

## Improved Understanding of Climate Variability and Change Relevant to Orchards and Vineyards in Arizona and New Mexico

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**Key Partners:** University of Arizona Cooperative Extension; New Mexico State University Cooperative Extension; Yavapai College Viticulture and Enology Program; Merkin Vineyards

**End Users:** Arizona Vignerons Alliance; Routson Orchards; fruit and nut tree growers, winegrape growers

**Project Dates:** 2017 – 2019

### Summary of Impact

**Supporting adaptation in viticulture:** Through this project winegrape growers gained better understandings of how climate change affects their vineyards, specifically through changes in vine phenology, or timing of growth stages. Growers incorporated climate and weather information into their decisions, such as the timing of irrigation.

**Building a network for information sharing and support:** The project fostered new relationships between researchers and growers, creating a stronger network for information sharing and support.

**Providing tailored resources:** Activities and resources like workshops, reports, and a monthly newsletter were designed to meet the expressed needs of local growers.

### Problem Statement

Orchards and vineyards are particularly sensitive to temperature and are increasingly important to rural economies of the Southwest. However, growers of these high-value perennial fruit and nut crops have limited climate information to support critical decisions about selecting sites and cultivars.

### Research Focus

This research focused on understanding the impact of climate change on winegrape growing in Arizona and New Mexico, with a particular emphasis on vine phenology (growth stages). Researchers investigated how climate change, especially rising temperatures, might affect winegrape cultivation and vine development. The project also focused on assessing how well current winegrape varieties might adapt to projected warmer climate conditions in the region.

## Project Activities

**Survey development:** Conducted with a set of orchards and vineyards about siting and cultivars.

**Partner interaction:** Workshops, field work, and meetings with wine grape growers about climate issues and events.

**Newsletter communication:** Developed a monthly newsletter for interested stakeholders on relevant local climate conditions.

**Collaborative research:** Compared winegrape growth stages (i.e., phenology) in the context of climatic conditions, with NM State University Extension, Yavapai College, and Merkin Vineyards.

**Climate impact analysis:** Historical and future assessments of temperature and climate impacts on winegrape growing and vine phenology and evaluation of present-day cultivar suitability given anticipated increases in regional temperature.

## Project Outputs

### **Workshops:**

An Exchange on Climate and Viticulture in Yavapai County 2018. Yavapai College Verde Valley Campus, Clarkdale AZ. Co-organizer. Presentations and discussions on climate and viticulture in Arizona, the agricultural heritage of Yavapai County, and a new grower-scientist collaborative project that aims to learn how variations and changes in climate are impacting vineyards across the state.

Growing Season in Review. 2019. Benson, AZ

Growing Season in Review. 2019. Clarkdale, AZ

### **Data:**

[Arizona AVAs](#): Data and visualizations about climate, soil, and topography for each of the proposed Sonoita, Willcox, and Verde Valley American Viticulture Areas (AVAs). This information is standard for winegrape-growing regions but did not exist for Arizona. Developed to help inform the expanding winegrape-growing industry in Arizona.

### **Newsletter:**

[Climate Viticulture Newsletter](#): Provides timely climate information relevant to winegrape growing in Arizona and New Mexico on a monthly basis. Stakeholder input led to development of the newsletter in May 2019, with 90 subscribers as of 2021.

### **Reports:**

Improved Understanding of Climate Variability and Change Relevant to Orchards and Vineyards in Arizona and New Mexico. 2018. *Report Series*. Presented historical data

analyses of temperature conditions relevant to orchards and vineyards as starting points for discussing project activities.

Report for Merkin Vineyards. Bud Break at Buhl Memorial Vineyard, 2016-2020. Climate Assessment for the Southwest (CLIMAS), 2020.

Review of the 2019 Winegrape Growing Season in Arizona. 2020. Climate Assessment for the Southwest (CLIMAS), University of Arizona.

Initial Assessment of Daily Minimum Temperature from Data Loggers in Routson Orchards. 2018. Climate Assessment for the Southwest (CLIMAS), University of Arizona.

### ***Presentations:***

Arizona Grape Growers Symposium 2018. Benson AZ

Outcomes from the Climate-Viticulture Exchange in Yavapai County. 2018. University of Arizona Cooperative Extension Conference, Tucson AZ.

What Are the Major Climatic Issues for Arizona Viticulture. 2019. Arizona Viticulture Symposium, Willcox AZ.

The Sonoita, Willcox, and Proposed Verde Valley American Viticultural Areas. 2019. Arizona Viticulture Symposium, Willcox AZ.

Exhibitor. 2019. New Mexico Wine Education Conference, Albuquerque NM.

Stakeholders of a Climate Science and Viticulture Project Affect Research Project Vintage. 2019. American Geophysical Union, San Francisco CA.

State of the Climate for the Arizona Pecan. 2020. Arizona Pecan Growers Association Annual Conference, Tucson, AZ.

How Growers Help Identify When and Why Excessive Heat Matters in Vineyards. 2021. Climate Prediction Applications Science Workshop.

How Growers Help Identify When and Why Heat Matters in Vineyards. 2021. CNRS-iGLOBES and University of Arizona - Tipping Points Working Group.

### ***Media Coverage:***

[Talking Wine, Weather, and Science](#). 2021. Come Rain or Shine podcast. USDA Southwest Climate Hub and the DOI Southwest Climate Adaptation Science Center.

[Climate change could shake up Arizona agriculture](#). 2018. Arizona Sonora News Service.

### ***Selected Scientific Findings:***

*Climate impact on winegrapes:* Vine phenology – the timing of growth stages – is how weather and climate connect to the vineyard. Warmer conditions are causing the vines to progress through their growth stages earlier than usual, meaning events like budburst (when the buds open) and flowering are happening sooner. Changes in the timing of growth phases increases the risk of damage from late spring frosts, can affect the harvest, and the quality of the grapes.

***Bud break modeling:*** Incorporating information about how fast grapevines lose their cold hardiness (de-acclimation kinetics), improves the accuracy of bud break models, especially in warmer climates.

***Impact on quality:*** In white grape varieties, the duration of heat and cold exposure, as well as how extreme those temperatures are, influence sugar content (Brix) and the level of acidity (TA). Both measures are crucial for determining the flavor and balance of wine.

***Growing winegrapes in the Southwest:*** Two of three American Viticultural Areas in Arizona and two of three in New Mexico are at the warm end of the winegrape growing spectrum. Excessive heat in these areas can cause negative impacts to plant physiology, fruit quality, composition.

### **Leveraged Funding**

*Supporting this project:*

- Southwest Climate Adaptation Science Center, U.S. Geological Survey (\$50,000)

### **Societal Impacts by Category**

#### **Conceptual:**

- Feedback from winegrape growers suggests that project-related information improved their understanding about the role of climate and climate change in viticulture, and specifically how climate affects vineyards through vine phenology.
- Merkin Vineyards requested a comparative analysis of vine bud break dates 2016-2020 for individual cultivars on their vineyard, as well as general information on climate and weather. The report developed for them helped them better understand how weather and climate could help predict the start of the next growing season.

#### **Connectivity:**

- New connections and partnerships developed between CLIMAS researchers and winegrape growers. Presentations tailored to local stakeholders drew increased numbers of interested stakeholders to the project.
- The [Climate Viticulture Newsletter](#) helped grow and connect the network of winegrape, fruit, and nut growers across Arizona and New Mexico.

#### **Instrumental:**

- Many growers who were engaged with the newsletter, workshops, and reports, have incorporated climate and weather information into decision-making processes such as irrigation decisions.