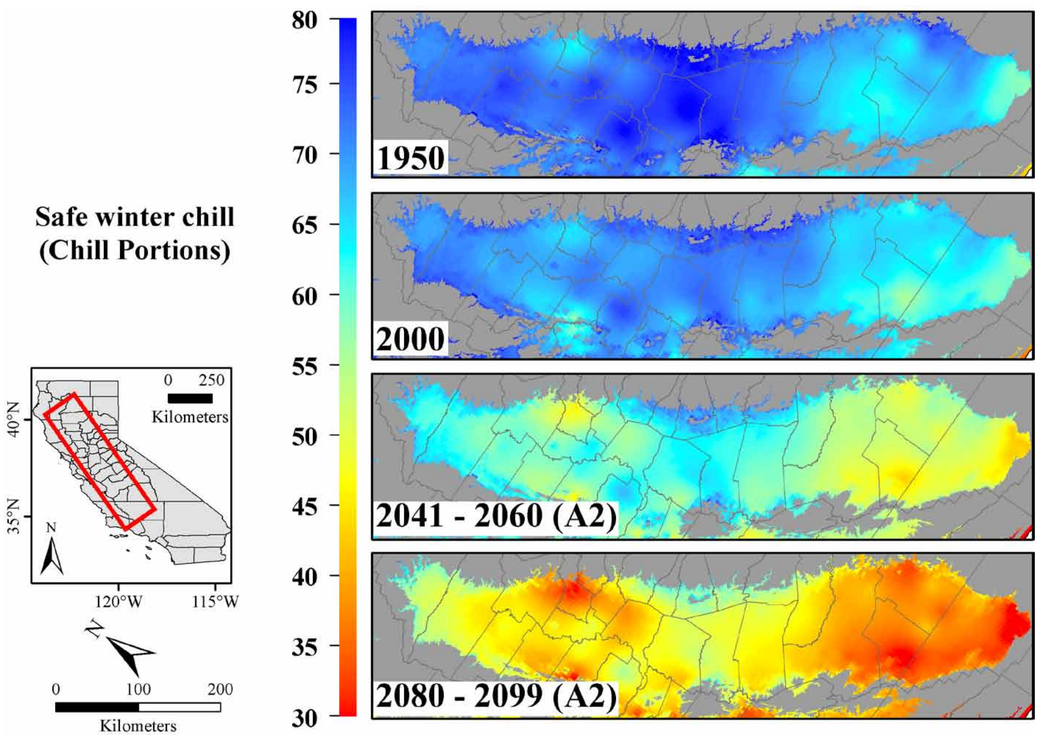
SUSTAINABLE FOOD AND AGRICULTURE

Warming Threatens Tree Crops

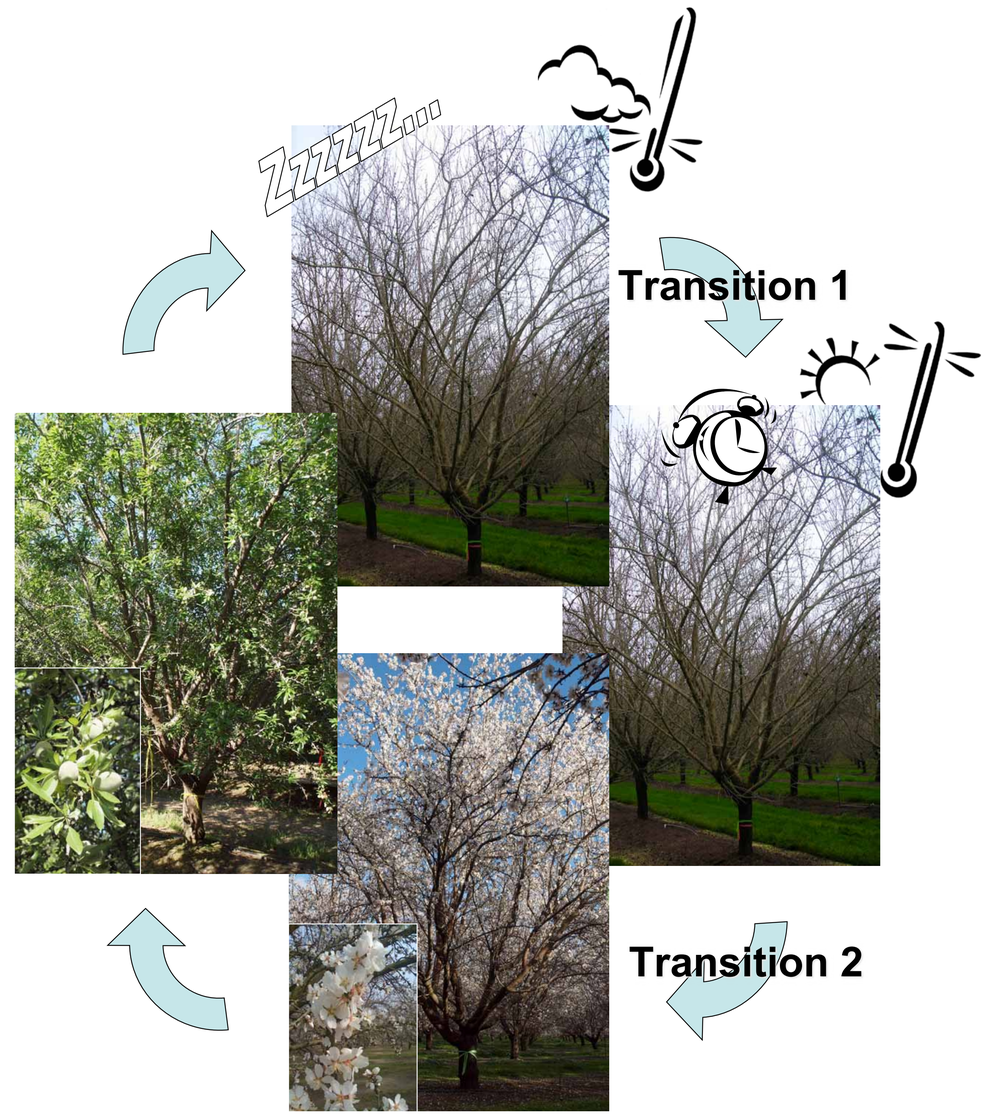
Better models of temperature-blossoming interactions are necessary to create strategies for a resilient industry.

TEMPERATE TREES, like almonds, cherries, pears and walnuts that evolved in climates with distinct seasons have "dormancy requirements" that allow them to track the passing of winter to know when conditions are safe for bloom. Like a sleeping person, trees need both enough "sleep" (winter cold) and a loud enough "alarm clock" (spring heat) to wake up. Climate change and warmer winters may cause trees to "sleep through their alarm," resulting in fewer flowers and reduced production. As a result, many current cultivation zones may become unsuitable for production in the future (see map).



As winters warm many trees may not experience enough cold to allow flower and leaf buds to open properly. Previous work has found in California, for example, the amount of tree-perceived cold could decrease from historic averages by half by the end of the century. (For more details, see Luedeling, E., M. H. Zhang, et al. (2009). "Climatic Changes Lead to Declining Winter Chill for Fruit and Nut Trees in California during 1950-2099." Plos One 4(7).)

Research by Katherine Jarvis-Shean and the Brown, DeJong, and Zhang labs is integrating the effects of winter and spring temperatures and other environmental variables to model when trees bloom and how well they'll bloom under future conditions. This knowledge will enable scientists to better quantify the financial repercussions of continued emissions on global agriculture, will help land owners plan orchard investments, and will aid breeders to identify cultivars that can tolerate future conditions.



To model how climate change will affect tree production, we need to know not just the minimum cold trees require to be primed to "wake up" (above "Transition 1"), but also the amount of heat required to then bloom ("Transition 2") and how much warmer springs will be able to compensate for less winter cold. Through work funded by the California Department of Food and Agriculture, we are examining the amounts of cold and heat necessary for optimal productivity.

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