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Vineyard Focus:

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2019 UNIFIED GUIDE

A preview of the Unified Wine & Grape Symposium

Climatologists Say Cabernet's Days as King in Napa are Numbered

How the changing climate could create unfavorable conditions for this particular grape

Larry Brooks

Larry Brooks has spent close to four decades making fine wine in California. His career began at Acacia in 1979. From his role as winemaker and general manager he went on to become the vice president and COO of Chalone Wine Estates, Acacia's parent company. He founded L.M. Brooks Consulting in 2000 after leaving executive winemaking and continues to offer a wide range of services. He has recently been lecturer in advanced sensory analysis of wine at both Cal Poly San Luis Obispo and at Fresno State. He is currently taking the lead role as consulting winemaker at Paraiso Winery.

THE OPTIMUM GROWING TEMPERATURE for luxury priced Cabernet Sauvignon sits at 17.5±1.5° C (63.5º±2.7° F), but climatologists project that most current California wine-growing regions will exceed 19° C, based on measurements taken from 1981 to 2010. On June 7, 2018 a symposium in Sonoma called, "**Bordeaux in America: The Climate Disruption**," sponsored by **Enologix**, featured climate experts discussing their predictions with vintners. While the symposium was focused on the effects of climate change on luxury Cabernet in Napa and Sonoma, the underlying science and temperature trends contain dire news for wine-growing at large.

The most startling and sobering fact was that within 30 years (the normal life span of a vineyard planted today), many current Napa vineyard locations will be too warm for some Bordeaux varieties to scale luxury-priced wines. Climate change is no longer something abstract affecting the future. Anyone planting or replanting a vineyard today should be taking climate warming trends and optimum grape-growing temperatures into account.

Four academics and **Doug McKesson**, general manager at Enologix, presented different facets of the problem. They are **Dan Cayan**, research meteorologist, **Scripps Institute**; **Greg Jones**, professor and climatologist, **Linfield College**; **Daniel Sumner**, director, **UCD Agricultural Issues Center**; and **Elizabeth Wolkovich**, **University of British Columbia** and **Harvard University**.

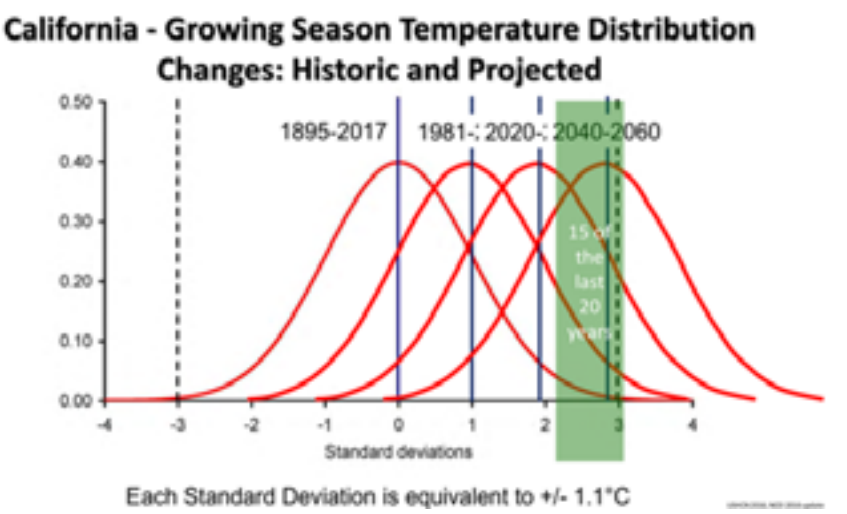
For concision's sake I have condensed the material from the day-long symposium into three parts. The first section addresses what the climate is doing; the second, the effect this warming is having on the vines and wines; and the last, strategies to mitigate the effects.

Part 1: Climate Warming

All speakers agreed that the planet is warming and that the increased greenhouse gases, primarily CO_2, that cause the warming are proven to be from human activity.

Rates of temperature increases began accelerating about 1980. Observation of the warming over the four decades since has allowed climatologists to project the temperature trends through the 21st century. All climatologists predict additional increases of 4° F to 5° F by the mid-21st century. Disturbingly, however, 15 of the last 20 growing seasons in California have already been 3° F to 5° F warmer than the 100-year average 1895-2017.[3] Projected temperatures will rise 6° F (3.3° C) by 2060 (**FIGURE 1**).

