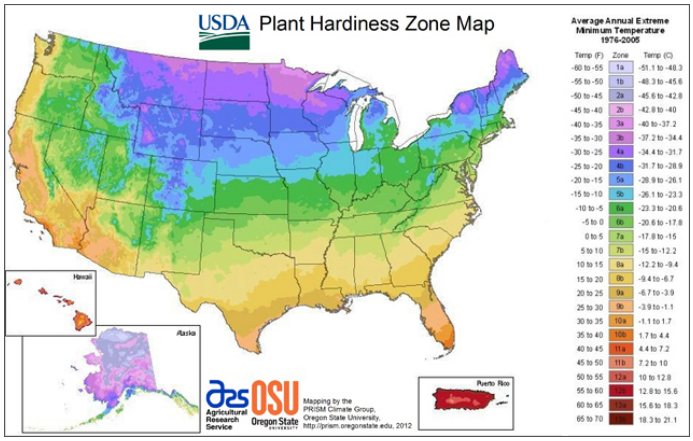
Climate Change and COLD HARDINESS ZONES

Picking Your Plants: USDA Cold Hardiness Zones

Of all the climatic factors that govern where plants can successfully be grown, winter cold hardiness is perhaps one of the most critical. Cold hardiness in this context refers to the coldest minimum temperatures that a fully dormant plant can withstand, and some plants are naturally more cold hardy than others. For instance, while apple trees can withstand the frigid winters in places like Minnesota and Maine, orange trees cold-sensitive nature confines their growth to the warmth of California, Arizona, Texas, and Florida.



Above: *The 2012 USDA Plant Hardiness Zone Map*

Above: *USDA Hardiness zones for California*

Since the 1960s, the USDA has produced a cold hardiness (aka plant hardiness) zone map to help landscapers, gardeners, and farmers select plants suitable for their location. Presently, the US is divided into 13 different zones representing winter's coldest minimum temperature. Each zone spans 10°F, with sub-zones ("a" and "b") spanning 5°F each. The USDA hardiness zones range from 1a, with winter's coldest temperatures falling as low as -60°F, to 13b, where winter temperatures never fall below 65°F. By comparison, California's hardiness zones range from 5a to 11a, with the majority of the state's agricultural areas experiencing winter minimum temperatures no colder than 20°F to 30°F, placing these regions in zone 9. From a winter cold perspective, zone 9 is ideal for many fruits and vegetables that are grown across the state!

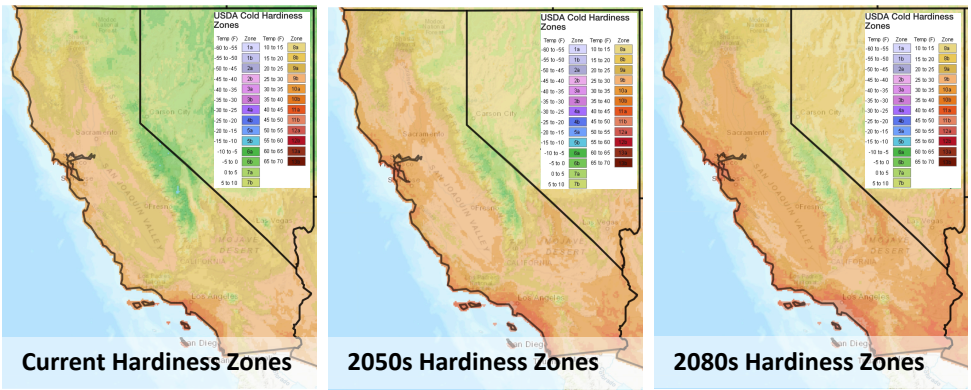
The 2012 USDA Plant Hardiness Zones Map Update

In 2012, the USDA partnered with researchers at Oregon State University to update the agency's map of US cold hardiness zones, previously updated in 1990. The new map used updated temperature data from weather stations across the country, incorporating the 30-year period 1976-2005. The 2012 map is also produced at a higher (finer) spatial resolution than the 1990 map, using a mathematical approach to better capture local climates and fill in the spatial gaps between weather stations (Daly et al. 2012). While the 2012 map shows many locations to have higher (warmer) hardiness zones compared to the 1990 map, the differences can be attributed to changes in the way the maps were produced and not necessarily any background warming from climate change.

Warming Winters and the Future of Cold Hardiness Zones

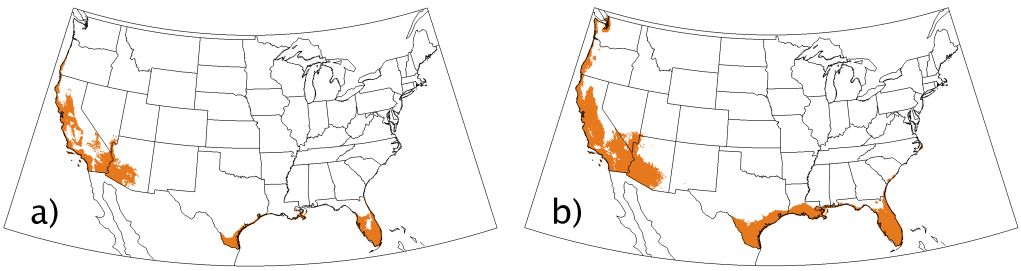
Across the US, winters have been warming over the past 120+ years. Looking to the future, climate change means warmer average winter temperatures *and* warmer extreme cold temperatures. In fact, the coldest minimum temperatures of the winter are projected to warm more than average winter minimum temperatures. Across California, the average winter minimum temperatures may warm ~2F by the 2050s, while the coldest winter minimum temperature could warm between 3.5F and 5.5F (Parker and Abatzoglou 2016). This amount of warming is enough to shift the USDA hardiness zones for some locations in California, such as in parts of the Central Valley, where the hardiness zone is projected to change from zone 9a to zone 9b by the 2050s, and to zone 10a by the 2080s.

Rights: *Maps from ClimateToolbox.org show how projected winter warming due to climate change will shift cold hardiness zones across California. By the end of the 21st century, many key agricultural regions will be one full hardiness zone warmer than they are at present.*



Could Crop Cultivation Expand?

While changes of a few degrees – or a half or even full hardiness zone – may not seem significant, these shifts can influence where crops can grow. For example, the coldest winter temperatures can be too cold for oranges across parts of the Central Valley. However, as winters warm, the area where orange trees can survive the winter's cold expands to include not only the entirety of the Central Valley, but most of southern California, and nearly the entirety of the Pacific coast (Parker & Abatzoglou, 2016). Of course, winter cold hardiness is only one of many factors that govern where crops are grown, but climate change will make winter cold damage will be one less concern for many growers.



Left: *Areas where the coldest winter temperatures are warm enough for oranges at present (a), and by the 2050s (b) under projected climate change (Parker & Abatzoglou, 2016).*

Where Can Growers Find More Information?

- What's your Hardiness Zone? Check with the interactive map from USDA-ARS and read more about hardiness zones at https://planthardiness.ars.usda.gov/PHZMWeb/
- Explore how climate change may shift hardiness zones across the Lower 48 at https://climatetoolbox.org/tool/future-cold-hardiness-zones

References

1. Daly, C., Widrlechner, M. P., Halbleib, M. D., Smith, J. I., & Gibson, W. P. (2012). Development of a new USDA plant hardiness zone map for the United States. Journal of Applied Meteorology and Climatology, 51(2), 242-264.
2. Parker, L. E., & Abatzoglou, J. T. (2016). Projected changes in cold hardiness zones and suitable overwinter ranges of perennial crops over the United States. Environmental Research Letters, 11(3), 034001.

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