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Influence of climate variability on wine regions in the western USA and on wine quality in the Napa Valley

Gregory V. Jones^{1,*}, Gregory B. Goodrich²

¹Department of Environmental Studies, Southern Oregon University, Ashland, Oregon 97520, USA

²Department of Geography & Geology, Western Kentucky University, Bowling Green, Kentucky 42101, USA

ABSTRACT: Trends in climate variables important to winegrape production in the western United States include fewer frost days, longer growing seasons, and higher spring and growing season temperatures. These trends have been related to a steady increase in wine quality and a decrease in year-to-year variability. While the trends in climate have been linked to increasing sea surface temperatures in the eastern Pacific, it is unknown whether this is caused by climate change or may be part of natural oscillations in the Pacific. In this study, 15 climate variables important to winegrape production were analyzed for 10 wine regions over the western USA. The variables were stratified by phases of the El Niño–Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO), both separately and then in combination (modulation effect) to determine if there are any significant differences between teleconnections. ‘Wine Spectator’ vintage ratings for Cabernet Sauvignon wines from the Napa Valley were also stratified by the same method, and multivariate statistics were used to determine which variables are most important to wine quality.

ENSO phase by itself was not found to be important to either climate variability in wine regions in the western USA or wine quality in Napa Valley, but the cold phase of the PDO was found to be associated with increased spring frosts and a shorter growing season that results in lower ratings relative to warm PDO. The combination of neutral ENSO conditions during the cold phase of the PDO was nearly always associated with low quality wine in the Napa Valley, which is a function of cold springs with increased frost risk, cool growing seasons, and ripening period rainfall (cold PDO), and above-average bloom and summer rainfall (neutral ENSO). Although climate trends toward generally warmer growing seasons with less frost risk have occurred, this research highlights the impact of climate variability on wine quality where, should the PDO return to a multi-decadal cold phase, wine growers in the Napa Valley and across the western USA will likely experience greater variability in wine quality.

Evidence of these conditions have occurred during the 2007-08 winter and into spring 2008 where a much colder and wetter than normal winter in the PNW and northern California has been seen. A lingering moderate to strong La Niña event in the tropical Pacific has been boosted by the influence of the larger cold phase of the PDO in the North Pacific. The result has been higher snow packs throughout most of Washington, Oregon, and northern California and anywhere from a one to four week delayed bud break or bloom (grapevines and orchard fruit, respectively) followed by an increased frequency of frost. During the third week of April 2008, some of coldest conditions since the mid 1970s caused widespread damage to everything from cherries, peaches, pears, apples, to winegrapes. As of April 24th winegrape growers in Sonoma and Napa had already estimated a 10-25% yield loss due to frost and are still waiting for spring to come.

KEY WORDS: Climate variability, El Niño–Southern Oscillation, Pacific Decadal Oscillation, Winegrapes, Wine, Vintage ratings