FIGURE 1



Climatologists use two CO_2 level scenarios for their projections—a moderate increase and a high increase. Until mid-century, both moderate CO_2 and high CO_2 increases yielded the same projected temperatures for California. After mid-century, if high CO_2 accumulation proves true, temperatures will sharply increase.[2]

In California coastal vineyards the nighttime minimums have increased more than the daytime maximums due to warming of the eastern Pacific Ocean. There has also been more variation in daytime than nighttime temperatures. By mid-century the hottest days will be 4° F to 5° F hotter with more days above 95° F. The frequency, duration and intensity of heat events will increase. Rainfall will become more variable with an increased frequency of drought years. This increase in drought years will further drive up demand for water resources, which will already be under pressure from rising average heat. Intense winter storms will become more intense.[2]

New Program to Support Climate-Smart Agriculture

A new $1.1 million program has been designed to spur climate-smart agricultural practices in 10 California counties. The program is a partnership between the **California Department of Food and Agriculture** and **University of California's Agriculture and Natural Resources**.

Under the agreement, 10 new **UC Cooperative Extension** community education specialists will be hired for a year to guide farmers and ranchers apply for cost-sharing grants to improve irrigation systems and soil health as well as set up alternative manure management programs.

The University of California employees will be assigned to 10 counties: Mendocino, Glenn, Yolo, San Joaquin, Merced, Kern, Imperial, San Diego, San Luis Obispo and Santa Cruz counties.

UC Cooperative Extension advisors will mentor the new educators and conduct research on sustainable farming and ranching practices.

Grape growers may primarily benefit from the **State Water Efficiency and Enhancement Program** and the **Healthy Soils Program**, said **Doug Parker**, director of the **UC California Institute for Water Resources**.

The community education specialists will also organize workshops on sustainable farming practices and advise farmers and ranchers on best management practices such as water and energy saving measures.

Glenda Humiston, vice president of **UC Agriculture and Natural Resources**, and **Karen Ross**, secretary of the **California Department of Food and Agriculture** signed a memorandum of understanding on Oct. 26, 2018.

"Agriculture is an important part of the climate solution," Ross said in a written statement. "This funding enables CDFA and UC ANR to partner with farmers to scale-up climate smart agricultural practices."

The program is funded through the California Strategic Growth Council. "Farmers and ranchers are key to carbon sequestration and a sustainable California," said **Ken Alex**, chair of the **Strategic Growth Council**. "The Strategic Growth Council is pleased to fund this partnership for smart agriculture practices."

For information on the UC ANR, check: *https://ucanr.edu/*

Information on the State Water Efficiency and Enhancement Program and the Healthy Soils Program are available at: *https://www.cdfa.ca.gov/oefi/sweep/ and https://www.cdfa.ca.gov/oefi/healthysoils/*

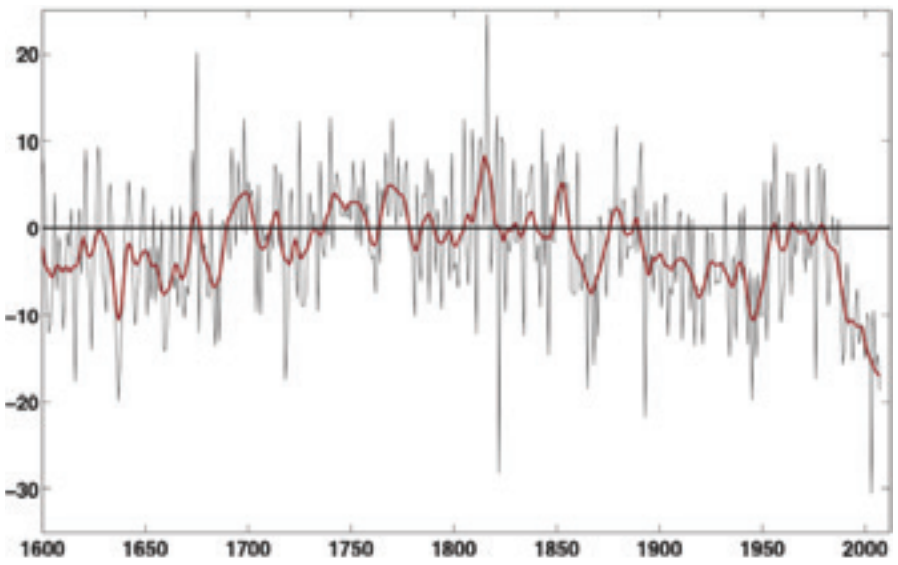
For information on the Alternative Manure Management Program, check: *https://www.cdfa.ca.gov/oefi/AMMP/*

Part 2: Effects of Warming on Vines and Wine

Climate warming has effects on growth, productivity, and quality. Warmer dormant periods make risk of freeze damage greater. Earlier budbreak and growth expose the vines to greater risk of frost. Earlier flowering can lead to greater chances of rainfall damage. Veraison will be earlier when heat stresses are greater. At harvest lower ranges of diurnal temperatures will lead to sugar ripeness before tannin and color ripeness. All phenological stages[5] shift earlier in response to warming, and the phases themselves are condensed.[3] Inevitably, there will be flavor changes in the wine as the vines respond.

