
NEWS

Surviving Climate Change: Replanting Wine Regions to Different Varieties May Be Key, Study Finds

Portuguese grapes in Bordeaux? Mourvèdre in Mendocino? Diversifying vineyards around the world may dramatically stem losses, analysis shows



As climates become less predictable, grapegrowers will need to try new techniques in the vineyard and potentially new grape varieties. (istockphotos)



By Dana Nigro

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Ancient, heat-hardy wine grapes are being resurrected in Spain to deal with rising temperatures. Worried producers in Bordeaux —where Cabernet and Merlot have long ruled—have approved the use of seven new wine grapes from Portugal, Spain and southern France in their blends. The University of California at Davis recently released five new hybrid grape varieties—its first such release since the 1980s—to resist vine-killing insects expected to proliferate as winters warm.

Around the world, forward-thinking winegrowers are banking on their crop's genetic diversity to help them survive as the global climate changes in coming decades. They are planting more [clones](#)

[<https://www.winespectator.com/glossary/index/word/Clone>]

and a wider range of varieties, experimenting even in regions where the permitted grapes are codified into law. By planting a mix of grapes that ripen earlier or later, that like cooler or warmer temperatures, that tolerate drought or aren't prone to mildew in heavy rains, they hope to minimize the crop losses expected due to shifting temperature patterns and extreme weather events.

But will that work? Until now, there haven't been large-scale tests on this front. "No one had ever actually asked what happens if growers changed varieties: Does it make a difference?" explained Elizabeth Wolkovich, an associate professor of forest and conservation sciences at the University of British Columbia.

The answer is yes, it does, to a degree. In a study published Jan. 27 in *PNAS*, the *Proceedings of the National Academy of Sciences of the United States of America*, Wolkovich and seven other scientists

from universities and research institutes in Canada, Spain, France, New Zealand, Sweden and the United States found that diversity within a crop would indeed provide some protection against climate change.

If global efforts to reduce emissions fail to prevent average annual temperatures from rising by 2° C (3.6° F), “our results suggest that half of current global winegrowing regions would become climatically unsuitable for today’s major wine grapes,” the researchers stated.

But winegrowers working locally could have a dramatic impact on that big picture. “We find that cultivar diversity halved potential losses of winegrowing regions under a 2° C warming scenario and could reduce losses by a third if warming reaches 4° C,” the scientists wrote in their report, “Diversity Buffers Winegrowing Regions from Climate Change Losses.”

A sobering analysis

The picture the report paints is sobering. If global average temperatures rise just 2° C, the scientists predict current winegrowing areas would shrink by 56 percent. That would be reduced to just 24 percent if growers change varieties, also known as cultivars. But if global efforts to cap warming at that level fail and temperatures increase by 4° C, those *terroirs* are projected to shrink by 85 percent. Changing what's planted would only reduce that to 58 percent.

The predicted losses in habitats would be primarily due to climatic changes during the times when grapes are ripening, with

higher maximum temperatures, higher minimum temperatures and an increasing number of very hot days, which can stress vines and alter the development of grape sugars, acids and polyphenols, reducing quality.

While the study focused on vineyards, the results hold out hope for other types of crops that have a lot of diversity, such as apples, bananas, chocolate, coffee, peaches and more. “One of the biggest developments in climate change is food security and how we’re going to continue to feed everyone,” said Wolkovich.

The research team, led by Ignacio Morales-Castilla at the University of Alcalá in Spain, studied *Vitis vinifera* grapes because plantings span diverse climates, the impacts of climate change are clear and they could work with long-term French records. They looked at 11 varieties (out of more than 1,100 vinifera cultivars currently planted) chosen because they are found globally, particularly in some of the largest wine-producing countries: Cabernet Sauvignon, Chasselas, Chardonnay, Grenache, Merlot, Monastrell/Mourvèdre, Pinot Noir, Riesling, Sauvignon Blanc, Syrah and Ugni Blanc.

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These varieties were also chosen because they vary immensely in a trait key to adaptation to climate change: the timing of developmental stages such as [budbreak](https://www.winespectator.com/glossary/index/word/Budbreak) [<https://www.winespectator.com/glossary/index/word/Budbreak>]

, flowering, veraison

[\[https://www.winespectator.com/glossary/index/word/Veraison\]](https://www.winespectator.com/glossary/index/word/Veraison)

and full maturity, which can happen as far as six to 10 weeks apart among different varieties grown in the same climate.

As warming trends have generally bumped harvest dates up earlier [\[https://www.winespectator.com/articles/nasa-and-harvard-experts-find-climate-change-has-fundamentally-altered-french-wine-harvests-52915\]](https://www.winespectator.com/articles/nasa-and-harvard-experts-find-climate-change-has-fundamentally-altered-french-wine-harvests-52915), mismatches are developing between a region's conditions and the grapes traditionally planted there. (For example, if global temperatures rise 4° C, the study predicts that the harvest for Cabernet Sauvignon in Bordeaux would happen 28 days earlier.) If a region is excelling with a specific variety today, Wolkovich stated, "Climate change means it's not going to be the correct variety in another 20 years." But a growing region can find other grapes whose key development phases—most important, the ripening period—do align better with periods of heat, cold, rain and other factors that can affect quality at harvest.

