

## **Climate Change and Trends in Global Wine Quality**

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Widespread changes in climate have been reported globally during the last few decades, attributed mainly to an enhanced greenhouse effect caused by rising atmospheric CO<sub>2</sub> levels. Depending on the magnitude and seasonality of climatic changes, their impacts on agriculture can be either positive or negative. For example, warmer winter/spring temperatures reduce frost damage and increase growing season length. Grapes grown for wine production are known to respond more directly to long-term climatic variations than some more intensively managed crops, because they are less irrigated and fertilized, minimally genetically engineered, and long-lived. Given that high quality wines are generally associated optimum climatic conditions in any given vintage, these questions arise: what is the direction and magnitude of climatic changes in the world's top wine regions and what effects do they have on wine quality?

To answer this question, this research analyses temperature data (1948-2000) from the NCEP/NCAR Reanalysis Project. The data are considered the most reliable climate data available and consists of values projected on a 1.8° x 1.8° degree global grid. These grids allow for the analysis of the macroclimate of a given region and are justified by the fact that "the macroclimate is the mean microclimate of a region." Growing season average, maximum, and minimum temperatures along with diurnal temperature ranges and heat summations are analyzed for each of the 20 major grape growing and wine making regions in the world.

To assess the relationships between climate and wine quality, vintage ratings, as published by numerous sources (e.g., Sotheby's, The Wine Spectator, etc.) are used. These various vintage ratings have long been determinants of the annual economic success of a wine region and while any assessment of a vintage is a generalization (wines from different properties and regions will vary) and a guess (no one can be sure how wines will develop in the bottle), it is the benchmark by which years are compared.

Here we report results of our analysis as: 1) observed changes in climate for the 20 regions, 2) potential causes for the changes, 3) how observed climatic changes impact vintage quality, and 4) trends in quality of recent vintages.

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