Climate is one of the key variables that contribute to terroir. As the climate changes, so too will terroir. Plant phenology is a good lens to observe these changes. Phenological records of winegrapes have been kept in France since the 1300s. These records clearly show that as the planet has warmed in the past 40 years, there has been a trend towards earlier harvests—a shortening of the phenological phases that lead to ripeness (**FIGURE 2**). While there was variability in harvest dates of individual vintages throughout the record, there has been a 0-day shortening of the growing season on average since 1980.[4]

FIGURE 2

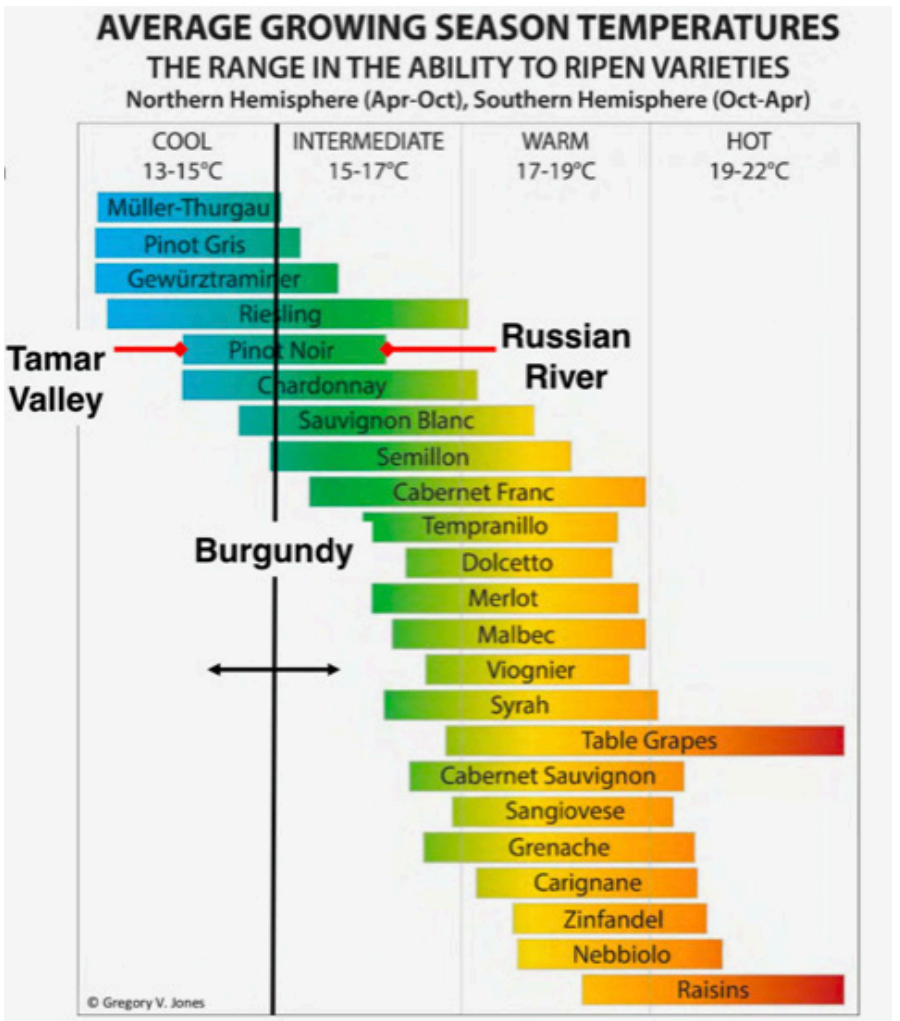


Grapevines have a wide adaptability to temperature between varieties. You have cold climate varietals, such as Pinot Noir, and varietals, like Grenache, which will thrive under much warmer conditions. Within each varietal, however, you have a narrow range of temperatures where quality wine is possible. This is why Grenache is not found in Burgundy, and Pinot Noir is not planted in Chateauneuf-du-Pape.

