



Climate Toolbox's Crop Suitability Tool: Perennial Crop Cultivation in a Changing Climate

Across the Pacific West, the changing climatic conditions are encouraging farmers to reconsider their management practices, including the cultivars and crops they plant. This region, stretching from Oregon to Idaho and Washington to California, is home to incredible crop diversity. It produces many high-value perennial crops, including apples, blueberries, cherries, and wine grapes that rely heavily on irrigation from surface and groundwater sources during the dry season. Water is a precious commodity across the west and is at risk of declining due to climate change. Perennial plants live for decades and are therefore exposed to year-round environmental conditions. This puts these systems at a disadvantage in terms of flexible adaptation, because of the time and costs required to re-plant and the years required in growth before a new field, orchard, or vineyard produces strong yields. In light of these challenges, guidance on how future climate conditions may influence site suitability, crop development, and water needs can be useful for science-informed planning.

Climate change and weather variability already affecting producers.

In California, warmer winters and springs have reduced chill accumulation for crops with high chill requirements. For instance, lower chill hours have led to early blooms for pistachio trees, whereas variable weather has led to frost damage in almond and citrus plants. Likewise, extreme heat and irrigation curtailments have led to damaged blueberries and apples in Washington. Climate change is projected to exacerbate these existing challenges (see box).

- Increased temperatures across seasons, including more frequent extreme heat
- Decreased snowpack and summer streamflow leading to potential water shortages
- Increased extreme precipitation
- Lengthened growing seasons
- Increased plant moisture stress
- Increased risk of pests and disease

Modeling Future Perennial Crop Suitability

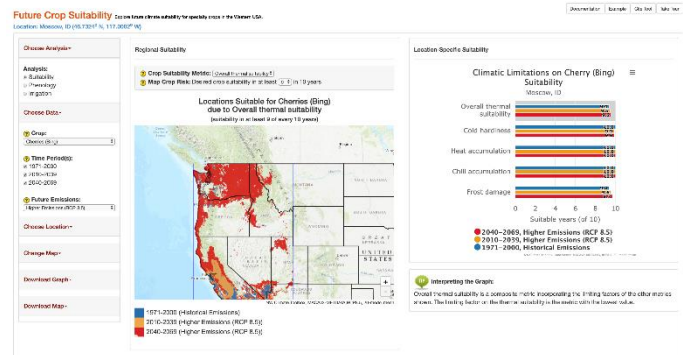
To understand potential crop success under future climate conditions – and what conditions might limit success – a tool has been developed that models site suitability by taking into consideration temperature factors (allowing for or limiting cultivation), changes to the timing of crop development, and potential future irrigation demands for five high-value crops: almonds, apples, blueberries, cherries, and wine grapes (Chardonnay and Cabernet Sauvignon).

Future Crop Suitability Web Tool

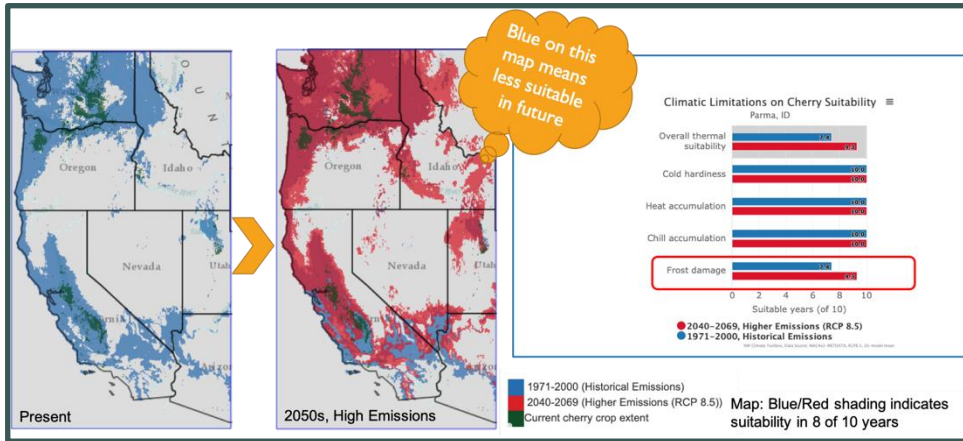
Explore how changes in suitability, phenology, and irrigation needs change by crop, location, time, and future climate scenario, check out the Future Crop Suitability webtool available online at

<https://climatetoolbox.org/tool/Future-Crop-Suitability>.

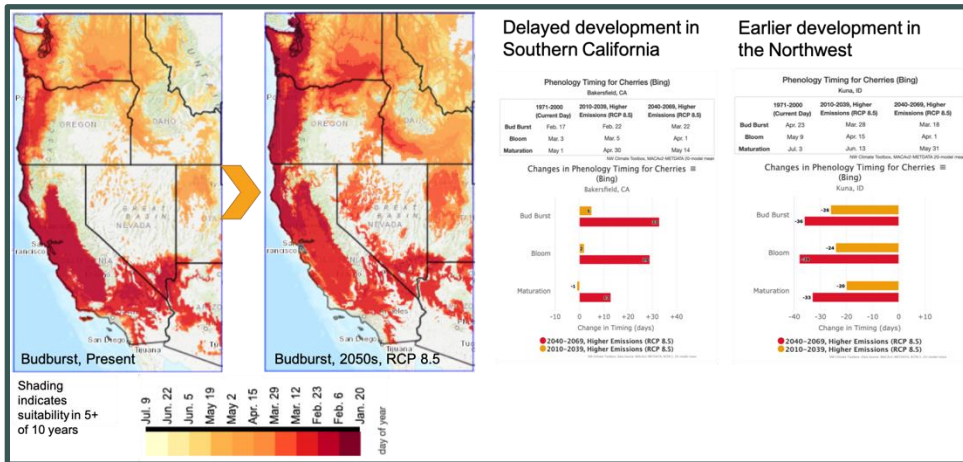
And be sure to check out the webtool's documentation page where you'll find much more information on model function and parameterization.



Changing Suitability and Phenology



Model results show that the future climate suitability for growing perennials can vary widely, depending on the location and crop. For example, the Northwest is expected to be more suitable for cherries (across >16,000 acres) due to a decrease in frost risk. In contrast, southern California is expected to experience declines in suitability due to insufficient chill accumulation for more than 3,000 acres of cherry orchards.



Changes to phenology also vary by location and crop. Cherry growers in the San Joaquin Valley of California could see a multi-week delay in bud burst due to slow chill accumulation, which delays bloom and maturity. Northwest cherry orchards are likely to experience earlier bud burst, bloom, and harvest – perhaps by more than a month in some locations.

Estimating Future Irrigation Demands

Model results show that climate change will increase irrigation needs across the Pacific West for nearly all crops and locations. Though warmer climates such as California's Central Valley may have higher absolute irrigation needs, for crops like cherries, parts of the Northwest could see a greater **increase** in irrigation demands given

Learn more about crop coefficients and reference evapotranspiration from the FAO bit.ly/36zn6VF

Irrigation Demand of Cherries (Bing)		
Kennewick, WA		
1971-2000 (Current Day)	2010-2039, Higher Emissions (RCP 8.5)	2040-2069, Higher Emissions (RCP 8.5)
39 in	41.6 in	44.2 in

NW Climate Toolbox: MACAv2-METDATA 20-model mean

expected future climate conditions. By the 2050s, the Columbia Plateau may need an additional 5 inches per year of irrigation water to sustain cherries under predicted climate conditions.

Contacts for more information

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