The researchers wanted to quantify how much "cultivar turnover"—shifting plantings in a locality from traditional varieties to newly appropriate ones over time—would affect which regions remain or become suitable for winegrowing. They looked at historical data (their sources covered key grape development dates from 62 locations, mostly in France, between 1956 and 2015) and at projections of daily temperatures and precipitation from an existing climate model. That was combined with global data on plantings of different varieties.

The scientists developed models to forecast budbreak, flowering and the onset of ripening for two warming scenarios—an increase of 2° C and an increase of 4° C—compared to no warming, in each current winegrowing region, as well as in areas identified as climatically suitable, meaning that they would allow at least one of the 11 grapes to fully ripen in most years. (A key distinction in their work from prior research is that their models account for delays in phenological ripening caused by extreme heat stress.) For each scenario, they then predicted the climatic suitability of each region during the period that grapes mature.

“What we did was look at the climate space within which the grapes can develop in such a way to make wine that has the classic characteristic of a Pinot or Cabernet or Grenache,” said Benjamin Cook, a study co-author and a climate scientist with the NASA Goddard Institute for Space Studies. “We’re talking about a longer term perspective, over the next several decades to the end of the century.”

But aren't some regions benefiting from warmer temperatures?

One tack some winegrowers have taken to deal with climate change is to move into new, previously unplanted regions—moving up hillsides to higher altitudes, moving north (or south) to places such as Canada, England and Patagonia, which have all seen growth in their wine industries. But that has raised alarms among conservationists who fear that it will push already-stressed wildlife out of their habitats

<https://www.winespectator.com/articles/will-vineyards-ireally-i->

[push-pandas-out-of-their-home-48288\]](#) and increase the biodiversity loss already happening due to climate change.

The researchers stressed the importance of maintaining current winegrowing regions, which their results show can be done by turning to later-ripening varieties such as Grenache and Monastrell, rather expanding into new areas. “You could consider moving every crop toward the poles, but that involves taking out what is often preserved land,” said Wolkovich. “It’s just not a sustainable option. ... These landscapes are critical for water, clean air and other things.”

And from a winegrowing perspective, she elaborated, “you can’t assume you can switch to a new region and grow an equally great crop. Bordeaux and Burgundy have had a lot of time to figure out how to do it well.”

Even though cooler-climate lands are becoming more suitable for wine grapes now, the research findings predict losses in potential winegrowing regions: “Under a 2° C warming scenario, 51 percent of all areas we identified as climatically suitable for winegrowing under our 0° C reference scenario would be lost. At 4° C, losses reach 77 percent.” With different grapes, however, these losses could be kept to 38 percent and 64 percent, respectively.

So what now?

While the findings provide a promising path forward, Wolkovich and Cook acknowledged it’s not easy for established

winegrowers to rip out planted vines and start fresh. That's a huge investment, with a long time before they see a return.

"If you're a farmer in the Midwest who grows wheat one year and soybeans the next, it's incredibly easy to on the fly make decisions from year to year and see how it plays," said Cook. "For something like wine, it takes several years before you get something commercially viable, so it's a really big deal to decide that you're going to fundamentally change."

Growers face a lot of uncertainty, said Wolkovich. "Until they have a zero-emissions scenario, they don't know how often to change and for how long. They have to change potentially every 30 years." And there are fundamental implications for the character of historic regions and their wines: "If you look at Burgundian wines, it's a huge hurdle to think about replanting vineyards there."

But she warns, it's not really a choice. "If they choose to stick with their older plants, they will have some good years, but as it gets warmer they will see lower quality." They can try to mitigate with other solutions, such as misters, shade cloths and heavier irrigation (if drought isn't also an issue). "But the wine in most bottles today is different than it was 20 years ago due to climate change, and that's just going to get exacerbated."

Wolkovich and Cook hope for more fine-grained research within regions, vineyards and microclimates on the right grape varieties for the future and ways for landscapes to adapt. And the study points to a reason for more hope. The 11 varieties studied represent less than 1 percent of known wine grape diversity, so

the benefits from diversity could be higher if they had been able to get data on more cultivars. "There is more adaptation potential in there, but not astronomically, not to the point where we'd save every winegrowing region," said Wolkovich.

She and Cook are particularly interested in seeing more research on native Italian, Iberian and Greek varieties, as well as others that aren't as widely familiar to consumers. "But what's the commercial viability?" asked Cook. "Can they produce wine that people actually want to drink? It's hard to predict how people respond to these social changes."

And that's where wine lovers have a role to play, Wolkovich indicates, in being open-minded to the experimentation going on. "Growers constantly tell me how concerned they are that consumers won't try new varieties. Consumers who will try something new have a big impact on what growers feel they can do."