus lifetime of a single orchard or vineyard. Therefore, consideration of the response of crops to climate change should be a central component of any perennial crop analysis and utilize statistical crop models along with downscaled climate model projections when predicting future climate scenarios. Studies further suggest that identifying potential adaptation strategies to minimize the potential costs and maximize the potential benefits of climate change should be undertaken sooner rather than later to be truly effective. Having this type of information will advance our understanding of climate impacts on California agriculture as well as other regions and highlights the importance of measuring and tracking uncertainties due to the difficulties involved in uncovering crop-climate relationships. It will also help growers improve their yields by being able to better plan for and adapt to future changes in the climate, ensuring better food security and economic outcomes for agricultural regions.



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This brief is based on the papers “California perennial crops in a changing climate” published in the journal *Climate Change* in November 2011 and “Impacts of future climate change on California perennial crop yields: Model projections with climate and crop uncertainties” published in the journal *Agricultural and Forest Meteorology* in December of 2006.

FOR MORE INFORMATION

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