

New Terroir: Climate Resiliency Through Variety Diversity

E. M. Wolkovich

Elizabeth M. Wolkovich is an associate professor and Canada research chair in the Department of Forest and Conservation Sciences, University of British Columbia (UBC). She started Wolkovich trained as an ecologist, earning her PhD at Dartmouth before postdoctoral training at the University of California, Santa Barbara and San Diego. She established the Temporal Ecology Lab at Harvard University in 2014, which she now runs from UBC. The lab focuses on understanding how climate change shapes plants and plant communities through shifting the timing of seasonal development, and benefits from an interdisciplinary and international team of collaborators from agriculture, biodiversity science, climatology, evolution and viticulture, across Canada, France, New Zealand, Spain, Switzerland and the U.S. The lab is particularly interested in how climate change will affect different winegrape varieties across different regions. Visit stateofwine.org for more information.

The Concept of Terroir is All About Climate

While always mentioned as a part of terroir, climate is actually embedded in most aspects of terroir. Geography and orography matter because they shape local climate: how much sunshine an area receives, how cold air pools or the moderating effects of fog. Similarly, the importance of soils often comes down to how they impact climate, how they hold heat overnight or drain water, for example.

With climate change, the terroir of all winegrowing regions is shifting. How much they are shifting and how detrimental that may be to each region, however, is a matter of debate. While numerous reports suggest the downfall of many major winegrowing regions and the rise of other regions with climate change, it is actually more complicated.

I argue that three major components will determine the future for a winegrowing region with continued human-caused (anthropogenic) warming. First, what is the current climate in a region relative to the global limits of where we can grow winegrapes today? Areas at the hotter edges (at the limits, effectively) of winegrowing will have fewer options for how to cope with warming while areas at the cooler edges will be able to grow a greater diversity of grape varieties than they currently can.

Second, what is the forecasted magnitude of climate change in a region? Climate change is highly uneven. Northern areas, higher elevations and continental regions generally warm more. Then, factors beyond warming matter, including changes in storm, fog and drought patterns.

The third and perhaps most important determinant of the impact of climate change is how much a region is willing to change growing practices. Growers (and regions) that do nothing should expect to see large negative impacts. Those who respond actively and proactively will cope much better. Winegrowers, of course, know this, and many are actively working on ways to adapt.

Many growers have already realized that how best to adapt terroir to changing climate is within the definition of terroir itself. The grape varieties of a region—including how well-matched they are to the local climate and wine styles—are part of the definition of terroir and can potentially allow growers to adapt to the large shifts in climate expected in the coming decades.

Why Variety and Climate Matching Matter

Grape varieties vary in many important attributes, including yield consistency, heat, drought, cold and disease tolerance, flavor and phenology. Varieties well-matched to a region's current climate will produce more consistent yields and high quality fruit. Phenology plays a critical—and critically changing—role with climate change, when considering this match, as regions need grapes that mature within the length and warmth of their growing season, flower before heat extremes (to maintain yield), and ideally mature during the cooler weather that produces more flavorful berries and balanced sugar:acid ratios.

The imprint of climate change on winegrowing has been apparent through the phenology of winegrapes for decades, with flowering and harvests that have shifted weeks earlier since significant anthropogenic warming started approximately 40 years ago. This advance has left many growers to harvest grapes at higher sugar:acid ratios and led some to wonder about shifting to later-ripening varieties to counteract this. But for many growers, which varieties to plant, as their terroir shifts beneath them, are not clear.

Winegrapes are a highly diverse crop with over 1,100 vinifera varieties planted today, but little of that diversity is planted outside of Europe. Almost all winegrowing regions outside Europe have 70 percent or more of their hectares planted with 12 or fewer varieties, and some regions plant Cabernet Sauvignon in more than 80 percent of their hectares. Altogether, only a few hundred varieties are planted commercially outside of Europe—a similar number to how many varieties are planted in some small regions of Italy, Portugal and Spain.

The reasons for the low diversity of winegrapes in newer winegrowing regions are myriad (including the difficulties of importing grape varieties, market forces and more), but one reason may be that the effort required to find well-matched varieties previously was sometimes not high enough for the reward—at least until recently.

Terroir highlights the complexity of the environment in relation to winegrowing as varieties grow and mature differently in different climates, so trying many varieties to find the ones that work for a particular region can be time-consuming. If a Pinot Noir or Chardonnay works well enough, then growers may skip the time-consuming step of finding truly well-matched varieties. But this ground is actively shifting underneath growers. As increased drought limits irrigation, and heatwaves and other climate extremes become more common in more regions, variety x climate matching becomes more critical.

VINEYARD & ORCHARD SPECIALISTS

SINCE 1959



METAL STAKES • CROSS ARMS • END POSTS • T-POSTS
WIRE • GROW TUBES • ANCHORS • FENCING • CLIPS
CROP PROTECTION • TYING & TRAINING SUPPLIES
HARVEST & PRUNING SUPPLIES • & MUCH MORE!

