Why climate change will not dramatically decrease viticultural suitability in main wine-producing areas by 2050

Hannah et al. (1) recently published a comprehensive study showing substantial impacts of climate change on viticultural suitability, leading to potential ecological issues. We agree that expansion of viticulture into new areas can lead to a decrease in biodiversity and that an increase in water use for irrigation might lead to major freshwater conservation impacts. However, we disagree with the alarming statement that suitability for winegrowing of main wine-producing areas worldwide will dramatically decrease over the next 40 y. We point out major methodological flaws in ref. 1, mostly linked to (*i*) the misuse of bibliographical data to compute suitability index, (*ii*) underestimation of adaptations of viticulture to warmer conditions, and (*iii*) the inadequacy of the monthly time step in the suitability approach.

The suitability index in ref. 1 is mainly compiled from grapevine maturity groupings as defined by Jones (ref. 2 is a wrong citation; this classification is given in ref. 3) and Gladstones [(4), not peer-reviewed]. In refs. 3 and 4, groupings were constructed from empirical observations collected in premium wine-growing areas and not based on grapevine physiological modeling. We argue that it is very difficult to establish precise upper limits by variety for growing high-quality wines and that those given in ref. 3 are underestimated. To illustrate this aspect, we compared average growing season temperature (AvGST) from 1971 to 1999 and from 2000 to 2012 for three major wine-growing regions (Fig. 1): Rheingau (Germany), Burgundy (France), and Rhone Valley (France). Burgundy continues to produce great wines with Pinot noir since 2000, although AvGST is already above the upper temperature limit cited in ref. 3. The same is true for Rheingau with Pinot gris and the Rhone Valley with Syrah. High-quality viticulture is sustained in these regions despite increased temperatures and dry farming, because of both the evolution of consumer's preferences and implementation of adaptative strategies by growers.

A major flaw in ref. 1 is that noncapped growing degree days (GDDs) are computed and subsequently compared with varietal maturity groupings from ref. 4, wherein GDDs are capped at 19 °C [called biologically effective degree days (BEDDs)]. As the climate becomes warmer, the seasonal difference between BEDDs and noncapped GDDs increases up to several hundreds of DDs. Hence, projected ripeness in ref. 1 is weeks ahead when compared with ripeness properly estimated using ref. 4. This subsequently results in much higher temperatures during the projected last month before ripeness, which was the main criterion used in ref. 1 to consider a region suitable for viticulture or not.

A monthly time step was used in ref. 1. One month accounts for up to 270 BEDDs. When varieties are compared in maturity groupings that are 50 DDs apart, this resolution is too crude to yield reliable maturity predictions.

Hannah et al. make an interesting point in predicting which regions worldwide may become suitable for viticulture by 2050 as a consequence of climate change, and in estimating related potential ecological impact. However, their conclusion that most of the present wine-growing regions will become unsuitable for viticulture is erroneous.

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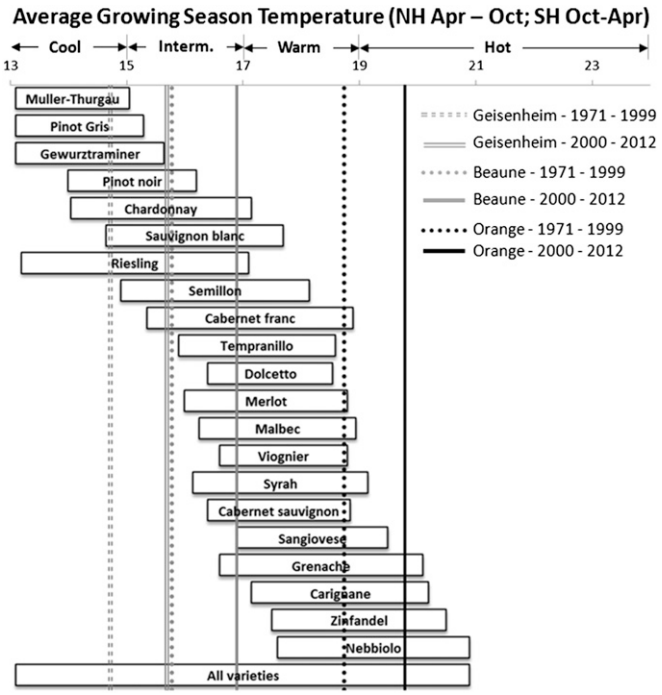

Fig. 1. Average growing season temperature from 1971 to 1999 and from 2000 to 2012 in Rheingau, Germany (Geisenheim station, Deutscher Wetterdienst); Burgundy, France (Beaune station); and Rhone Valley, France (Orange station). Note that Müller-Thurgau and Pinot gris, Pinot noir, as well as Syrah and Viognier are already beyond the maximum value given in ref. 3 in Rheingau, Burgundy, and Rhone Valley, respectively.