Average Growing Season Temperature (GST) is becoming the standard metric for discussion of climate effects on wine-growing. There are four broad categories of heat ranges that are suitable for quality wine—Cool, 55.4° F to 59° F (13° C to 15° C); Intermediate, 59° F to 62.6° F (15° C to 17° C); Warm, 62.6° F to 66.2° F (17° C to 19° C) and Hot, above 66.2° F. Varieties vary in the range of temperatures that are successful for them. Pinot Noir has one of the narrowest ranges at roughly 3.5° F (2° C) while others like Cabernet Sauvignon are somewhat wider at 5.5° F (3° C) (**FIGURE 3**).

Here lies the crux of the problem for any region that has established its reputation based on the interaction of its terroir with a specific variety. Take Cabernet and Napa Valley, as an example. Cabernet has a range of 60.8° F to 66.2° F (16° C to 19° C) in which it will produce quality wine. In St. Helena, the average GST for 1971-2000 was 66° F (18.9° C)—very near the high-end of the range for Cabernet. Bordeaux, in contrast, had an average GST of 61.7° F (16.5° C) for 1950-2000, which is near the low end of the optimum range.[1,3] Warming has occurred in both areas since 2000, and that has likely benefited Bordeaux, but not Napa.

FIGURE 3



While there is a range of increases predicted for upcoming decades—even the most conservative predict increases that will raise Napa GST out of the warm range and into the hot range by the mid-21st century—this hot range is not compatible with luxury-priced Cabernet. The direst forecasts based on higher accumulation of CO_2 would make Napa Valley more compatible with table grapes than winegrapes by century's end.

Other appellations besides Napa Valley are at equal risk. Continental climates, in particular, such as central France and Germany, will see significant warming. Terroirs that have grown the same varieties for many centuries will no longer find them suitable.

Part 3: Mitigation

One reaction to a warming climate will be a general movement of new wine-growing in higher latitudes. It should be kept in mind that because of their patterns of day length, Northern latitudes also cause compression of phenological phases and will make wines dissimilar to those grown in middle latitudes. Within appellations, movement towards higher elevations will help—obviously not an option in all areas.

In the case of coastal locations, moving closer to the ocean could help. Patterns of fog and coastal moisture will need to be considered before making such a decision. While relocation may sound drastic to a current vineyard or winery, this will inevitably happen. As Dr. Wolkovich so vividly put it, "Climate change is a wave you must ride or be swept away by."

For those who do not wish to relocate or cannot, there are alternative solutions. Changing varieties or proportions of blends is less expensive

than changing location. As previously noted, there is a wide range of heat tolerance between grape varieties. In the case of a Bordeaux style blend, this may involve lowering or eliminating the less heat-tolerant Merlot, and increasing portions of Malbec and Petite Verdot. Rhône blends can shift to the more heat-tolerant Grenache from Syrah-based blends. Pinot Noir and Chardonnay usually made as single varieties do not offer the same flexibility.

Unfortunately, most of the "International" varieties, which are currently widely planted around the globe, originated in France and are in the range of cold- to warm-tolerant. They will not be a big part of the longer term solutions. Varieties found in southern Italy, Greece and Spain are the likeliest candidates for planting in warming terroirs. These varieties have both longer phenological cycles and the ability to retain acidity and color in hot conditions. They, of course, pose a marketing challenge in a sales world dominated by a dozen or so largely French varieties.[4]

There will be existing growing areas that become so hot that they will be outside of the range of winegrowing entirely—not even the broad range of *Vitus vinifera* heat adaptability will offset climate change in every area. Some appellations will be abandoned.

Genetic adaptations, through traditional plant breeding and the use of GMOs to increase heat and drought tolerance, are an avenue that is worth pursuing in both scion and rootstock development[3]. Parts of society and the market have issues with genetic solutions, but hopefully this will change.

Myriad shorter term and temporary solutions exist and will be applied. Landscape potential, such as aspect to the sun and row orientation to protect fruit zones from direct solar, help. Training, trellising and application of shading materials are also effective. Choice of rootstock for drought tolerance and water management is important. The use of micro sprinklers and other forms of irrigation for short-term temperature control during "heat storms" are already in routine use for some fruit crops and should be considered.

These short-term solutions will be most effective in areas that are currently at the cool end of the range for the variety grown. Pinot Noir in parts of Oregon and the coolest California locations fall into this category. If you are already at the warmer edge of climate for your variety, moving or replanting makes more sense. Pinot Noir in parts of the Russian River fall into this category. **WBM**

References

[1] According to Doug McKesson, general manager, Enologix

[2] According to Dan Cayan, research meteorologist, Scripps Institute

[3] According to Greg Jones, professor and climatologist, Linfield College

[4] According to Elizabeth Wolkovich, University of British Columbia and Harvard University

[5] Phenology is the study of the annual timing of stages of development and growth in plants. It is an indicator of how they are responding to their environment.