CUSTOMIZED TRELLISING MATERIALS MANUFACTURED DOMESTICALLY
SEVERAL LOCATIONS ACROSS CALIFORNIA AND THE PACIFIC NORTHWEST

Bakersfield

3500 Buck Owens Blvd.
Bakersfield, CA 93308
661-616-6977

Delano

17216 County Line Rd.
Delano, CA 93215
661-720-9725

Victor

17335 N. Sunrise St.
Victor, CA 95253
209-989-5721

Windsor

10001 Old Redwood Hwy
Windsor, CA 95492
707-293-9552

Oregon

599 South 3rd St.
Independence, OR 97351
503-664-5721

Washington

2746 Kingsgate Way
Richland, WA 99354
509-233-5000



www.JSCAgSupply.com

@JSCAgSupply



New Terroir: Climate Resiliency Through Variety Diversity

Complexity of Variety and Climate Matching with Climate Change

How do we better match varieties to climate? The answer is unlikely to come from researchers alone. While researchers have grown different varieties of winegrapes together to compare varieties—sometimes called a research collection (or common garden)—these studies cannot inform exactly which varieties to grow where.

Even collections designed for specific regions, such as the VitAdapt program in Bordeaux, have highlighted this as many varieties expected to perform well based on how they grew elsewhere performed poorly or unexpectedly, suggesting that they would not be ideal for planting in a future, warmer

Bordeaux. This is likely not surprising to many—what we know about terroir is that fine-scale, nuanced differences in the environment matter, and they matter to how a variety performs.

The solution to better matching varieties to climate rests with growers. Specifically, it rests with grower networks that invest in trying different varieties across vineyards. Researchers have long understood that a single variety (or genotype) rarely acts the same across environments; instead different tree species grow to different heights (for example) in different environments—often called a genotype x environment (or G x E) interaction. Winegrape growers and researchers know the same is true of different varieties: how a variety performs depends on the climate (a V x C interaction). Thus, picking the right portfolio of varieties requires knowing how different varieties perform differently across climates.

Variety Diversity Networks

Investing in variety diversity blocks in a winegrowing region—where growers each try a suite of semi-overlapping varieties (in a block or two of their vineyards) across years and vineyards and collect and share the resulting data—is the major way growers can select ideal varieties for the future.

As different vineyards and different years provide different climate regimes, variety diversity blocks, coupled with statistical models, can identify which varieties will consistently work, or not, across a local climate and which may work in only certain vineyards or certain years. This is a much more powerful approach compared to single research collection or trying to develop the answers from a limited number of vineyards.

Importantly, variety diversity networks leverage the climate complexity and diversity of a region in a way that all growers benefit more than they ever could working alone. State-of-the-art Bayesian hierarchical (statistical) models can leverage the data from small to large diversity blocks, providing insights into which varieties will be ideal in the future and information on any additional unique aspects of a vineyard—but both of these outcomes can only be estimated when growers invest in sharing data across a network.

Growers in a network benefit more in some ways based on the size of their own variety diversity blocks—vineyards that can grow more replicates of more varieties can be more precisely modeled—but they rely on the climates of other vineyards for the most useful estimates of what to grow in the future, and in this way, even a small number of replicates and a few varieties grown across many vineyards provide critical insights.

Scaling Up Variety Diversity Networks

Findings from variety diversity networks can rapidly scale up our understanding of winegrape varieties from a research perspective, which could improve breeding and precision management techniques. For climate change, we critically need to know the different phenology of winegrape varieties, their heat and drought tolerances, how they respond to different trellis and irrigation strategies, how they work with different rootstocks and more.

Remarkably, we have very little of this information beyond just a dozen or so varieties, but growers hold the keys to changing this. The more growers invest in trying different varieties across these different regimes and share their data, the more researchers can provide answers as to which varieties will have consistent high quality yields under the longer droughts and warmer growing seasons of today and the future. www.wm



We farm quality fruit in Appellations spanning from Clarksburg to Moon Mountain, to Carneros, to Bennett Valley.

We produce quality bulk wine and shiners and have the fruit and juice that you are looking for.

LEASING

Are the economics of your vineyard not working for you? Talk to us about our leasing options for a win-win solution.

CUSTOM LABELS

We can work with you to create a custom label for a completely unique wine that you can sell, gift or use for promotional purposes. We have access to a range of world-class white, red and rosé wines that can be bottled in different sizes and quantities to suit your tastes.

SHINERS

Ask about our bottled inventory of high quality wines from our farmed vineyards available for your creative use.

Ned Hill owner	Mike Cox winemaker	Guido Murnig sales	Charlie Tolbert industry veteran
--------------------------	------------------------------	------------------------------	--

Please contact Guido Murnig at guido@laprendavineyards.com

La Prenda Vineyards Management
laprendavineyards.com | 707-935-6445