

Winter chill

Winter chill, the extended period of cold temperatures critical for fruit and nut trees, is decreasing at certain sites in California's Central Valley.

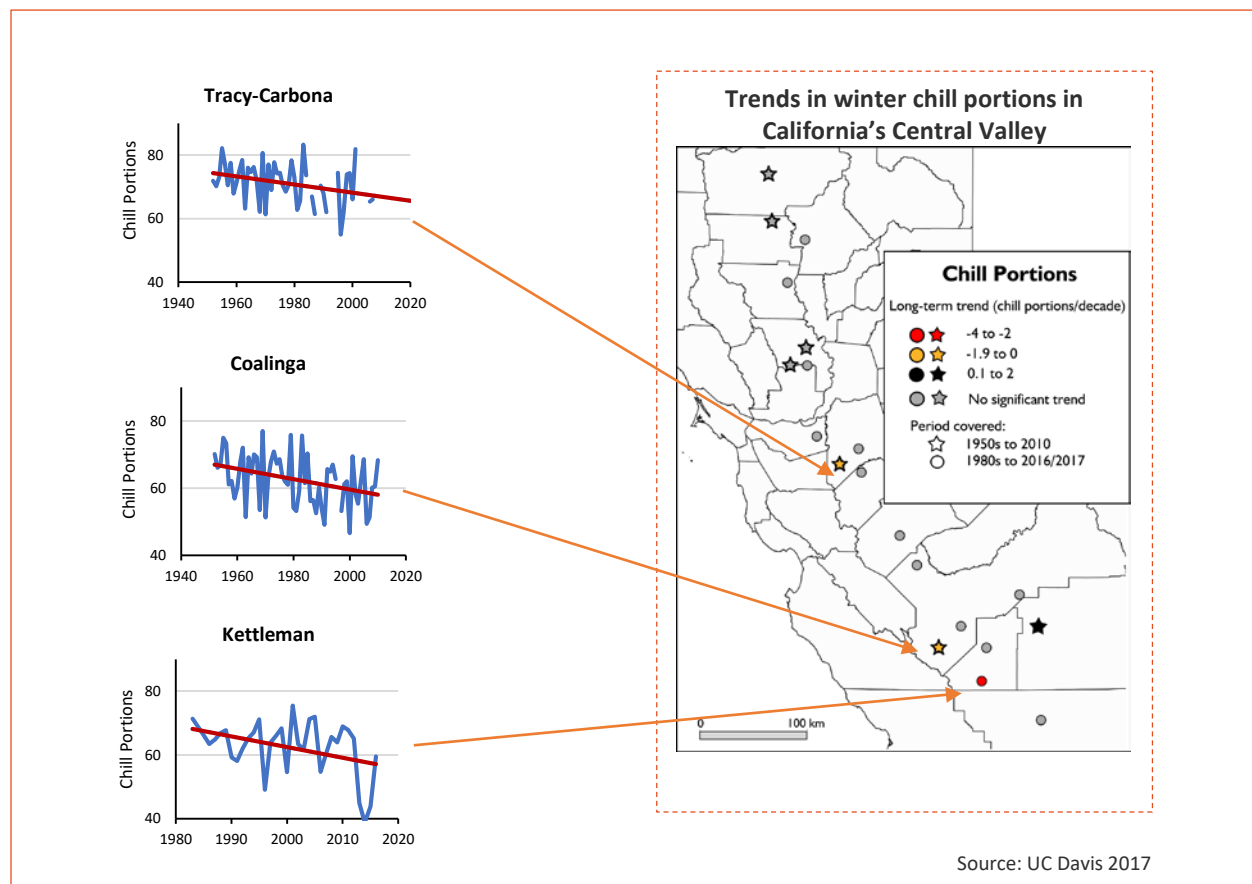


Fruit and nut trees require a period of cold temperatures to become and remain dormant before blooming in the spring. Growers track the amount of cold experienced by trees during this dormant period as "winter chill." Certain locations across California's Central Valley, the state's agriculture hub, have experienced declining winter chill as temperatures have warmed over the years. Meeting winter chill requirements is critical for many of the state's high-value fruits and nuts such as cherries, plums, walnuts and almonds.

California accounts for over half of the nation's fruit and nut production. The state's fruit and nut crops have been valued at about \$20 billion annually in the last five years. Serious economic loss could result if temperatures warm to a point when fruit and nut trees no longer experience sufficient winter chill.

What does the indicator show?

The map below shows trends in "chill portions," one of the measures used to track the accumulation of winter chill. Calculated using a biologically based model, chill portions accumulate when temperatures are between 32 and 54°F (with greater weight given to temperatures that correspond to optimal chill conditions). This model also accounts for the "cancelling" effect of warm temperatures. Chill portions (which are unitless) have significantly declined at three of the 20 sites studied: Tracy-Carbona, Coalinga and Kettleman. An *increasing* trend (black star) was found at one site (Visalia).





Winter chill has also been tracked since the 1940s using “chill hours,” a measure which is simpler and more sensitive to warming winter temperatures than chill portions. When tracked using chill hours, declines in winter chill are seen at more Central Valley sites (these are reported in the technical report, see link below). Recent research favors the use of the chill portions because they more closely represent how trees accumulate winter chill in California’s Mediterranean climate.

Why is this indicator important?

Winter chill is a key factor in fruit and nut development. Fruit and nut trees have varying chill requirements during the winter before leaf growth or flowering. This period of dormancy helps ensure that the plant does not flower during a warm spell in the middle of winter. Under ideal conditions, leaf growth or flowering start after the cold and wet winter conditions have diminished. This allows for the longest possible growing season, thus optimizing yield. When winter chill requirements are not met, bloom



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may be late and prolonged, and crop yield decreases. During the warm winter of 2013-2014, average chill portions dropped by 25 percent in the Central Valley. Many tree crops showed delayed and extended bloom, the blooming of pollen-producing and fruit-producing flowers were mismatched, and crop yields were low.

Insufficient winter chill could also lead to other production problems for farmers. Extended bloom can alter fruit or nut maturation timing. This could mean a prolonged, costly harvest, and increased risk of crop damage from pests.

Climate scientists predict that by the middle to the end of the 21st century, climatic conditions will no longer support certain varieties of tree crops currently grown in California. Without changes to fruit-growing practices, such as using chill-compensating products or growing low-chill varieties, the region’s ability to sustain its production of nuts and fruits could be jeopardized.

For more information about this and other climate change indicators, visit:
<https://oehha.ca.gov/climate-change/report/2018-report-indicators-climate-change-california>